ESTABLISHMENT OF BOUNDARIES FOR SUSTAINABLE CONSERVATION AND ENHANCED LIVELIHOODS OF FOREST DEPENDENT COMMUNITIES NEIGHBOURING ARABUKO SOKOKE FOREST RESERVE IN KILIFI COUNTY, KENYA

LONZI ZIPPORAH

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD FOR THE DEGREE OF MASTER OF ENVIRONMENTAL STUDIES AND COMMUNITY DEVELOPMENT IN THE SCHOOL OF AGRICULTURE AND ENVIRONMENTAL SCIENCES OF KENYATTA UNIVERSITY.

APRIL, 2024

DECLARATION

I Lonzi Zipporah declare that this thesis is my original work and has not been presented for the award of degree or any other award in any other university. No part of this thesis work should be reproduced without prior permission of the author and/ or Kenyatta University.

Signature…… Date……

Lonzi Zipporah

N50/CTY/PT/37649/2016

Department of Environmental Studies and Community Development.

SUPERVISORS

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

Signature…… Date……

Dr. Felix Ming'ate

Department of Environmental Studies and Community Development

Kenyatta University.

Signature…… Date……

Dr. Joseph Kurauka

Department of Environmental Studies and Community Development

Kenyatta University.

DEDICATION

I dedicate this project to my supervisors, family and friends who made it a success.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASFR	Arabuko Sokoke Forest Reserve
CFA	Community Forest Association
CBO	Community Based Organization
FAO	Food and Agricultural Organization
FCC	Forest Conservation Committee
GOK	Government of Kenya
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KWCA	Kenya Wildlife Conservancies Association
KWS	Kenya Wildlife Service
LBC	Leaders Business Community
NACOSTI	National Commission for Science, Technology and Innovation
NEMA	National Environment Management Authority of Kenya
NGOs	Non-Governmental Organizations
MDG	Millennium Development Goals
NMK	National Museums of Kenya
NPFM	Non-Participatory Forest Management
NPH	Non-Participatory Households
PH	Participatory Households
PFM	Participatory Forest Management
VMGs	Vulnerable Marginalized Groups

ABSTRACT

Forest management in Kenya was initiated in the year 1902, marking the inception of organized efforts to sustainably oversee and regulate the country's forest resources. Before, forests were taken care of by specified area leaders, specifically local chiefs with the typical system of governance, but the introduction of state system of forest administration lowered community-based forest management systems in all forests of in Kenya. Consequently, forest dependent communities were forced away from the forest and lost the resources they used to collect from the forests for their livelihood. Thus, in the 1980s, there were confrontations between the government and communities surrounding forests which led to the need for Participatory Forest Management. The research therefore sought to examine how forest resource users' boundaries can be developed for enhanced sustainable community livelihoods and forest conservation. The specific objectives of the study were, to examine the extent to which participatory forest management boundaries are developed in Arabuko-Sokoke Forest Reserve; to examine the effectiveness of the government policies in governing forest resources and resource user's boundaries in Arabuko-Sokoke Forest Reserve and; to assess how the income of the forest dependent communities has been increased as a result of forest resources use and resource users' boundaries in Arabuko-Sokoke Forest Reserve. The study used a case study approach where qualitative data was collected to address the study objectives. The study employed purposive sampling to select 220 respondents from various groups involved in the co-management of the Arabuko-Sokoke Forest Reserve, using Yamane's formula to initially target 396 households from a population of 39,112, but ultimately included a mix of PFM and non-PFM households, government agencies, NGOs, and community leaders to ensure comprehensive representation. To collect data, semi-structured sets of questions were used to both participatory and non-participatory forest management households and all the data collected was analyzed qualitatively by putting similar themes together and using them to answer the study objectives. Based on the first objective, the study found that the development of participatory forest management boundaries in Arabuko-Sokoke has been largely successful, with most communities acknowledging the importance of such boundaries for sustainable resource use and forest conservation, facilitated by government agencies. Based on the second objective, the study found that government policies on forest resource and boundary regulation have been effective, significantly reducing resource destruction, although challenges such as community leader intimidation and insufficient protection for forest scouts highlight areas for policy and enforcement improvement. Concerning the third objective, the study revealed that the implementation of forest management boundaries and resource use regulations have positively impacted community livelihoods, enabling income-generating activities like beekeeping and tourism, which have contributed to educational advancements and a significant reduction in poverty levels. The study therefore recommends that the establishment of the forest resource use boundaries is necessary for sustainable community livelihood and forest conservation.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The international and local demand for forest resources such as timber and fuel wood have in one way or another, ultimately encouraged what is currently considered forest offenses such as illegal logging (Filardi, 2020). Forest is a complex ecosystem which involves mainly trees, which buffer the earth and supports a great number of life forms. Trees help create a unique environment that in turn, influences the types of animals and plants which can thrive in the forest. Trees are key elements of the environment and the forest. They clean the air, cool it on hot days, conserve heat at night, and act as excellent sound absorbers. Forestry is the art and science of safeguarding, conserving and regulating forests, tree plantations and natural resources (Jenkins & Schaap, 2018). Since forest ecosystems are extremely key to the planet, the sector of forestry is just as important for the environment as it is for our communities and whole economy.

Ninety-three percent of world's forest area (3.7 billion ha) comprises all-natural forests, whose management has been modified over the past twenty-five years with a significant change from the state-centered technique to a much more decentralized versions, where actors are involved in the management of natural resources. More exactly, the technique of participatory forest management (PFM) has seen essential development with close to ninety nine percent of the world's forests lined by statutes sustaining PFM at national and subnational levels, and with many nations offering opportunities for stakeholders to join nationwide planned procedures regarding the very same (Kairu & Kariuki, 2015).

This progression has nonetheless been tainted with irregularity's specifically within the tropics, where the capability to make use of or apply PFM policies, laws and by-laws continues to be irregular (FAO, 2018). Whereas it holds true that clear possession and management of legal rights are very important in the management and participating in the management of forests (World Bank, 2016), the international environmental governance espousing co-management of important commons has experienced substantial difficulties as stakeholders within the sector undertaking to

command monitoring of the extremely vital resources (Saunders, 2014). It is remarkable that the administration of natural resources, including the forest reserves, has been a critical and sensitive issue in Sub-Saharan in the past and Kenya is not exceptional. In this respect, a reliable partnership between the government and a reliable community can be realized through co-management and sharing of obligation and authority. However, the extent to which co-management techniques have worked in forest governance and the improvement of the resources of regional individuals, mainly in the developing countries remains a crucial problem. The vastness of tropical forests such as Arabuko-Sokoke includes them the diverse populations who depend on the reserves not only for subsistence but also for revenue needs (Ytterdahl, 2021). Consequently, clear interpretation of common-pool resource limits plays main role in the accomplishment of sustainability and enhancement of incomes of the local population (Huxham *et al.*, 2018).

Non-governmental organizations (NGOs) and communities do contend for rights to handle forest resources including land and pasture fields (Kimutai & Watanabe, 2016). As a matter of fact, Ming'ate *et al.* (2014a) insists that most of the interested groups scramble for the reserve to utilize the resources, normally in inappropriate way. In this respect, stakeholders have created methods and systems to counter enhanced interests through promoting collaboration and partnerships among the concerned individuals (ibid). According to Aggarwal (2020), engagement of community participants beside the forest, in tandem with the state, in forest administration is vital not just for safeguarding the really essential resources but also in improving livelihoods of these native locals. A reliable co-management of natural forests would certainly be without a doubt convert to raised source of incomes amongst forest-dependent communities in Africa and across the globe. Competitions for the management of such natural resources have for more years added to the mystery within the worked-out services and concerns attributed to the management of natural resources, significantly the forest reserve.

Accordingly, Chisika and Yeom (2020) argued that for forest management to be successful, individuals or families with the rights to withdraw common pool resources and limits need to be clearly specified. Boundaries are important in the management of forest resources. Specified limits increases sustainable conservation and enhances income of the forest dependent people (Quinn *et al.*, 2007: Ming *et al* 2014). The

study examined specifically on how to establish clear CFA boundaries in order to enhance the livelihoods of communities depended on Arabuko-Sokoke Forest Reserve for their livelihoods. It is expected that the establishment of clear boundaries will have a positive influence on the livelihoods of forest dependent communities.

Clearly delineated protected area boundaries and resource use zonation are crucial to balance goals of biodiversity preservation alongside securing local community livelihoods needs dependent upon forest resources Campos-Silva, Peres, Hawes, Haugaasen, Freitas, Ladle & Lopes, 2021). Participatory planning to designate strict conservation core zones, transitional buffer access areas, and alternative economic opportunity transition zones for households promises to redirect extractive livelihood dependence away from endangered habitats toward sustainable activities. Coupled capacity building for communities in areas like eco-tourism, agroforestry and beekeeping fosters voluntary reduced encroachment and diligent monitoring against unauthorized actors. Ultimately multi-stakeholder negotiated forest access boundaries institute guarded use parameters to nurture the interwoven wellbeing of ecosystems and human populations reliant on them, rather than stark exclusions that antagonize locals and sabotage conservation aims.

1.2 Problem Statement

The Arabuko Sokoke Forest Reserve represents the largest remaining patch of indigenous coastal forest in East Africa, home to rare and threatened biodiversity. However, unclear boundaries and unregulated human activity severely threaten the ecological integrity of Arabuko Sokoke. Local communities also directly depend on extracting forest resources like wood, poles and grass for livelihoods and grazing. This leads to unsustainable exploitation of biodiversity, deteriorating habitat and loss of ecosystem services, jeopardizing the long-term survival of both the forest ecosystems and surrounding populations.

Communities living around Arabuko Sokoke lack alternative sustainable income strategies independent of forest extraction or agriculture, perpetuating dependence and pressure on the protected area. There is an urgent need for collaborative action through participatory zoning to designate strict conservation regions and transitional buffer areas for controlled resource access to foster biodiversity preservation along with community support through targeted capacity building for reduced

encroachment. Clarifying Arabuko Sokoke's boundaries and managing the forest-community interface is vital to harmonize ecological and social goals, yielding joint outcomes of sustained biodiversity refuge alongside enhanced local livelihoods security and self-sufficiency. Ultimately, an evidence-based zoning plan promises to balance conservation priorities and community welfare for durable prosperity of both Arabuko Sokoke's ecosystems and neighboring human populations.

While the ecological significance of Arabuko Sokoke Forest Reserve is established, critical baseline data is lacking regarding up-to-date forest boundaries, land use zonation, and socioeconomic analyses of interface villages to update management plans for biodiversity conservation alongside community welfare gains. Thus, the scope encompasses ecological surveys to classify habitat types, severity of threats and inventory rare endemic species, while also systematically assessing dependence on forest resources by fringe communities. This dual ecological-social dataset will inform a stakeholder-endorsed participatory planning process to delineate strict forest conservation zones, transitional buffer areas for controlled resource access, sustainable use regions and alternative income transition zones for communities.

Key village stakeholders will mark ground-truthed forest boundaries and resource use maps to update land demarcations. Socioeconomic data will identify compatible alternative livelihoods including eco-tourism, beekeeping and agroforestry for which communities will receive capacity building. This promise updated, collaboratively-developed zoning to enhance Arabuko Sokoke’s conservation while redirecting communities toward sustainable self-sufficiency, addressing gaps in current knowledge for integrated, evidence-based policy to balance ecological and social wellbeing at this vital East African forest refuge.

1.3. Research Objectives

1.3.1 General Objective

The research focused on examining how forest resource user’s boundaries can be developed for sustainable community livelihoods and forest conservation.

1.3.2 Specific Objectives

The study focused on completing the following particular objectives: -

i) To examine the extent to which participatory forest management boundaries are developed in Arabuko-Sokoke Forest Reserve.
ii) To determine the effectiveness of government policies in governing forest resources and resource user's boundaries in Arabuko-Sokoke Forest Reserve.
iii) To assess the level to which the income of the forest dependent communities has been increased due to the forest resources use of and resources user's boundaries in Arabuko-Sokoke Forest Reserve.

1.3.3 Research Questions

i) How inclusive and engaged are local communities in developing participatory forest management boundaries in Arabuko-Sokoke Forest Reserve?
ii) How well aligned and implemented are existing government policies regarding governance of forest resources and user boundaries in Arabuko-Sokoke Forest Reserve?
iii) How has household income for forest-dependent communities changed in relation to current forest resource use practices and access boundaries?

1.4 Significance of the Study

The findings of the study are being of great benefit to the forest-dependent communities, the government agencies, the Non-Governmental Organizations, and Community-Based Organizations. As boundaries are being well established, locals are becoming more involved in the management of the forest. The findings of the study are giving an in-depth understanding of the initiatives or strategies that are being undertaken by the forest managers to enhance the conservation of forests. The study is being beneficial to the government, concerned organizations, and the locals since it is showing the areas which need to be enhanced, especially on the conservation of forests.

1.5 Justification of the Study

The Arabuko Sokoke Forest Reserve is the largest remaining coastal forest in East Africa, home to unique biodiversity and endangered species. However, unclear boundaries and encroachment threats jeopardize conservation efforts. Neighboring communities also heavily depend on forest resources for livelihoods through activities like logging, charcoal production, grazing and subsistence farming. Clarifying forest boundaries through collaborative stakeholder participation is essential to balance biodiversity protection with supporting local community socioeconomic needs. This will delineate a forest zone for strict conservation, buffer areas to promote sustainable use and community transition zones for alternative income activities. Enhanced understanding of the forest-community interface and resource use dependence will inform evidence-based policies to reduce human pressures, curb biodiversity loss and foster local ownership and stewardship over forest resources for long-term sustainability. This study aims to promote integrated, inclusive strategies that conserve Arabuko Sokoke's ecological integrity while also improving the wellbeing and resilience of its forest fringe inhabitants.

1.6 Conceptual Framework

In this study there is well developed independent variable which is boundaries and dependent variables (stringent policies rationing the use of resources, forest ecosystem, and participatory management). Rigorous policies allocating use of resources, forest ecology and participatory management are dependent variables. If this concept is applied well, definitely it will enhance the income of the local communities and assure conservation of the forest reserve. This study will be informed by: Collaborative governance theory, Ostrom's institutional analysis and development theory and Sustainable rural livelihoods theory.

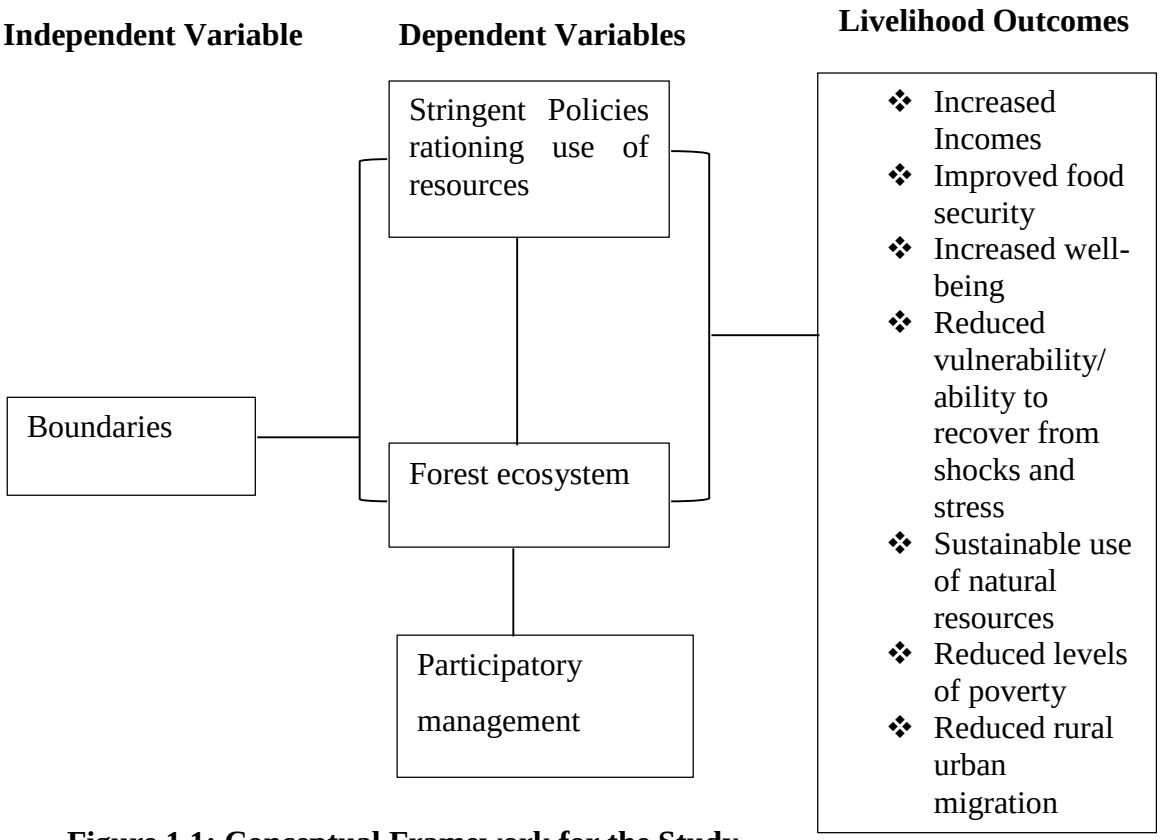

Figure 1.1: Conceptual Framework for the Study

Source; Researcher, 2023

The independent variable boundaries in the study on sustainable conservation in Arabuko Sokoke Forest Reserve focus on factors such as the extent of forest resources and community land use patterns. These boundaries help to understand the impact of conservation efforts on the livelihoods of local communities and the health of the ecosystem.

In the context of the Arabuko Sokoke Forest Reserve in Kilifi County, Kenya, the dependent variables include the effects of stringent policies on resource use, the health and sustainability of the forest ecosystem, and the outcomes of participatory management approaches. These variables are influenced by the management and conservation strategies applied, where stricter resource use policies aim to protect the forest, but their impact on the ecosystem and community livelihoods depends on effective participation and collaboration among local communities, conservationists, and policymakers. The health of the forest ecosystem serves as a measure of conservation success, while participatory management reflects the involvement and

empowerment of local communities in conservation efforts, which in turn affects both the ecosystem's sustainability and the communities' well-being.

The establishment of boundaries for sustainable conservation and enhanced livelihoods of forest-dependent communities neighboring Arabuko Sokoke Forest Reserve in Kilifi County, Kenya, aimed to achieve positive livelihood outcomes. By promoting sustainable use of natural resources and involving local communities in conservation efforts, the initiative sought to increase incomes, improve food security, and enhance overall well-being. Through sustainable livelihood opportunities and capacity-building programs, the project aimed to reduce poverty levels and mitigate rural-urban migration. By striking a balance between conservation and community development, the initiative endeavored to empower local communities while ensuring the long-term protection of the forest reserve's biodiversity and ecological integrity.

Community acceptance and understanding of the established boundaries can influence compliance with resource use policies. The effectiveness of boundary demarcation and enforcement mechanisms can impact the ability to control access and resource extraction within the designated areas. The availability of alternative resources or livelihood options for communities outside the established boundaries can reduce their dependence on the protected forest areas. The level of community involvement and participation in the boundary establishment process and subsequent management approaches can shape the outcomes of participatory efforts.

1.7 Definition of Terms

Community Forest Organization: a team of local community members who are formally registered as an organization or company for the sake of community forest to participate in forest management and conservation (Republic of Kenya, 2016).

Defined boundaries for resource and resource users: Techniques where people or family members with the legal rights to get resource units from the typical pool resources along with boundaries of the common pool resources such as forest are plainly defined.

Livelihoods: It refers to means and resources by which individuals or communities sustain their lives and well-being, often comprising a combination of employment, income-generating activities, assets, social networks, and access to essential services (Aryal, 2015).

Boundaries: Refers to demarcated areas or perimeters that define the extent of the forest ecosystem, delineating its spatial limits and serving to regulate human activities, biodiversity conservation efforts, and ecosystem management practices within its confines.

Local Community: consists of people and family members residing in close distance to a forest and determined by common history, common society or normal house and may, frequently include all the citizens of a particular village which share a boundary with a forest (Kant, 2018).

Non-Government Organization: a charitable, volunteer citizens' team, which is organized on a local or international level to address concerns on behalf of the public good (Kimutai & Watanabe, 2016)

Participatory Forest Management: describes procedures and tools that permit individuals to take part in all aspects of forest resources management e.g., decision-making, forest surveillance, looking after resources, and producing and applying institutional frameworks (Kairu & Kariuki, 2015).

Sustainable Conservation: It involves the strategic management and preservation of natural resources and ecosystems in a manner that ensures their long-term viability and resilience while also promoting equitable access, community engagement, and the maintenance of ecosystem services for current and future generations (Schulze *et al.*, 2019).

Forest Ecosystem: A forest ecosystem is a complex community of living organisms, including trees, plants, animals, and microorganisms, that interact with each other and their physical environment within a forested area. It encompasses the intricate web of ecological relationships, energy flows, and nutrient cycles that sustain the diverse life forms found in forests.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature as follows, section 2.2 examines theoretical framework, section 2.3 examines literature on the development of forest boundaries, 2.3 concentrates on government policies in governing forest resources, 2.4 analyzes the significance of forest resources and user boundaries, in 2.5 literature on the extent to which forest resources use and resources user's boundaries can increase forest dependent communities' income and finally 2.6 opens up gaps for the study.

2.2 Theoretical Framework

The study was underpinned by collaborative governance theory, ostrom's institutional analysis and development theory and sustainable rural livelihoods theory.

2.2.1 Collaborative Governance Theory

Collaborative governance theory posits that sustainable outcomes for communally-shared natural resources emerge through democratic inclusion and participation of community stakeholders, not just bureaucratic policymaking alone (Hofius, 2016). It applies to clarifying sustainable access rights to the jointly-utilized Arabuko Sokoke forest spanning government agencies, conservation groups and adjacent villages reliant on resource harvesting. The theory argues that any newly imposed boundaries and zoning must arise through legitimate two-way partnerships, whereby;

Building shared understanding and trust across forest managers and local farmers on appropriate access frontiers and safe yields enhances voluntary compliance, monitoring and peer accountability over time. Democratically integrating villages into the participatory forest management process as legitimate decision makers also uplifts marginalized groups while tapping into intergenerational traditional ecological knowledge on sustainable extraction aligned with conservation (Walsh, 2022). Applying collaborative governance theory promises an inclusive approach to negotiating boundary realignments and new multi-purpose buffer areas that balances livelihoods needs alongside preservation mandates.

Durand (2020) noted that collaborative governance ushers a co-management paradigm for heightened transparency, representation and social equity around decisions delimiting human usage in protected zones so that forest-dependent communities see their identity and cultural traditions secured along with conservation targets. It provides a collaborative lens to clarify boundaries integrating top-down policies with ground-level dependence patterns to forge synergies across Arabuko Sokoke's human and ecological fabric.

2.2.2 Ostrom's Institutional Analysis and Development Theory

Ostrom's Nobel prize winning framework provides an institutional approach to sustainably self-governing common pool resources like forests through community-designed rules that protect against overexploitation while still supporting livelihoods (Nigussie, Tsunekawa, Haregeweyn, Adgo, Cochrane, Floquet & Abele, 2018; Ostrom, 2019). This directly applies to clarifying equitable usage boundaries around the jointly used Arabuko Sokoke forest continuum spanning government holdings into community claimed transition zones.

Key principles applicable are clearly defining who has legitimate rights to specific forest products and zones while mapping differentiated conservation-only no take regions versus buffer areas allowing controlled harvesting by permitted users only. Rule-making also requires graduated sanctions against violators for deterrence, collective village organizations to monitor compliance alongside state patrols, and recognizing shared local to national government authority over the forest territory to build trust in co-management (Li, 2022).

Applying Ostrom's boundaries setting prescription as Arabuko Sokoke's zoning is updated promises to balance and safeguard future ecological viability with securing local access through tailoring extraction levels and livelihood dependence patterns sustainably to natural regeneration rates. The framework lends proven guidance for communal environmental governance to uphold intergenerational conservation without depriving marginal groups through participatory self-organization by directly affected stakeholders themselves, not just remote top-down regulators.

2.2.3 Sustainable Rural Livelihoods Theory

The sustainable rural livelihoods framework spotlights the assets, capabilities, income activities and risk coping behaviors tied to forest dwelling community welfare (Saliman, Swee-Kiong, Abdullah, Awang & Noor, 2023). This lens sees household wellbeing interdependent with sustainable management of adjacent forests many rely upon for subsistence needs. Understanding location-specific dependence patterns tied to Arabuko Sokoke and availability of diversified income options guides collaborative boundary setting and zoning to redirect unsustainable pressures away from the protected area.

Village-level analyses will generate evidence on proportions of households undertaking commercial wood carving, charcoal production, unauthorized farming encroachment versus those sustaining through beekeeping, tourism microenterprises or small retail. Sound data clarifies realistic transitional zones for controlled forest access to maintain interim livelihood stability until diversified income schemes are viable (Pokorny, Pacheco, de Jong & Entenmann, 2021). Findings will also map dependence factors like skill constraints needing capacity building prior to curtailing access rights.

Applying a livelihoods approach shines light on the socioeconomic tradeoffs and community resilience factors interplaying with conservation plans. The goal is forest zoning that sustains biodiversity along with the human capabilities facilitating stewardship not sabotage over boundaries, so households secure in basic needs become willing allies not violators (Edo, 2023). This lens steers an integrated "pro-poor" strategy balancing ecosystems health with just, community-supported outcomes meeting mutual goals.

2.3 Development of Forest Boundaries

The forest boundaries are established to restrict access by unauthorized individuals (Mungai *et al.,* 2015). Before, 1902, forests were managed by defined community leadership through a traditional governance system. Modern state establishment discouraged community-based forest management systems in most forests, thereby alienating communities from accessing resources. However, their dependence on the resources continued to increase. Introduction of Shamba system in forest plantation led to communities planting and tending to trees in as they cultivated crops for a short

period of time as they waited for the tree canopy to close. Despite initial success, this system was banned due to mismanagement in the 1980s (Kagombe *et al.,* 2017).

Lamentations for changes in forest management by communities and other stakeholders in Kenya became vocal in the 1980s (Girma *et al.,* 2015). A formal platform to administer the change in governance of forests in Kenya was introduced by the forest master plan of 1994. This led to the need for a democratic space for communities to participate in forest governance, which was further supported by the paradigm shift globally and Kenya opted to adopt the PFM approach which led to piloting of PFM at Arabuko Sokoke forest in 1997, a move that led to the revision of the Forest Act cap 385 to Forests Act 2005. The act legalized the new forest management approach and additionally supported the inclusion of management of all forests under KFS. This also created a semi-autonomous organization responsible for the management of forests and introduction of devolved forest governance in the form of FCC and community participation. The forests act 2005 was later repealed to the national forest management and conservation act 2016 to provide opportunities for multiple stakeholder participation in forest management, community participation through CFA, linkages with KFS and counties, management through FCCs, legal participation through management plans and management agreements.

Community participation in PFM were expected to improve forest resources conditions and community livelihoods. The constitution of Kenya 2010, also provides for devolved governance, espoused public participation in decision making and provides equitable sharing of benefits emanating from natural resource management (Mungai *et al.,* 2015, Mligo *et al.,* 2019).

The development of the forest boundaries contributes to the achievement of effective protection of forests from degradation (Sweeney *et al.,* 2017). In Kenya, the law requires that all forests be managed in accordance with an approved management plan. The engagement of communities to manage forests must be accompanied with at least a draft management plan. Development of forest boundaries requires technical planning tools, requires appropriate methodology, financial resources and is time-consuming to develop (Steffen *et al.,* 2015). Forest boundaries require participation of all stakeholders and mobilization of resources. Ideally, forest boundaries potential should be assessed before engaging communities in forest management because PFM

is not suitable for all forests (Kant, 2018). Feasibility assessment is an important process that may take some time but is a necessary step in ensuring sustainable forest boundary processes.

Bedelian and Ogutu (2017) argued that community and private conservancies in Kenya are key conservation areas. Also, they reported that community policy support and implementation programs facilitate communities and landowners' to participation in the policy review processes, better access to policy information and incentives, in this environment conservancies can provide long-term sustainable social, economic and ecological outcomes, improved structures for governance, management of community land, secure land ownership rights, better living standards, gender and youth inclusiveness and resilience to climate change. Community and private conservancies in Kenya play a key role in conservation, but research shows that enabling policy environments with community participation in review processes, access to information and incentives facilitates sustainable social, economic and ecological outcomes within conservancies over the long term. The literature further finds that supportive policies and programs lead to improved conservancy governance and management, secure land rights, better living standards, inclusivity and climate resilience.

According to Fasona, *et al.,* (2019), forest resource use is beneficial both to the community and government and that development of forest resource use and user boundaries between forests and human habituated areas reduces human-animal conflict. Forest resource use boundaries help to minimize human activities that degrade forests Clark, *et al.,* (2016). Ming'ate and Bollig (2016) noted that forest boundaries act as a deterrent for trespassers and intruders and keep unwanted wild animals off from reaching where human lives. Forest resource use provides mutual benefits for communities and government, but delineating boundaries between forestland and human settlements mitigates human-wildlife conflict; clearly defined forest use boundaries constrain degrading human activities within sensitive ecosystems, deter unwanted trespassing and wildlife intrusions into inhabited areas.

Schulze, *et al.,* (2019) argued that forest resource use boundaries promote numerous ecosystem services such as timber, biodiversity protection and climate change mitigation. However, in some cases, the demands for these services and goods from

the forests may lead to conflicts. According to Odeck, (2016), the Maasai culture, women are seldom given the opportunity to speak in public more so in the presence of men neither are they given the opportunity to lead in the Oloisukut community conservancy thus they are not very much involved in the development of forest resource use boundaries. However, the study revealed that the community had positive attitudes and perception towards the sustainable use of the conservancy and forest resources conservation boundaries.

Functioning governance structures, legal and policy instruments and institutional capacity are important for judicious implementation and enforcement of effective forest boundaries (Ayana, 2020). Development of forest boundaries requires satisfactory public participation to ensure relevant government agencies, local authorities, private sector, civil society and communities are involved in planning, implementation and decision-making processes. Good forest governance principles have been articulated in the Constitution of Kenya 2010, Millennium Development Goals (MDG) and the Kenyan Vision 2030 blueprint document (Kariuki *et al.,* 2016).

Nyagero (2016) argued that poverty and level of education are the major cause of poor implementation of forest conservation strategies, in addition to inadequate financing and policies as well as social-cultural factors. Musyoki, *et al.,* (2016), Kairu *et al.*, (2018) argued that boundaries for forest resources management are fundamental to both the community and the government because they help in restoring the ecosystem's nature, which benefits both the community and the government in the long run. This justifies the need to understand how to establish forest resource use and users' boundaries (Thygesen *et al*., 2016). Defining distinct boundaries for forest resource management is essential for both communities and government to facilitate ecosystem restoration over the long term, underscoring the need for effective, mutually beneficial delineation of permitted forest use areas.

2.4 Government Policies in Governing Forest Resources

A study by Adinoyi (2015) discovered that environmental degradation contributes to the need for PFM approach between the Kenyan government, civil society organization and the local communities. Thus, the Government of Kenya also in partnership with NGOs and donor agencies have delineated zones referred to us as Protected Areas, Community Forest Management areas and Co-management areas to

ensure mitigation of forest related hazards ranging from deforestation, forest fires, environmental degradation, desertification, biodiversity loss, environmental pollution, climate change, ozone depletion and rise of sea levels.

Communities in Kenya participates in participatory forest management through formation of CFAs (Mbeche, Ateka, Herrmann & Grote, 2021). A well-designed CFA contributes significantly to the conservation of a community-based forest as well as deliver livelihoods to the communities adjacent to the forests that depend on them for their survival and enable them to operate efficiently. However, the current participatory forestry governance approaches seem not to support the involvement of forest to the forest dependent communities, who depend on the forests products as sources of their livelihood.

Forestry sector extension service plays a key role in disseminating knowledge, technology and forestry information and in linking farmers with other actors of the economy. The extension services are critical in transforming subsistence related forestry farming by promoting household income as a way of reducing poverty through the sale of forest products. Hayes (2016) indicated that forest management ensures that forestry and environmental considerations are integrated into national policies, plans and decision-making processes, sustainable growth of the forestry sector, highly depends on the development of effective policies that oversees protection of forests resources

Non-governmental organizations and communities compete for rights to manage forest resources including land, and inherent pastures (Kimutai & Watanabe, 2016). Different interest team's scramble for the reserve to extract resources, usually in incompatible ways. In this respect, stakeholders have designed methods and mechanisms to counter heightened interests through promoting collaboration and partnerships among the concerned parties. Participation of community members adjacent to the forest, in tandem with the state, in forest management is crucial not just for protecting the very important resources but also in enhancing livelihoods of these native communities. Also, adequate forest resource and monetary benefits from employment and income-generating activities, may sustain the livelihood of forest dependent communities.

Gupta and Koontz (2019) argued that capacity building of the community members is one of the strategies the governments use to facilitate protection of forest resources, as this equips communities who are beneficiaries of the forest resources with knowledge and skills necessary for the sustainable forest governance policies. Macura, *et al.,* (2015) indicated that government regulations are key in enhancing protection of forest resources and establishment of forest resource use boundaries. Building capacity among forest-dependent communities enables their meaningful participation in sustainable governance, underscoring government initiatives to cultivate local knowledge and abilities supporting responsible forest stewardship; equipping beneficiary groups with requisite skills for self-directed resource management aligns with policy goals for collaborative, community-centric conservation efforts.

Furthermore, Rasmussen, *et al*., (2017) and Mujawamariya and Karimov (2014) argued that the principal aim of national forest policy is to ensure environmental stability and maintenance of ecological balance, including atmospheric equilibrium, in order to sustain all life forms. The central objective articulated in national forest policy emphasizes preserving ecological stability and homeostasis to support all life; this policy direction orients forest management strategies toward ensuring resilient, biodiverse environments via maintenance of beneficial ecosystem services and functions.

According to Wright, *et al.,* (2016) the government policies should be applicable to everyone in the community and should not be selective in any way, clear on the protocols to be followed to maximize on forest protection, fundamental in enhancing the sustainability of various species, aimed at protecting the environment, inclusive and should ensure community members are engaged. Forest governance policies should provide unambiguous, universally applicable guidance supporting environmental sustainability through comprehensive protections and community engagement; ideal policy frameworks outline specific inclusive protocols facilitating species preservation and habitat stability while ensuring local participation in collaborative forest stewardship.

Sing, *et al.,* (2018) argued that one of the government policies in the protection of the forests is enhancing collaboration of various government agencies. Heikkala, *et al.,* (2016) reported that some of the government policies on enhancing protection of the

forests include advocating for the use of dead resources such as the fallen trees and cutting firewood from already dead trees. Aryal (2015) argues that community involvement and participation are essential in achieving sustainable integration and sound environmental management of protected areas. Also, competency in communication, accountability and level of education are key determinants in the inclusion of the community members in the management positions of protected areas.

Muturi (2018) study revealed a very low level of community participation in governance of forest resources (especially women) in conservation and a continuous dominance of government limits conservation and management of forest resources which eventually lowers sustainability. Moreover, factors such as poverty, inadequate conservation facilities, partisan politics and lack of motivations influenced the participation of women in the conservation of the resources. Minimal involvement of local community members, especially women, in forest governance diminishes conservation outcomes and long-term sustainability due to persistent, top-down government control; further barriers to participation include poverty, insufficient infrastructure, political interests and lacking motivation.

Meinich (2018) study revealed that villagers emphasize conservational values of the forest but seem unaware of its market value; they have a strong sense of ownership of the local forest. Muok, Mosberg, Eriksen & Ong'ech (2021) established that effective policies are key for enhancing good governance that in turn reduces deforestation and forest degradation together with environmental shocks and threats of climate change. Well-formulated policies enable strong environmental governance and forest stewardship critical for mitigating habitat destruction and climate impacts. Ndege and Gichuki (2016) argued that that community participation has the great influence on the performance of participatory forest governance followed by social-cultural factors, monitoring, evaluation and management team competence. According to Achieng (2015) that cultural beliefs were the main factors that influence women from participating in decision-making in forest resources governance.

2.5 Forest Resources Use and User's Boundaries Impact on Forest Communities' Livelihoods

The factors that influence the household decision to join CFAs as established in Forest legislations include the expected benefits to be reaped by the members

(Musyoki *et al.*, 2013; Mungai *et al.*, 2015). Kariuki and Otieno (2017) and Matiku, et al., (2013) indicated that forest resources use boundaries are important in increasing tourism and other benefits to community members and attract private investors and locals communities may benefit from employment. Defining forest resource use boundaries can boost tourism and investment to provide employment and other economic benefits to local communities residing near protected areas.

Study conducted by Steffen and Rockström (2014) indicated that livelihoods of communities involved in participatory forest governance improved significantly. Sweeney, et al., (2017) indicated that participation in forest management has numerous livelihoods benefits. A study conducted by Gatiso (2017) confirmed that forest boundaries improve forest ecosystem services, water resources management, and conservation of biodiversity, enhance air quality management, reduced poverty, and address social exclusion. Establishing defined boundaries for forest ecosystems enhances services, resources, biodiversity, air quality, economic welfare and social equity. Kinyili (2014) reported that that forest resource boundaries may support training activities for communities especially among the youth and scouts and also enhance tourism activities in forest areas.

Wamae (2017) identified that the growth of tourism activities due to forest resource boundaries creates employment opportunities to the locals. There is high growth of hotels and other activities that act as a source of income generation to community members and especially the community forest associations. Successful management of forest resources has significant benefits to the communities as they provide food, rainfall attraction and medicine (Okumu and Muchapondwa 2020; and Hao, *et al*, 2019, generation of income (Aryal 2015), reduce human-animal conflicts (Fasona, *et al*., 2019; Ming'ate and Bollig 2016)). Moreover, reduce human activities that degrade forest resources Clark, *et al.*, (2016). Also, Muturi (2018) argued that forest and forest resources users' boundaries promote partnerships and coordination of forest management among communities. They also stimulate areas for water catchment and fishing activities (Mligo, *et al.*, 2019). Delineating boundaries between forests and resource users fosters collaborative management partnerships among communities while protecting critical watershed and aquatic habitats.

Also study by Kenya Wildlife Conservancies Association, KWCA (2019) reported that the conservancies have improved living standards of people in areas where they have been established, by securing natural resource utilization rights for communities (Wulifan *et al.*, 2015; Achieng, 2015; Beintema & Burton, 2015; Kandusi & Waiganjo, 2015; Mbogori, 2014, Muli, 2016). They also improve community access to services such as health, water and education and provide opportunities for communities' economic development, disaster risk reduction and the means of providing nature-based solutions to issues emanating from climate change (Beintema & Burton, 2015). Also, according to Mugambi, *et al.*, (2020) forests have the potential of improving the standards of livings of the forest dependent communities.

2.6 Study Gaps

Based on the literature reviewed, there was inadequate information to make inferences for the current study. Previous studies have focused on the protection, afforestation and rehabilitation of degraded forest areas but have put little emphasis on the communities depended on the forest livelihoods. None of the studies have examined how one can establish boundaries for sustainable conservation and improvement of livelihoods of forest dependent communities, the extent to which participating forest management boundaries may be developed, the development of effective policies on forest resources and resource user's boundaries and the extent to which the livelihoods of the communities may be enhanced due to the forest resources use and resources users' boundaries.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter entailed the methods that the researcher utilized in conducting the research. It presented the study location, the research layout and techniques of data collection and their analysis.

3.2 Study Area

The forest under study covers 420 km^2 and it's located in the coastal region in East Africa (Kenya Forest Service, 2016). Arabuko-Sokoke Forest Reserve is located in Kilifi County. It is about 110 kilometres North of Mombasa at latitude of 3 ° 20' S and a longitude of 39 ° 50' E (ASFMT, 2002). The forest is lowland complete dry forest mixed-up with the mangroves at the Mida Creek (Mbuvi & Musyoki, 2013). The forest is rich in species diversity and endemism, and key for the conservation of birds, butterflies, reptiles, plants and wildlife. The participatory forest management strategy was started by the government upon the realization of continued over-exploitation and destruction of the forest reserve by the forest adjacent communities as they were not involved in planning the forest resource use or even participation in decision making. The study area is shown in (Figure 3.1). The Arabuko Sokoke Forest reserve in the map is painted in green.

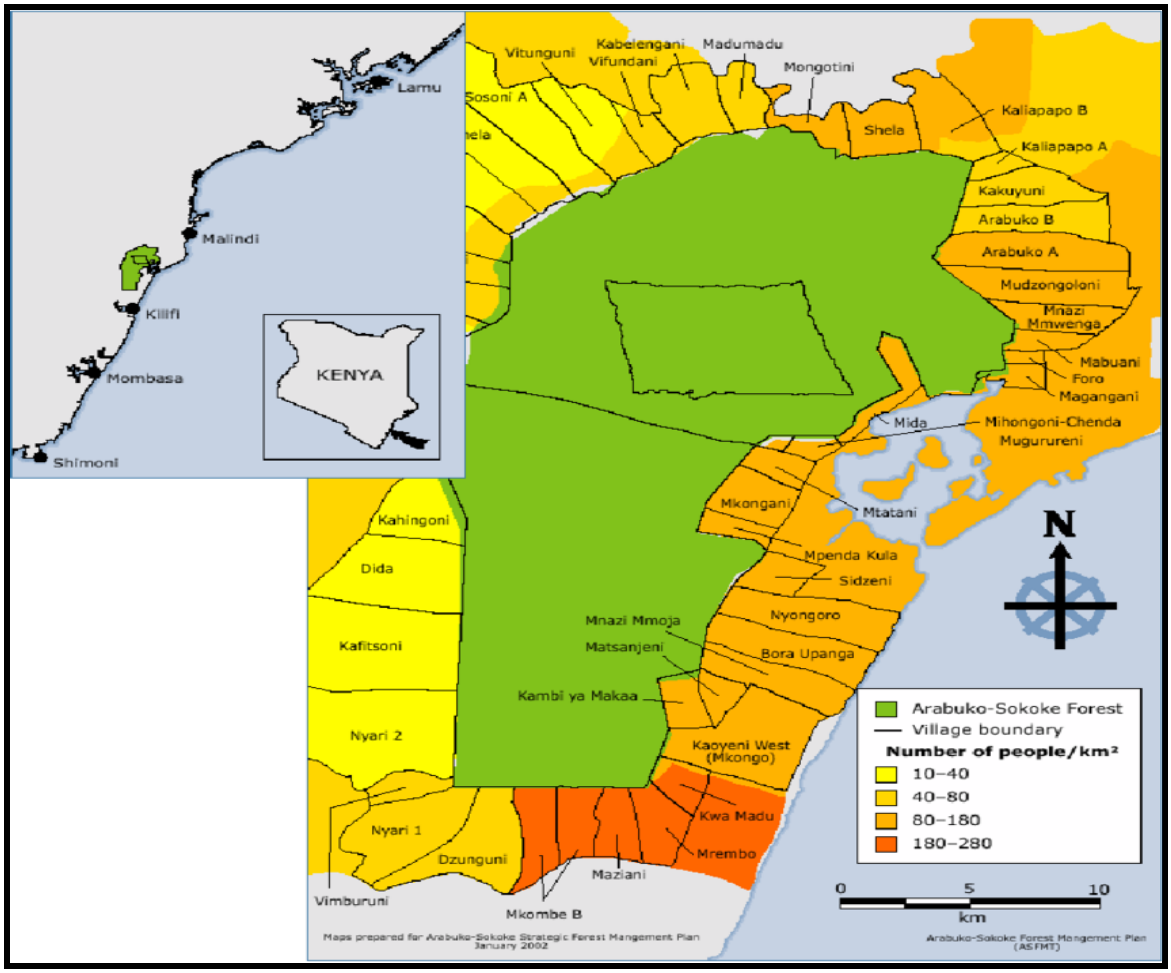

Figure 3.1: Study Area

Source (Boundaries Commission, 2022)

3.3 Research Design

The study adopted a qualitative research design with a case study approach. This was chosen due to the exploratory nature of the research, which aimed to deeply understand the development of participatory forest management boundaries, assess the effectiveness of government policies on forest resource management and evaluate the socio-economic impacts on forest-dependent communities within the specific context of the Arabuko-Sokoke Forest Reserve. A qualitative design is particularly suited for this study as it facilitates an in-depth exploration of complex social phenomena within their natural settings, allowing for a nuanced understanding of the perspectives, experiences, and practices of individuals and groups involved in forest management (Creswell & Poth, 2018).

The case study methodology was selected because it enables a comprehensive examination of the participatory forest management strategies within Arabuko-Sokoke Forest Reserve, providing a detailed and contextual analysis of the factors influencing their development and implementation. This approach is effective in addressing the first specific objective of the study, as it allows for the integration of various data sources, including semi-structured interviews, participant observation, and document analysis, to construct a holistic picture of the management practices and their outcomes (Baxter & Jack, 2008).

Furthermore, the qualitative case study design is conducive to evaluating the effectiveness of government policies related to forest conservation and management. It offers a flexible framework for investigating the intricacies of policy formulation, implementation, and impact on forest conservation efforts and resource management within the reserve. This methodology facilitates an in-depth analysis of policy documents, stakeholder interviews, and community feedback, thereby addressing the second specific objective by capturing the complexities of policy dynamics and their real-world implications.

To assess the impact of forest resource use and boundary definitions on the livelihoods of forest-dependent communities, the case study approach within a qualitative design allows for an empathetic understanding of community experiences and socio-economic conditions. Through detailed narratives and qualitative data, the research can explore changes in income, livelihood strategies, and community well-being attributable to participatory forest management practices, thus effectively addressing the third specific objective.

In summary, the qualitative research design with a case study approach was the best fit for this study because it allowed for an in-depth, contextual, and holistic examination of participatory forest management practices, policy effectiveness, and socio-economic impacts in the Arabuko-Sokoke Forest Reserve. The flexibility and depth offered by this methodology align with the study's objectives, enabling a rich and comprehensive understanding of the complex interplay between forest conservation efforts and community livelihoods.

One potential weakness of the qualitative case study design used in this research is its limited generalizability, as the findings may be specific to the context of the Arabuko-

Sokoke Forest Reserve and may not be directly applicable to other forest reserves or communities. Additionally, qualitative data can be subjective and influenced by the researchers' personal biases or interpretations, which could affect the objectivity of the findings. Furthermore, the depth of exploration in a case study may come at the expense of breadth, potentially overlooking broader trends or patterns that could be observed through a more extensive quantitative study.

The study addressed the weaknesses inherent in its qualitative research design by implementing several robust strategies. The study enhanced the credibility of the findings through method triangulation, integrating interviews, observations and document analysis to cross-validate data. In addition, it ensured a diverse and representative sample by carefully selecting participants from various backgrounds, aiming to capture a wide range of perspectives. The study also employed reflexivity, with researchers critically examining their own biases and influence on the research process. Lastly, to increase the transferability of its findings, the study provided detailed descriptions of the context and participants, allowing others to assess the applicability of the results to similar settings.

The study used purposive sampling to select respondents from various groups involved in or affected by the participatory forest management (PFM) of the Arabuko-Sokoke Forest Reserve. These groups included households involved in PFM, households not associated with PFM, government agencies co-managing the forest reserve (Kenya Forest Service, Kenya Wildlife Service, National Museums of Kenya, Kenya Forestry Research Institute), NGOs, community-based organizations, village elders, chiefs, and business community leaders. For households, the target population was 39,112 households in the area, and the sample size was calculated using Yamane's formula at 95% confidence level as 396 households, though the final sample sizes were 100 for PFM households and 90 for non-PFM households based on data saturation. The total sample size across all groups was 220 respondents.

3.4 Sample Size and Sampling Procedures

The researcher purposively sampled respondents from various groups of interviewees particularly: households involved in PFM and those not associated with PFM , various agencies involved in co- management of the forest reserve namely; heads of government agencies namely: KFS, KWS, NMK,NGOs e.g. Nature Kenya, CBO

(Community Based Organization), and Business Community Leaders Based on KNBS (2019), there are 39, 112 households in the area, thus the sample size was determined using Yamane's (1967) formulae at 95% confidence level, p = 0.05, which was calculated as follows: $\boldsymbol{n = \frac{N}{1+N(e)^2} = \frac{39{,}112}{1+39{,}112(0.05)^2}} = 396\ Households$

The researcher purposively sampled respondents from various groups involved in the co-management of the Arabuko-Sokoke Forest Reserve, including households involved in participatory forest management (PFM) and those not associated with PFM, government agencies (Kenya Forest Service, Kenya Wildlife Service, National Museums of Kenya, Kenya Forestry Research Institute), NGOs like Nature Kenya, community-based organizations (CBOs), village elders, chiefs, and leaders from the business community.

Thus, the sampling frame for the study encompassed a diverse set of respondents involved in the co-management of the Arabuko-Sokoke Forest Reserve, including both participatory forest management (PFM) households and non-PFM households, as well as representatives from government agencies, NGOs, community-based organizations, and the business community. Based on the Kenya National Bureau of Statistics (2019) data of 39,112 households in the area, the initial sample size was determined using Yamane's formula at 95% confidence level as 396 households. However, since the research employed qualitative data collection methods, this calculated sample size served as a guide, and data collection continued until saturation was reached, resulting in a final sample of 100 respondents for PFM households and 90 respondents for non-PFM households.

Table 3.1: Sample Size for the Study Participants

Target Population Group	PFM	Non-PFM
Households staying adjacent to the Arabuko-Sokoke Forest Reserve	100	90
Kenya Forest Service officials	5	
Kenya Wildlife Service Officials	8	
Officials from National Museums of Kenya	3	
Officials from KEFRI	5	
Village elders	4	
Chiefs	1	
Leaders from business community	4	
Total		**220**

3.5 Data Collection Techniques

Both primary and secondary data collection procedures were used in data collection. Primary data collection entailed carrying out semi-structured sets of questions to households from participatory and non-participatory forest management, namely: Key informants, particularly: officials of CBOs, NGOs and Business Communities administrators. The primary data collection method is essential for this study since it provides original information directly from the primary population adjacent to ASFR. Secondary data collection involved a review of relevant and reliable sources from the internet namely: books and journal articles, government documents and daily newspapers.

3.6 Reliability and Validity

Reliability and validity refine the research tools with the objective that participants will certainly have no problems bearing in mind the comments and recording the information. Additionally, it equips one with some evaluation of the issue's legitimacy and the practical reliability of the details that will be gathered. Reliability and validity was carried out to check the reputation and stability of the study tools in collecting the details required for the research objectives. The study used 10% of the sample size to examine the validity and reliability of the research instruments. Therefore, 22 were used. Participants who were included were left out during the final data collection to avoid biasness.

To ensure reliability and validity, the research tools underwent a comprehensive examination by the supervisors accountable for the activity development and the forest specialists (KWS, KFS, KEFRI). The supervisors and the forest experts evaluated the declarations in the research study instruments for significance. Based upon their analysis, the tools were changed appropriately before subjecting them to data the collection for the study. Supervisors' and experts' evaluations were utilized to guarantee validity and reliability. Managers and experts counterchecked the study tools to ensure that the content within is sufficient and justifiable for adequate and sensible research. Thus, the review from the supervisors and experts ensured the reliability and validity of the research instruments obtained.

3.7 Analysis of Data

The study used qualitative data analysis to analyze data collected. The researcher sought to understand Arabuko-Sokoke participatory forest management particularly on how CFAs can establish clear CFA boundaries that can enhance the livelihoods of the adjacent communities. Qualitative analysis was essential to enable in description of both the past and present events as they appear on in the Arabuko-Sokoke participatory Forest management. From the interview, notes jotted, audio recordings collected were coded and then transcribed. Different themes that emerged were put together to assist in answering the study objectives.

The coding in the study included assigning a unique number to the respondents. The code for Households living adjacent to the Arabuko-Sokoke Forest Reserve was PH. The sample size was 100, the unique number attached was PH1---PH 100 to represent respondents from the 1st to the 100th thus following this format, Kenya Forest Service was coded as KFS 1…KFS5. Also, the Kenya Wildlife Service Officials were coded KWS1…KWS6, National Museums of officials were coded as NMK1…. NMK3, Kenya Forestry Research Institute were coded as KEFRI 1…. KEFRI 5, Village elders were coded as VE1…. VE4, since there was one chief the code provided was CF, Leaders from the business community were coded LBC1… LBC 4

3.8 Ethical Considerations

The researcher clarified research advantages to all participants prior to interactions ensuring their privacy by hiding their identification and appreciating their views. The respondents were provided with an introductory letter from the Kenyatta University seeking to ask them to consent volunteer to participants to contribute in the study. Therefore, no coercion was made to any respondent. Also, a consent letter was sought from NACOSTI before conducting the research.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter provides the introduction, general information, the extent to which participatory forest management boundaries have been developed in Arabuko-Sokoke Forest Reserve, the effectiveness of the government policies in governing the Arabuko-Sokoke Forest Resources and resource user's boundaries and the extent to which the livelihoods of the communities adjacent to the forest have improved as a result of the forest resources use and resources users' boundaries.

4.2 General Information

Questionnaires and interviews were conducted to both participatory and non-participatory households in forest management and the response rate was identified as showed in Table 4.1.

Table 4.1 Response Rate

	Respondents	**Returned**	**Unreturned**	**Percentage**
Participatory Households in Forest Management	Households living adjacent to the Arabuko-Sokoke Forest Reserve	95	5	**95**
	Kenya Forest Service officials	5	0	**100**
	Kenya Wildlife Service Officials	8	0	**100**
	Officials from National Museums of Kenya	3	0	**100**
	KEFRI	4	1	**80**
	Village elders	4	0	**100**
	Chiefs	1	0	**100**
	Leaders from business community	4	0	**100**
Non-Participatory Households in Forest Management	Non-Participatory Forest Management (NPH)	83	7	**92.22**
	Total	**207**	**13**	**94.09**

Therefore, as indicated in the Table 4.1, the average response rate for participatory and non-participatory households was found to be 94.09%. The study did not include

the questionnaires that had incomplete information. In addition, the study did not collect 100% of the data from the interviewees because some of the respondents were not available during the time of data collection. Nonetheless, a reaction rate of over 50% is sufficient and acceptable for evaluation and publication, 60% is good, while above 70% is excellent. (Mugenda and Mugenda 2008; and Kothari 2004). Based upon these assertions, the feedback rate acquired from the Arabuko-Sokoke forest adjacent participatory communities and non-participatory communities was considered perfect for this study.

The study found most (69%) of the participants in forest management were females. Males were found to be 31% of the total participatory households. This was expected since women's duties are confined to the domestic space, including firewood collection and taking care of other household affairs. In most African culture cases, women are the primary users of forest products such as fuel wood, wild foods and fodder (Mbuvi and Musyoki 2013; Mogoi, *et al.*, 2012 and Okumu and Muchapondwa 2020).

Contrary, mostly 48 (57.83%) of the non-participatory households were males while females were 35 (42.17%). This implied that men were mostly non-participatory in forest management. This was anticipated since forest's resources from Arabuko were more confined to women such as firewood collection, beekeeping, butterfly keeping and grass collection as supported by the arguments of Katwai (2016), who reported that women are more involved in the forest management.

The residency duration (period lived in the area) in Years for both the participatory households and non-participatory households are summarized in (Figure 4.1).

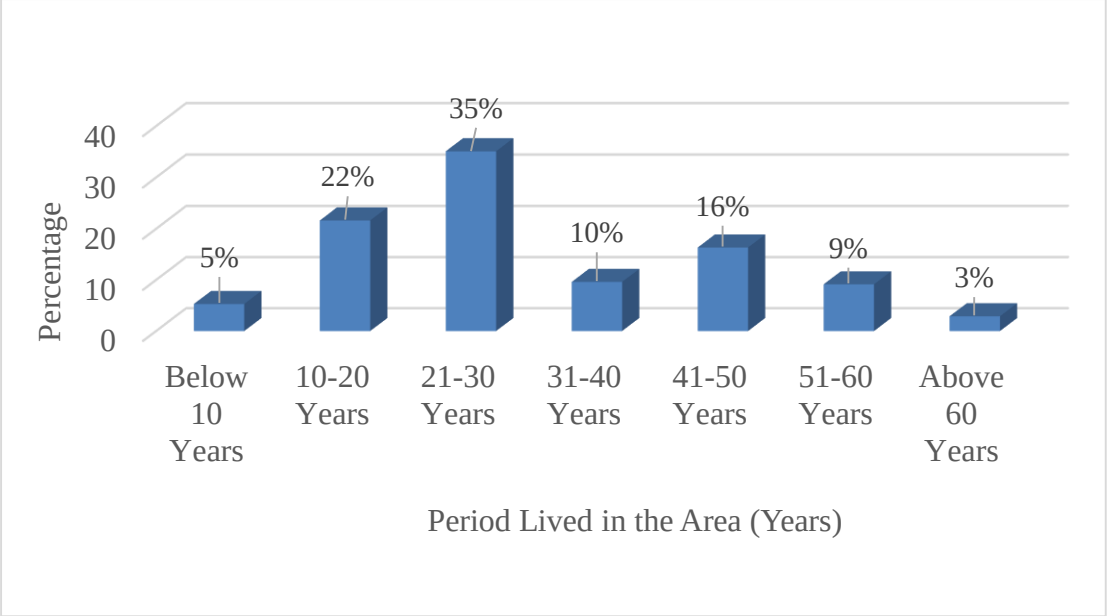

Figure 4.1: Period Lived in the Area (Years)

From the above figure 4.1, the results inferred that most participatory and non-participatory locals had resided in the study area for more than 10 years thus making them reliable in answering the study questions. The study also examined income levels, and the results are presented in Figure (4.2)

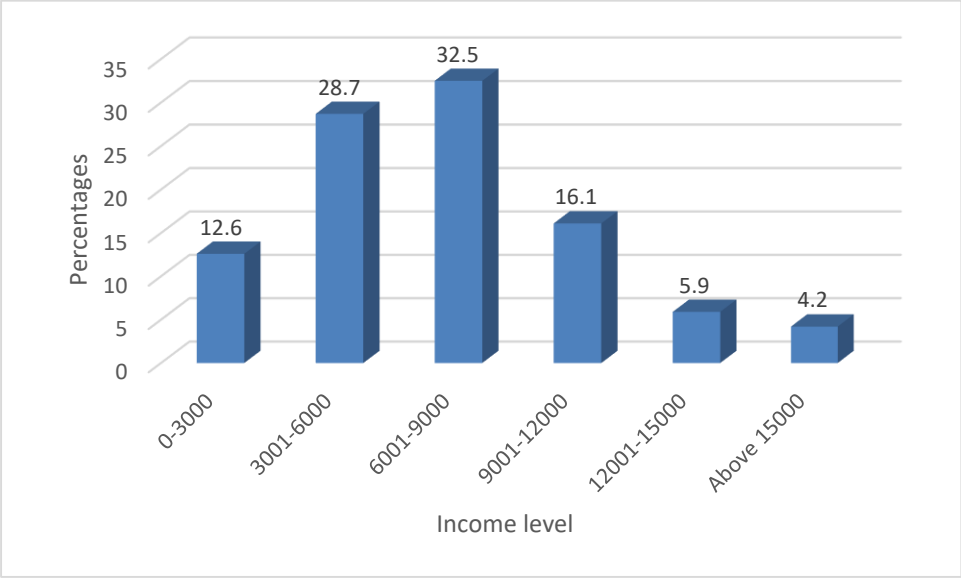

Figure 4.2: Household Income Level

The study found that the largest percentage of households surveyed, 32.5%, have an income level between 9,001 and 12,000, while the smallest percentage, 4.2%, have an income above 15,000. Income levels of 6,001-9,000 and 3,001-6,000 are almost

equally represented, with 28.7% and 27.3% of the households, respectively. A smaller fraction of households, 12.6%, reported incomes of 0-3,000. The distribution of household income levels within the Arabuko-Sokoke Forest Reserve area has significant implications for the implementation and success of participatory forest management (PFM) strategies.

The predominance of households within the 9,001 to 12,000 income bracket suggests a moderate economic base that could influence the way communities engage with PFM initiatives. With a substantial proportion of the population potentially preoccupied with meeting basic needs, there may be less incentive to participate in long-term conservation efforts that do not offer immediate financial benefits. This economic dynamic can create challenges for PFM, as the participation of local communities is crucial for the success of sustainable forest management. Conservation programs will need to be designed with sensitivity to these economic realities, ensuring that they do not place additional burdens on the households. Alternatively, these programs could provide economic incentives or benefits that align with the community's immediate financial needs, thereby fostering a more robust and mutually beneficial relationship between conservation efforts and local livelihoods.

Moreover, the small percentage of households earning above 15,000 represents a potential gap in economic diversity within the community that might impact the PFM. High-income households could possess more resources and influence, potentially enabling them to support conservation efforts more robustly or, conversely, to prioritize economic gains over environmental sustainability. The low-income households, especially those earning 0-3,000, are likely to be more vulnerable to economic pressures that could compel them to engage in unsustainable exploitation of forest resources as a means of survival.

This economic vulnerability could be addressed through PFM initiatives that incorporate alternative income-generating activities that are sustainable and reduce reliance on forest resources. Creating such economic opportunities could mitigate the pressure on the forest ecosystem while contributing to the overall socio-economic resilience of the community. For PFM strategies to be effective, they must not only consider the ecological aspects of forest conservation but also integrate socio-economic dimensions that influence human behaviour and community engagement

with natural resources. The distance in kilometres for both participatory and non-participatory households has been indicated in (Figure 4.3).

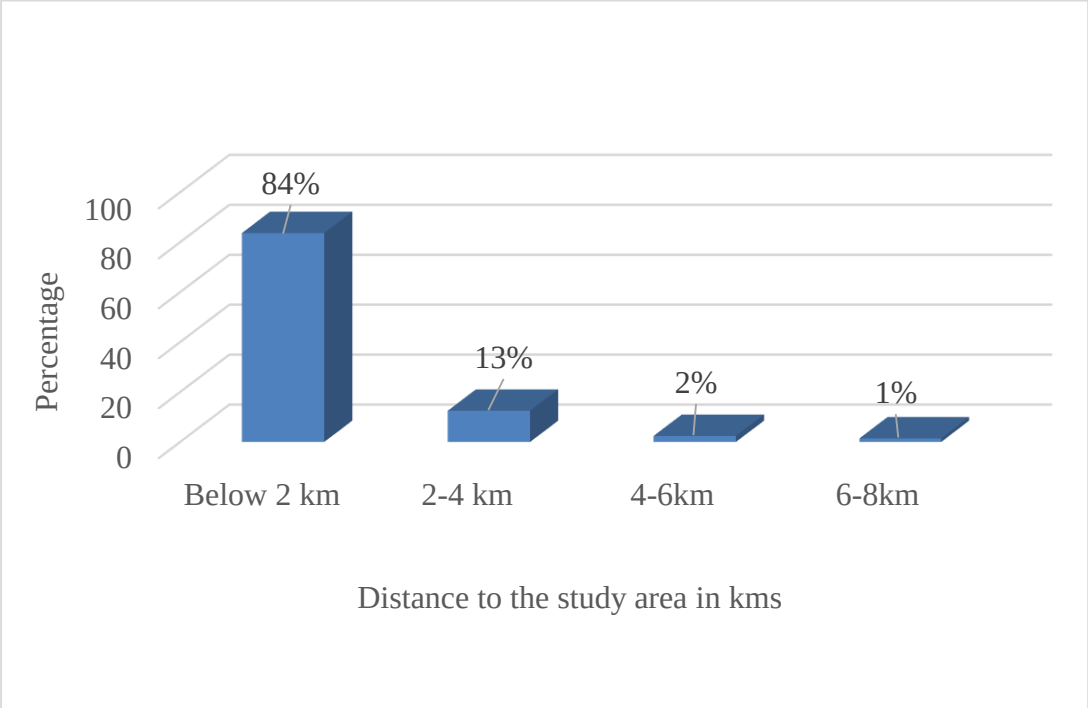

Figure 4.3: Distance to the Study Area in Kilometers

From figure 4.3, the results implied that most respondents were close to Arabuko-Sokoke Forest Reserve and thus were more knowledgeable on daily activities taking place in the reserve. The respondents were considered notable in giving comprehensive information regarding the reserve and therefore conclusions made were satisfactory for policy implication.

4.3 Participatory Forest Management Boundary Development in Arabuko-Sokoke Forest Reserve

Participatory forest management boundary development in Arabuko-Sokoke Forest Reserve was examined by conducting a comparison between communities involved in participatory forest management and those without such involvement. This comparison aimed to provide a detailed understanding of whether the establishment of boundaries for sustainable conservation and enhancement of community livelihoods has been effective in the study area. Additionally, it sought to assess if both participatory and non-participatory communities in forest management comprehended

the significance of resource user involvement and the delineation of resource boundaries.

For participatory communities, it was apparent that 88% of the forest management participants knew the meaning of resource users and resource use boundaries, while about 12% did not know the meaning of the resource user or resource users' boundaries. Some of the definitions below represents those who knew the meaning of resources users and use boundaries

> *"Resource users are those who use forest-related products" (PH1).*
>
> *"the person who depends on the forest for his/her livelihood is the resource user and boundaries are areas he is supposed to benefit and where he is not supposed to benefit from (PH3).*
>
> *Forest resource users are the communities that live adjacent to the forest and boundaries are limitations that prohibit the community from accessing the forest (PH 23).*
>
> *Moreover, VE4 reported, "resource users are people who manage their forest particularly for forest products to maintain their livelihood."*
>
> *PH12 said, "there is a distance inside the forest where people are allowed to fetch firewood and this forms the resource boundary.*
>
> *PH 14 stated, "We are allowed a distance of 1.5 kilometers beyond is a nature reserve and this includes resource boundary.*
>
> *PH26 said, "Resource users are beneficiaries of the forest resources, i.e., those using forest-related products for their income while boundaries refers to areas that separate the community with the forest and people are not supposed to go beyond that boundary."*
>
> *PH51 stated, "forest users are those at a radius of 5km and distance of 3km in the forest or people who manage their forest particularly for forest products to maintain their livelihood."*

On the part of non-participatory communities, it was found that about 71% knew the meaning of the forest users and forest boundaries. Some of the definitions from the community are captured below:

Resource users are people using forest resources from Arabuko-Sokoke forest NPH.

Resource users are people using directly or indirectly resources such as fire wood mushrooms etc. from Arabuko forest reserve and are adjacent to the forest, while boundaries entail the limits that curtail the sovereignty of those resource users (NPH5).

The results offered above imply that most of the participatory and non-participatory households understood the meaning of resource users and resource use boundaries, even though majority of the participatory communities in the management of the forest knew what the resources use and users' boundaries were as compared to non-participatory communities. This could be attributed to the fact that both the participatory and non-participatory communities live in the same location and interact regularly. These findings concur with Meador et al. (2017) who define resource users on pg. 81 as individuals that have a straight advantage or indirect advantage of the resources, while boundaries involve the limits that constraints the level of the use of those resources. Myers *et al.*, (2017) define resource users in page 19 as a group of individuals that can get the benefits of the surrounding resources and boundaries involve obstacles of accessing those resources.

The study also examined the type of forest resources that one can access from the forest by both the participatory and non-participatory community members (Figure 4.4). The major resources drawn from the forest reserve were, butterflies (31%), mangroves and dry seaside forest resources which consisted of 18%, beekeeping 10%, eco-tourism 9%, snakes 7% and food that included mushrooms and bush meat 4%, tree seedlings 6% and other types of forest resources such as fire wood was 15%.

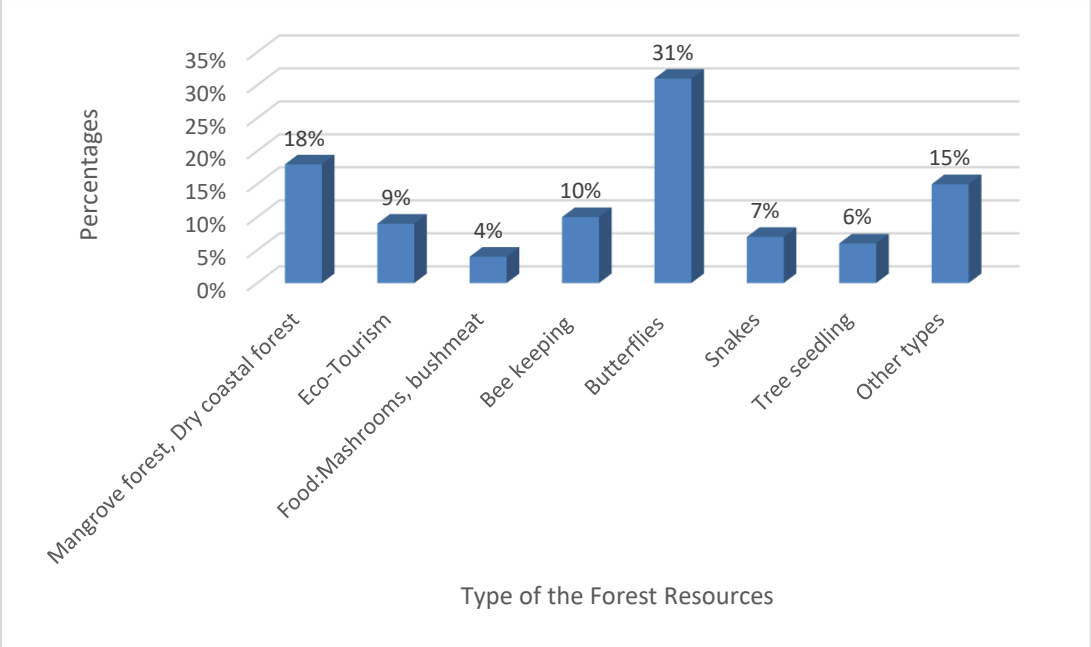

Figure 4.4: Types of Forest Resources

A forest resource refers to any material or non-material benefits derived from the forest ecosystem, including timber, non-timber forest products, water, biodiversity, and ecosystem services. It encompasses all the goods and services provided by forests that contribute to the livelihood and well-being of the surrounding communities.

As summarized in Figure 4.4, the results indicate that butterflies are the type of forest resources that members access from the forest to a large extent. Some of the participatory members who know the types of the forest resources accessed from the forest confirmed this finding as follows:

> *Mangrove seedlings" (PH1).*
> *Services such as eco-tourism, food e.g mushroom & Firewood." PH2*
> *Tree seedlings, …we also take tourists to the forest and explain different functions of tree species, we dance to the tourists and show them our clothes, artifacts and get some income (PH8, PH25 and PH27).*
> *Herbals, building materials and snakes PH8.PH6*
> *Beekeeping, butterflies PH71 PH43*

Non-participatory household respondents were not familiar with forest resources accessed from the forest given that they were not directly involved in the management of the forest reserve. They reported that, most of the forest resources are enjoyed by

those registered in as CFA groups and it is unlawful to gather resources when one is not a participant in a certain CFA. Nevertheless, few of them pointed out the type of resources one may access from the forest as follows:

> *Fuel, wood, building poles, medicine and textile dyes"* (NPH, 7).
> *Beekeeping* NPH13
> *Firewood, timber, poles, butterflies, honey, mushroom and herbs are the forest resources*. NPH43
> *Mangrove seedlings* NPH75
> *Butterflies, grass, herbals, firewood* NPH 26

In summary, both participatory and non-participatory members in forest management demonstrated that there are numerous types of forest resources available in Arabuko Sokoke Forest Reserve and that the resource users do not benefit from one type of resource, but they enjoy a variety of the resources depending on their preferences. It is clear that the forest resource users' boundaries have been well established as only resource users must be /registered members in order to be allowed to use a particular resource from the forest as long it is acceptable and does not endanger the species extinction. Langat, *et al.,* (2016) reported that, forests are essential to communities as they provide numerous benefits such as collecting firewood, rainfall attraction and promotes tourism.

Furthermore, Hao, *et al.,* (2019) disclosed a favorable relationship between forest resources and economic development. Furthermore, Okumu and Muchapondwa (2020) discovered that effective protection of forest resources is beneficial to the area via the provision of food, rainfall attraction and medicinal herbs. Aryal (2015) also reported that the susceptible and marginalized groups, to a high level, depend on natural resources, particularly forestry, wild animals and fisheries resources as a source of their incomes. They further, rely upon the forests for honey, fruits, medicinal plants, fire wood and charcoal for income generation, worship, and for performing their rituals.

The research sought to discover the procedure of gathering forest resources. The research included both the participatory and non-participatory communities in forest administration in determining the ways of collecting forest resources. The participatory and non-participatory communities gave the procedures as follows:

> One needs to be a member of a CFA or user group in order to be eligible to get resources from the forest (PH1, PH17 and PH66).

Obtaining a permit from KFS was also identified as one of the procedures as demonstrated by the following respondents:

> *You have to get a permit from the respective department like KFS for collecting the resources in the forests*." PH2
>
> *Obtaining permit from KFS is the procedure for collecting the resources in the forests*." PH4
>
> *By getting a permit from KFS and going to the forest 3 days a week (Monday, Wednesday and Friday) is the procedure for collecting the resources in the forests*" PH37

On the other side, the responses from the non-participatory community members gave the procedure as follows:

> *One has to present to the forest management authority* the *relevant documents and interviews done before collecting resources from the forest* (NPH48).
>
> *One also has to be a user group member to get resources from the forests* (NPH61and NPH5).
>
> *When collecting resources from the forest you are not required engage in unlawful activities such as deforestation, felling down live trees and killing of the wild animals*. NPH7
>
> *Any interested individual member willing to carry out any activity from the forest must first be registered by the user group and have an identity to access the utilization areas (zones) in the forest*. NPH73
>
> *You have to apply for a user license for the collection of the resources from the forest*... NPH81

In summary, both the participatory and non-participatory households indicated that there are boundaries for collecting forest resources from Arabuko Sokoke Forest Reserve. These boundaries cut across as long as the resource users are either registered CFA members of a user group and or are given a license to use those resources and there is a certain distance inside the forest from which one can collect a particular resource.

The importance of the boundaries is to minimize the destruction of the forests and make sure the only registered or authorized members can have access to the resources. Also, by enabling the licensed individuals to enter the forest makes those users to be self-disciplined and not engage in criminal activities. Community resource users can protect the resources so that they can use them for a long time without destroying them (Mutune and Lund 2016; Adinoyi, 2015, Ouko, *et al.*, 2018)

The study also examined the advantages of forest resource use and the acceptable limits that one can collect from the forest. The findings from the participatory CFA members clarified the benefits of forest resource use and boundaries as follows: provision of continuous income to the community (PH2) and acts as windbreakers attracts rainfall and offer organic medication VE2. In the case of the advantages of the forest limits, the CF reported that forest resource usage and limits helps them in getting food- wild fruits, edible caterpillars are quickly collected and consumed by citizens. To maintain honey through bee-keeping PH21, improves the security of the forest and enhances sustainable use of the resources, control exploitation of forest resources (CF).

The majority of the non-participatory members suggested that they have not directly benefited from the establishment of the PH. However, it emerged that non-PH community are also indirectly gaining from the resource use and users' limits as this has boosted the forest's protection which functions as the source of rainfall attraction in the locality. This has made it possible for the non-PH communities to farm cassava, pepper and other crucial products as a result of appropriate rains.

Furthermore, from an interview session with the KFS 3 and KEFRI 1 informants, it was reported that resource use and boundaries establishments are necessary to curb encroachment, clear conservation area and reduce human-animal conflict.

Moreover, KFS 1 Reported that:

> *Livelihoods of CFA members were poor and dependent mostly on poaching both trees and wild animals before resource users and boundaries were established due to uncoordinated forest management system.*

Furthermore, a KWS 2 and KEFRI 2 informants noted that resource use and users boundaries are important in benefiting the adjacent communities in accessing forest resources and conservation of the forest.

> *Resource users and boundaries establishments are necessary because the forest is an important conservation area and also communities need to benefit from the forest resources*, KWS2.
>
> *Resource users and boundaries establishments are necessary to benefit the forest adjacent communities and also conservation of the forest* KEFRI 2.

Finally, the NMK 3 informant observed that:

> *Resource use and users boundaries establishments are necessary for the conservation and protection of our heritage and are necessary for both biological diversity and resource partitioning for sustainable control, movements of people and wildlife to safeguard human and wildlife fights by reducing the level of interactions.*

The argument from both participatory and non-participatory members showed immeasurable benefits associated with forest resource use and resource users' boundaries. Maintaining firm boundaries is significant in ensuring the resources are protected and are not overused (Fasona, *et al.*, 2019, Clark, *et al.*, 2016, Ming'ate and Bollig 2016).

The study examined the rules governing the access of the forest resources from both participatory and non-participatory communities in at Arabuko-Sokoke Forest reserve. About 100% of the participatory communities reported that collecting of the resources from the forest is only done if a member belongs to a registered conservation group and has to fulfill the following requirements;

> *A member has to possess a card signed by the forester and warden to be allowed to collect resources from the forest (PH19).*
>
> *Monthly collections of fuel-woods, reptiles and fishing at Mida creeks are regulated by KFS certificates.*
>
> *The forest users need to limit the collection of endangered tree species to avoid population decline.*

There are specific times and duration for the forest users to access the utilization zone.

Members of the CFA are not allowed to use an axe saw when collecting firewood, but, if a person is found using axe saw to collect firewood, he or she is barred from the forest.

There are specific days for firewood collection, notably Monday, Wednesday and Friday and children are barred from collecting resources from the forest.

For the non-participatory locals, majority, about 80% of them showed that they do not know particular rules for regulating the collection of forest resources since they were not direct beneficiaries. Nevertheless, about 20% of those not participating in forest management indicated that one has to belong to a user group in order to be allowed to utilize forest resources. The following quotes represent this finding:

Some rules governing the forest resources collection is that one has to be registered in a conservation group (NPH2).

Only *registered members get resources from the forest and those not in any group are barred from the forest* (NHP7).

However, KFS being custodian have more rights compared to the community surrounding the resource at the expense of these two being in partnership of its management (NPH5).

These results implied that the government; through the Kenya Forest Service, KEFRI, Kenya Wildlife Service and National Museums of Kenya has developed effective rules and regulations that are much effective for protecting the forest. Additionally, conducive rules and regulations effectively minimize destruction of resources and reduce the conflicts between human and wildlife. Effective policies and regulations are necessary for forest governance and enhanced sustainability (Adinoyi 2015, Ming'ate, *et al.,* 2016; Mutune and Lund 2016).

The research sought to examine if there are sanctions for resource users' terms of dealing with those who break the laws from both participatory and non-participatory locals.

In the case of participatory communities, the policy breakers are apprehended and banned from accessing forest resources (PH1and PH7). Further:

Majority of the respondents in the non-PH participatory communities reported that, the rule-breakers usually face penalties of being fined or prohibited from carrying any activities for a particular period when found guilty, NPH45, Are arrested by the forest wardens and charged on the spot NPH 58, charged in the courts, NPH83 and members of the conservation groups are fined when found destroying the forest and in some cases are barred from accessing the forest, (NPH37).

Based on these arguments from both the participatory and non-participatory locals, it is evident that there are punishments for those who break the regulations concerning forest resource use whether one is in participatory team or not (Adinoyi 2015, Duguma, *et al.,* 2019, Tegegne, *et al.*, 2016, Hamunyela, *et al.,* 2020).

The study examined whether there is protection of the community agents and responses from PH and non-PH communities analyzed. In the case of PH participatory communities, leaders fear to report the rule-breakers to the authorities because of fear and death threats (VE, 4, PH41, LBC 1 PH3 PH3, CF, LBC 4, and PH44).

In the case of non-participatory members, it became apparent that: "*The protection for communities' representatives is under government and people fear government because they wear uniforms and this has led the leaders from the community to be respected but still are attacked*" (NPH 5). The community leaders report those who disrespect them to the government agencies and stiff actions are taken, and this has widened the attacks of the representatives in some areas. NPH 1 said "*there are communities scouts who help the government forest guards overlook the forest's protection, especially from the non-members"* NPH23 stated. NPH38 stated, "*The Kenya forest service is determinant of execution of rules, but the community representatives have a boundary of this since they are within the community*" NPH38.

Furthermore, from an interview session, KFS 1 noted, "*Good agencies such as KFS, KWS and other friendly ministries and disciplined forces are available not forgetting various stakeholders such as ASF, AROCHA, Nature Kenya among others who ensure rules are obeyed,"* KFS 1

Moreover, KWS 2 revealed, "*resource user's boundaries have got support from government. All the government agencies support the CFAs and boundaries set in collaboration with the agencies to ensure the resources are protected,"* KWS 1. Besides, KEFRI 3, reported that "*there is an agreement on how to benefit from the forest, and they write a memorandum of understanding with the government and this has led to mutual understanding"* KEFRI 3.

Also, KEFRI 1 noted that, "*There is a lot of support from the government. Now that the community forest associations have been recognized in the new forest Act 2016, it becomes easy to execute the rules".* Lastly, NMK 2 argued, "*Several government agencies working in ASFR have started to promote positive livelihood programs in the section of forest conservation. This could not be achieved without collaborations and working with the adjacent population,"*

The participatory and non-participatory respondents indicated that the community leadership' protection in enforcement of the rules for those violating them is not sufficient. These pose risks to these community leaders and may decide not to report the lawbreakers to the authority because of the fear of their lives and their families. The community leaders need to be granted sufficient security to minimize coercion and be vocal to report the perpetrators to the authority; their safety has not been practically guaranteed. Few community leaders are provided with security and this puts their life at risk. Ensuring there is adequate security for the leaders is essential to prevent them from attacks, especially by the lawbreakers who may feel betrayed to the forest authority

Participatory forest management boundary development in Arabuko-Sokoke Forest Reserve involves delineating specific areas within the forest reserve for sustainable resource use and conservation, with active involvement and decision-making from local communities. These boundaries are established through a collaborative process between the Kenya Forest Service, Community Forest Associations (CFAs), and other stakeholders. The management boundaries aim to regulate access to forest resources, prevent overexploitation, and ensure the long-term preservation of the ecosystem. They may include physical demarcations such as fences, buffer zones, or designated areas for controlled resource extraction. The boundaries define the rights and responsibilities of community members in terms of resource utilization, monitoring,

and enforcement. Effective boundary management requires continuous engagement with local communities, capacity building, and awareness-raising efforts to promote sustainable practices and foster a sense of ownership in the conservation efforts.

The high response rate of 94.09% from both participatory (95%) and non-participatory (92.22%) households as shown in Table 4.1 lends credibility to the findings on communities' understanding of resource users, boundaries and procedures for accessing forest resources. The gender distribution, with 69% female participation in forest management activities aligns with the sociocultural roles of women in utilizing forest products like firewood, food and handicrafts. Conversely, the male majority (57.83%) among non-participatory households reflects traditional gender norms around direct forest exploitation.

4.4 The Effectiveness of the Government Policies in Governing Forest Resources and Resource User's Boundaries

Analysis of the results is presented from both PH and NPH communities to show their understanding concerning government policies in managing the forest resources. It was noted the participatory communities reported that resource users are allowed to collect only dead logs and no cutting of live ones" (PH2), supervision of forest has to be done by KWS and KFS, (CF) and it is illegal to cut down *mangrove trees* (LBC 4). The household from the PH communities further argued that the policies are effective since they have helped the communities and especially the resource users to understand the scope of sustainable conservation of the forest fully (PH4), minimized the extensive destruction of forests (PH3): ,accelerated members to be involvement in various individual rights like collecting fire wood, timber, butterflies for sale, grass for thatching, grazing their animals, leisure activities and for research (PH 16).

In the case the non-participatory communities regarding the effectiveness of the government policies in the sustainable management of the Arabuko-Sokoke Forest Resources and resource user's limits they reported that "government policies have plainly stipulated exactly how the CFA participants should protect the forest from the destruction" (NPH3) “the participatory forest management initiatives are primarily relevant and beneficial to the community members involved, as non-members are prohibited from entering the forest to collect or utilize any kind of resource” (NPH8 and NPH 36).

The results from both participatory and non-participatory communities signified effectiveness of the government policies in the sustainable management of the Arabuko-Sokoke Forest Reserve; resource user's boundaries are mainly applicable to those who benefit from the forest resources. Conservation of the forest is critical in promoting the sustainability of the AFSR ecosystem for both participatory and non-participatory communities. This could provide a loophole for the non–participatory communities to engage in forest destruction activities thinking that the developed policies do not affect them (Heikkala, *et al.,* 2016; Picchio *et al.,* 2018; Mutoko, *et al.,* 2015; Buttoud, *et al.,* 2011; Rasmussen, *et al.,* 2017; Mujawamariya and Karimov 2014). Concerning how the government influences policies in the PH community members and how to manage the forest resource users and resources boundaries at Arabuko Sokoke Forest Reserve the study found that, the government ensures there is no forest destruction and prosecute the culprits (CF) *by massively punishing those engaged in forest destruction and revoking their license or permit for accessing forest resources* (PH4). The government also uses the policies to help the communities to establish tree nurseries (LBC and PH17) protect water resources in the forest *which has increased the supply of fish especially at the Mida Creek* (VE4 and VE), helped *communities to harvest forest resources such as firewood, beekeeping and butterfly* (PH57and finally led to law and order in the use of the forest resources (VE2).

For the non-participatory communities, almost all of them were not able to explain how government policies have influenced the management of the resource users and resources boundaries at Arabuko-Sokoke Forest Reserve since only registered members are allowed to benefit from the forest resources NPH4. The responses from both participatory and non-participatory members show that there is an influence of government policies on managing resource users and resources boundaries. The community is aware of how government policies influence resource users and boundaries. The government policies have helped community members to understand their role in the conservation and management of resources PH57and NPH4. (Myers, *et al*., 2017; Mutune and Lund 2016; Adinoyi, 2015),

The study also sought to answer the question on how the implementation of the government policies can be done in order to enhance the management of resource users and use resource boundaries. The results confirmed that for implementation of the boundaries to be effective, "*resource users must participate in forest management*

*as CFA groups user groups (*PH3), so that they can *monitor and protect forest resources to reduce forest deforestation and destruction (*LBC 3 and PH38) *and the laws policies created to govern the forest must be used without favour* (PH43) (GoK, 2016).

It can be concluded from the results that, the government's effectiveness in governing the Arabuko-Sokoke forest resources and resource user's boundaries depends on developing effective policies and improving community awareness. Local communities should be actively involved in forest management and sustainable use of forest resources. (Ming'ate 2014a; 2016.; Ming'ate 20 14 b; Wily 2018; Pringle, 2017; Chhetri, *et al.*, 2013; Jashimuddin & Inoue, 2012; Maikhuri, *et al.*, 2000)

A further review of the forest governance policies in Kenya to understand if they have been effective found that, forest governance policies in Kenya have been the subject of much scrutiny in recent years due to the high rates of deforestation and degradation that have been observed, Muok, Mosberg, Eriksen & Ong'ech, 2021

However, the government of Kenya, has responded by implementing a range of measures aimed at curbing illegal logging and promoting efficient forest governance. These measures include increased enforcement of forest laws, the establishment of community forest management plans, and the promotion of alternative livelihoods for forest-dependent communities (Thygesen, Løber, Skensved & Hansen, 2016). Thus, for this study to understand the effectiveness of the effectiveness of the government policies in governing forest resources and resource user's boundaries. Some of the policies were reviewed as follows:

1. Forest policy, 2014: The Forest Policy 2014 provides a framework for sustainable conservation and participatory management of forest resources in Kenya. Specifically, it promotes fair access to forest products and services through public-private partnerships for ecotourism, agroforestry and commercial off-take of forest products. It also advocates for demarcation and protection of forest boundaries in collaboration with adjacent communities. However, effective implementation of the policy is constrained by factors like weak inter-agency coordination, land tenure conflicts, human-wildlife conflicts, funding shortfalls and inadequate capacity for surveillance. A multi-stakeholder approach involving forest authorities, communities, private sector and development partners is essential for addressing these challenges and realizing the

policy goals of sustainable forest conservation and enhanced socio-economic development of forest-dependent communities as envisioned for Arabuko Sokoke Forest Reserve.

The policy Strengths:

The Forest Policy 2014 aligns with the goals of establishing clear forest boundaries and enhancing livelihoods of forest communities. It promotes participatory forest management, ecotourism, agroforestry and sustainable use of forest resources.

Weaknesses:

The policy lacks clear guidelines for demarcating forest boundaries which may challenge the Arabuko Sokoke forest reservation process.

There are no clear measures outlined to resolve human-wildlife conflicts which pose threats to communities living near Arabuko Sokoke forest.

Opportunities:

The policy advocates for public-private partnerships in ecotourism and value addition which could attract investment and create income for the Arabuko Sokoke forest communities.

It also promotes commercial off-take of some forest products like honey through participatory agreements which can provide alternative livelihood sources.

Threats:

Weak inter-agency coordination between environment authorities and lack of adequate personnel and funds to implement the policy. This may hamper conservation and livelihood enhancement initiatives around Arabuko Sokoke forest.

According to PESTEL analysis:

Politically: Enhanced political goodwill is required to resolve land tenure issues with communities bordering Arabuko Sokoke forest.

Economically: Ecotourism and participatory forest commercialization opportunities need to be optimized.

Socio-culturally: There is need for more education and awareness on sustainable conservation for the forest-adjacent communities.

Technologically: GIS, remote sensing and drones could facilitate more precise forest boundary mapping.

Environmentally: Clear boundaries will promote forest protection and reduce human encroachment.

Legally: The policy provides a framework for participatory forest management plans that are legally binding.

In conclusion, the Forest Policy 2014 provides an enabling environment for sustainable conservation and livelihood enhancement goals around Arabuko Sokoke forest reserve, if well implemented. A multi-stakeholder and participatory approach is key for its successful actualization.

2. Wildlife policy, 2020: The Wildlife Policy 2020 provides a framework for sustainable management of wildlife resources in Kenya. It promotes an integrated ecosystem approach involving communities, private sector, civil society and other stakeholders in wildlife conservation and management. The policy has objectives of enhancing economic and social benefits from wildlife through devolution of user rights, benefit sharing, commercial investments, access regulations, as well as addressing human-wildlife conflicts. It also aims to conserve wildlife habitats and expand range areas through participatory land use planning and resource mobilization for protection and surveillance. However, realizing these goals faces challenges like poaching, climate change, land use changes, institutional capacity and funding constraints. Overcoming these limitations requires concerted efforts in capacity building, community engagement, public-private partnerships, and regional cooperation to harness the full potential of wildlife as a driver of sustainable development in Kenya.

Strengths of the policy:

The policy prioritizes participatory wildlife conservation and management through community scouts and rangers. This can enhance protection of Arabuko Sokoke forest boundaries.

It promotes wildlife conservation enterprises and benefit-sharing to improve community livelihoods. This provides income opportunities for Arabuko Sokoke forest adjacent communities.

Weaknesses:

Inadequate funding for compensation of human-wildlife conflicts which are prevalent in communities bordering Arabuko Sokoke forest.

Lack of clear institutional framework for mitigating human-wildlife conflicts around conservation areas like Arabuko Sokoke forest.

Opportunities:

Provisions for public-private partnerships in wildlife conservation can attract investments in ecotourism and conservation enterprises around Arabuko Sokoke, benefiting local communities.

The devolution of user rights to communities provides for participation of Arabuko Sokoke adjacent communities in sustainable utilization of wildlife resources within the forest.

Threats:

Climate change leading to adverse impacts on wildlife habitats within Arabuko Sokoke forest reserve.

Inadequate personnel and technology capacitation for effective monitoring of the Arabuko Sokoke forest boundaries and wildlife security operations.

According to PESTEL analysis:

Political: Engagement with local leaders and administration is key for mobilizing community participation in establishing and protecting Arabuko Sokoke forest boundaries.

Economic: Investments in conservation enterprises and payment for ecosystem services can incentivize communities in sustainable management of Arabuko Sokoke forest ecosystem.

Socio-cultural: Community awareness and educating local clans bordering the forest can promote conservation culture.

Technological: Geo-mapping technology and digital wildlife surveillance infrastructure can enhance real-time monitoring of Arabuko Sokoke forest boundaries.

Environmental: Clear boundaries will deter degradation of Arabuko Sokoke forest ecosystem and corridors used by wildlife.

Legal: Registration and gazettement of Arabuko Sokoke forest boundary is crucial for legal protection from human encroachment.

In summary, the Wildlife Policy 2020 creates an enabling environment for participatory management, investment mobilization and institutional coordination towards wildlife conservation and increased community benefits around protected areas like Arabuko Sokoke forest.

3. Agricultural Policy, 2021: The Agricultural Policy 2021 provides a framework for transforming Kenya's agricultural sector into an economically viable, modern and climate-smart sector. It aims to increase production and productivity for food and nutritional security by facilitating access to inputs, technology, financial services and markets. The policy also seeks to make agriculture more resilient to climate change through promotion of innovations such as drought tolerant crops and irrigation. To achieve this, the policy proposes reforms in research, extension services, value addition and post-harvest management. However, implementation faces hurdles like inadequate financing, weak public-private partnerships and institutional capacity constraints across national and county governments. Overcoming these limitations calls for increased budgetary allocation, incentivizing private sector participation and strengthening coordination between stakeholders in the agricultural value chain in line with a food systems approach.

The Strengths of the policy include:

Promotes climate-smart agriculture and agroforestry which can reduce pressure on Arabuko Sokoke forest reserve.

Advocates for value addition and alternative livelihood sources which can benefit Arabuko Sokoke forest-adjacent communities.

Weaknesses:

No clear guidelines on preventing encroachment of protected forests for farming activities which affects Arabuko Sokoke.

Lacks clear mechanisms for resolving crop damage by wildlife from Arabuko Sokoke forest.

Opportunities:

Scope for public-private-partnerships in commercial off-take of non-wood forest products like gums, resins and honey, generating income for local communities.

Potential to leverage emerging technologies like drones, GIS and digitized extension platforms to monitor boundaries and land use changes around Arabuko Sokoke forest.

Threats:

Climate change leading to negative impacts on crop and livestock productivity for communities neighboring Arabuko Sokoke forest reserve.

Human-wildlife conflicts due to lack of clear buffer zones around Arabuko Sokoke forest reserve.

According to PESTEL analysis:

Political: Support from county leadership and administrators needed to prevent encroachment into Arabuko Sokoke forest.

Economic: Incentives for communities in forest conservation through payment for ecosystem services.

Socio-cultural: Community sensitization to reduce overdependence on subsistence farming around Arabuko Sokoke.

Technological: Leveraging GIS, remote sensing and digital systems to bolster monitoring of Arabuko Sokoke forest ecosystems.

Environmental: Clearly defined Arabuko Sokoke boundaries will conserve water catchment areas and breeding grounds for pollinators.

Legal: Gaps in coordination between environment and agriculture agencies undermine enforcement of conservation regulations.

In summary, an integrated approach aligning agriculture, environment, land use policies and community interests is vital for achieving Arabuko Sokoke forest conservation and improved livelihoods of neighboring communities.

4. National Environment Policy, 2013: The National Environment Policy 2013 provides a framework for an integrated approach towards sustainable management of Kenya's environment and natural resources. It aims to ensure a clean, healthy, secure and sustainably managed environment while also enhancing economic growth and improving community livelihoods. To achieve this, the policy proposes mainstreaming environmental considerations across all sectors, improving pollution and waste management, increasing forest cover, and promoting biodiversity conservation, environmental governance, education and awareness. However, implementation faces barriers like conflicting sectoral policies, climate change impacts, population pressure, urbanization and institutional challenges in coordination between national and county governments. Realizing the objectives calls for concerted efforts across all levels of government, private sector, civil society and communities to facilitate the harmonization of environmental, social and economic goals for sustainable development.

Strengths of the policy:

Promotes participatory forest management through involvement of communities in protection of water towers like Arabuko Sokoke forest reserve.

Advocates for development of county environmental action plans to address specific conservation needs of Arabuko Sokoke forest.

Weaknesses:

Lacks clear guidelines for resolving issues of land tenure and squatting which contribute to deforestation of key water towers like Arabuko Sokoke forest.

No clear mechanisms and funds allocation for compensating crop damage by wildlife from Arabuko Sokoke forest reserve.

Opportunities:

Partnerships with private sector and civil society organizations to mobilize resources and expertise for conservation initiatives around Arabuko Sokoke forest.

Potential to leverage carbon trading opportunities to fund forest conservation and alternative livelihood projects for adjacent communities of Arabuko Sokoke forest.

Threats:

Climate change leading to negative impacts on viability of Arabuko Sokoke forest ecosystems.

Conflicting sector policies driving agricultural expansion at expense of key water towers like Arabuko Sokoke Forest Reserve.

According to PESTEL analysis:

Political: Support from county leadership key to resolve squatting and land tenure issues around Arabuko Sokoke forest.

Economic: Ecotourism and sustainable utilization of forest resources to generate county revenue and community livelihoods.

Socio-cultural: Sensitizing community on importance of Arabuko Sokoke forest conservation for cultural heritage.

Technological: Geo-mapping for forest boundary demarcation and digital systems for surveillance.

Environmental: Arabuko Sokoke boundaries critical for sustaining key water catchment areas and endangered species habitat.

Legal: Gaps in coordination between environment and land agencies in developing integrated regional conservation plans.

In conclusion, the policy provides a good framework for participatory and sustainable conservation initiatives around Arabuko Sokoke forest, albeit implementation challenges that require collaborative resolution.

5. National Water Policy, 2021*:* The National Water Policy 2021 provides a framework for sustainable management of water resources to ensure adequate quantity and quality for livelihoods, food security, industrial development and environmental sustainability. It promotes integrated water resources management approaches involving coordination between national and county governments, catchment authorities, private sector and communities. The policy advocates for

measures like water storage and flood control infrastructure, water recycling and conservation technologies, protection of water catchments, and reviewing institutional frameworks. However, implementation faces barriers like climate change, inadequate funding, weak governance structures and low public awareness. Overcoming these limitations calls for increased budgetary allocation to the sector, capacity building of water institutions, embracing innovations, and enabling greater stakeholder participation to actualize sustainable, equitable and affordable access to clean water.

The Strengths of the policy include:

Promotes protection and conservation of water catchment areas like the Arabuko Sokoke forest, which is a vital water tower.

Advocates for community participation in water resources management, enhancing involvement of locals around Arabuko Sokoke.

Calls for developing alternative livelihoods and income sources for communities living near water towers, benefiting those around Arabuko Sokoke.

Weaknesses:

Lacks specific strategies to resolve land tenure issues and human encroachment affecting critical water catchments like Arabuko Sokoke.

Inadequate budgetary provisions to compensate communities affected by human-wildlife conflicts around water towers.

Opportunities:

Public-private partnerships can mobilize financing for water projects benefiting communities around Arabuko Sokoke while promoting conservation.

Use of data, mapping and monitoring technologies for demarcating boundaries and surveillance of forests like Arabuko Sokoke.

Threats:

Climate change impacts like droughts affecting water availability and ecosystems in Arabuko Sokoke forest.

Population pressure and illegal activities threatening conservation efforts in water catchment areas.

According to PESTEL Analysis:

Political: Political goodwill is needed to resolve land tenure issues affecting conservation areas like Arabuko Sokoke.

Economic: Payment for ecosystem services from Arabuko Sokoke can incentivize community participation in conservation efforts.

Social: Collaborating with local traditional institutions can enhance community awareness on conserving Arabuko Sokoke.

Technological: Deploying technologies like GIS, drones for mapping, monitoring boundaries and encroachment in Arabuko Sokoke.

Environmental: Conserving Arabuko Sokoke boundaries protects vital water sources and regulates local micro-climates.

Legal: Harmonizing policies around land, water and environment to enforce conservation of Arabuko Sokoke forest.

In summary, the Water Policy 2021 provides an enabling environment for sustainable water resources management by prioritizing conservation of catchment areas like Arabuko Sokoke through a participatory, multi-sectoral and community-based approach. Proper implementation addressing the highlighted challenges is key.

6. National Wetlands Conservation and Management Policy, 2008: The National Wetlands Conservation and Management Policy 2008 provides a framework for the sustainable utilization, conservation and management of wetland resources in Kenya. It aims to mainstream wetland concerns into the national development process, promote interdisciplinary and cross-sectoral approaches, and ensure equitable sharing of benefits from wetland resources. The policy advocates for measures such as developing an inventory of wetlands, promoting sustainable use, rehabilitating degraded wetlands, establishing buffer zones, and encouraging community participation in conservation efforts. However, implementation has faced challenges such as inadequate funding, weak enforcement of regulations, lack of public awareness, and conflicting sectoral policies. Realizing the goals of this policy requires addressing these barriers through increased budgetary allocation, capacity building, enhanced stakeholder coordination, and harmonization of policies to strike a balance between sustainable use and conservation of wetland ecosystems.

The Strengths of the policy include:

Promotes identification and delineation of wetland boundaries, which could aid in demarcating sensitive wetland areas within Arabuko Sokoke.

Advocates for community participation in wetland management, enhancing involvement of locals around Arabuko Sokoke.

Emphasizes sustainable use of wetland resources, allowing regulated access for communities neighboring Arabuko Sokoke.

Weaknesses:

Lacks clear mechanisms for resolving land tenure conflicts in wetland/forest areas like Arabuko Sokoke.

Inadequate provisions for alternative livelihood support for communities affected by restricted wetland access around Arabuko Sokoke.

Opportunities:

Potential for ecotourism partnerships highlighting unique wetland ecosystems within Arabuko Sokoke.

Development of community-based wetland management plans for areas bordering Arabuko Sokoke forest.

Threats:

Population pressure and illegal extraction threatening conservation of wetlands within Arabuko Sokoke forest.

Climate change impacts like droughts affecting wetland hydrology and ecosystems of Arabuko Sokoke.

According to PESTEL Analysis:

Political: Need political will to safeguard wetlands and resolve land conflicts around Arabuko Sokoke.

Economic: Wetland conservation can sustain livelihoods through tourism, fisheries and forest products around Arabuko Sokoke.

Social: Collaborating with local institutions for public awareness on conserving wetland-forest ecosystems like Arabuko Sokoke.

Technological: Using technologies like satellite mapping and drones to demarcate wetland boundaries within Arabuko Sokoke.

Environmental: Establishing Arabuko Sokoke wetland boundaries protects breeding areas for fauna and regulates water flows.

Legal: Harmonizing policies across environment, forestry, land and water sectors to enforce conservation regulations.

The Wetlands Policy provides a basis for integrated conservation of unique wetland-forest ecosystems like Arabuko Sokoke through delineation of boundaries, sustainable community use, and collaboration with stakeholders. However, effective implementation requires overcoming land tenure issues, resource constraints and policy disharmony.

4.4.1 Summary of the Effectiveness of All Policies Above

The Forest Policy 2014 provides a strong foundation for the establishment of clear forest boundaries and participatory management involving local communities around Arabuko Sokoke. Its promotion of ecotourism, agroforestry, and sustainable utilization of forest resources aligns well with the aim of enhancing livelihoods while conserving the reserve. However, the policy lacks specific guidelines for demarcating boundaries and addressing human-wildlife conflicts, which are critical issues in the Arabuko Sokoke context. The Wildlife Policy 2020 complements these aspects by advocating for community involvement in conservation enterprises, benefit-sharing mechanisms, and mitigation of human-wildlife conflicts. Cumulatively, these policies create an enabling environment for participatory boundary establishment and livelihood diversification for communities neighboring Arabuko Sokoke.

The Agricultural Policy 2021 and the National Environment Policy 2013 also offer relevant provisions. The former promotes climate-smart agriculture and value addition of forest products, which could reduce pressures on Arabuko Sokoke while generating alternative income sources. The latter emphasizes participatory forest management, county-level environmental action plans, and partnerships for resource mobilization – all applicable to the Arabuko Sokoke context. However, both policies lack explicit

conflict resolution mechanisms related to crop damage by wildlife and land tenure issues around protected areas. The National Water Policy 2021 directly tackles the conservation of critical water catchments like Arabuko Sokoke and calls for community involvement in managing such areas, though it too lacks strategies to address land conflicts.

The National Wetlands Conservation and Management Policy 2008 is particularly relevant given the unique wetland-forest ecosystems within Arabuko Sokoke. Its provisions on identifying wetland boundaries, promoting sustainable use, and involving communities in management could significantly aid in delineating and protecting sensitive areas within the reserve. Nonetheless, implementation challenges persist across all these policies, including inadequate funding, weak enforcement, limited public awareness, and lack of harmonization between sectors. Overcoming these barriers through enhanced stakeholder coordination, capacity building, policy coherence, and innovative financing mechanisms is crucial to realizing the full potential of the policy frameworks in establishing clear boundaries and improving livelihoods around Arabuko Sokoke Forest Reserve.

4.5 How the Livelihoods of the Communities Have Improved as a Result of Resource Use and Resources User's Boundaries

The PH households were asked to explain the resources depended on from the forest and indicate the extent to which these livelihoods had improved their livelihoods (Figure 4.5).

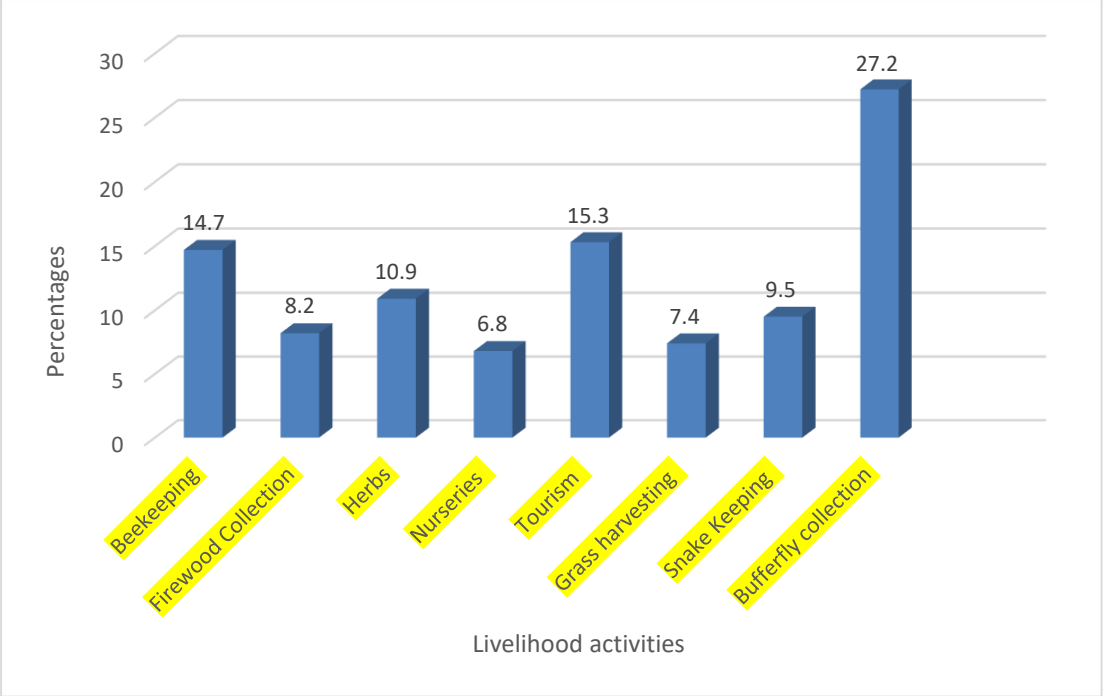

Figure 4.5: Improvement of PH Households' Livelihoods

About 27.2% of the participatory households (PH) indicated that butterfly collection supported their livelihood to a great extent beekeeping, supported the households, by about 14.7%, firewood collection stands at 8.2%, herbs at 10.9%, nurseries at 6.8%, tourism at 15.3%, grass harvesting at 7.4% and snake keeping at 9.5%. Overall, the evidence suggests that the establishment of boundaries in Arabuko Sokoke Forest Reserve through a PH approach has had a positive impact on the livelihoods of participatory households to a large extent. By involving local communities in forest conservation and management, the PH approach has led to the conservation of forest habitats, which in turn has resulted in increased incomes and improved livelihoods for PH households. The study also examined the livelihoods being depended from the forest by non-PH households and the summary of the results is shown in (Figure 4.6).

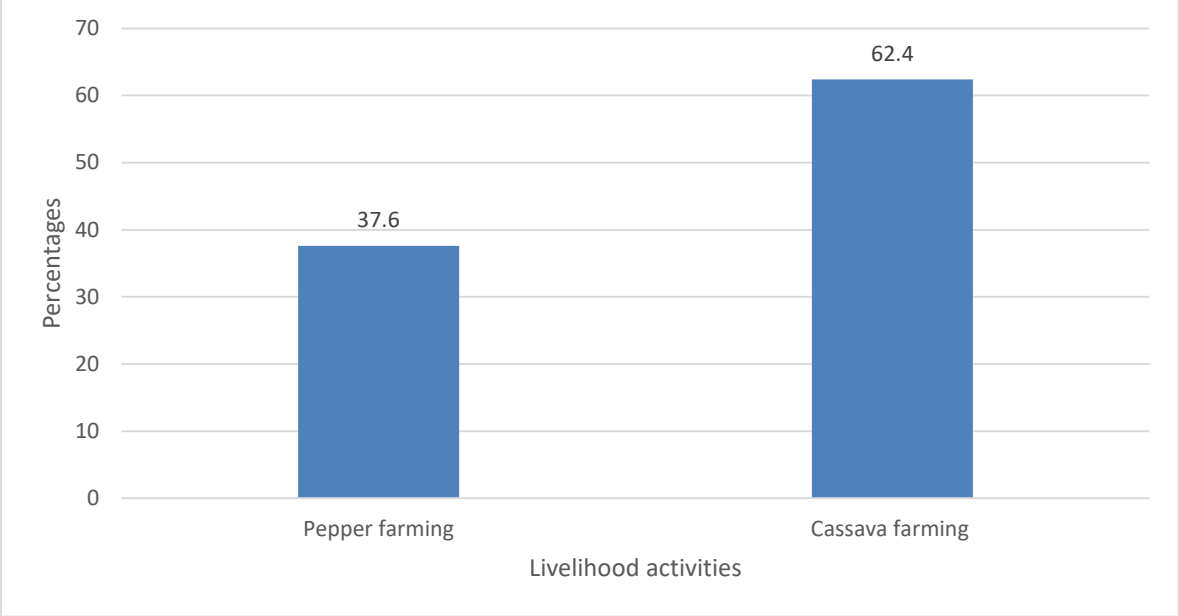

Figure 4.6: Non-PH Households' Livelihoods Dependent on the Forest

The above results on non-participatory households (non-PH households) indicated their livelihoods to a large extent has improved through cassava farming at about (62.4%) followed by pepper farming at 37.6%. This is so because the resources use and users' boundaries provide limited access of resources for non-participatory communities but they benefit from rainfall due to the conservation of the forest which has led them to do cassava and pepper farming. These results are supported by the following quotes from the various Key informants:

"*We earn income from the sale of honey, herbs, seedlings and firewood collection for cooking"* (LBC), "tourism activities PH37)." *such as guiding tourists and working in the restaurants,* (VE) Moreover, we sell "*forest's seedlings. We* keep bees and *get income from the sale of the* honey which *enables us to buy food and pay school fees for our children (CF), forest resources have acted as medicines* (PH 14). "*The incomes collected from these forest resources due to well established forest resource use and users' boundaries have led to improved livelihoods of participatory communities*" (PH11, CF, VE and LBC).

Surprisingly in the case of the non-participatory locals their livelihoods have improved as well. As summarized by the following one key informant:

, "*boundaries have improved the protection of the forest which has attracted rainfall and this has enabled non-participatory members to benefit from farming activities as well, thus improving their livelihoods* (NPH 24).

To further a certain this finding, the researcher asked the household if they can say Yes or No if real their livelihoods had improved to a greater extent (Figure 4.7).

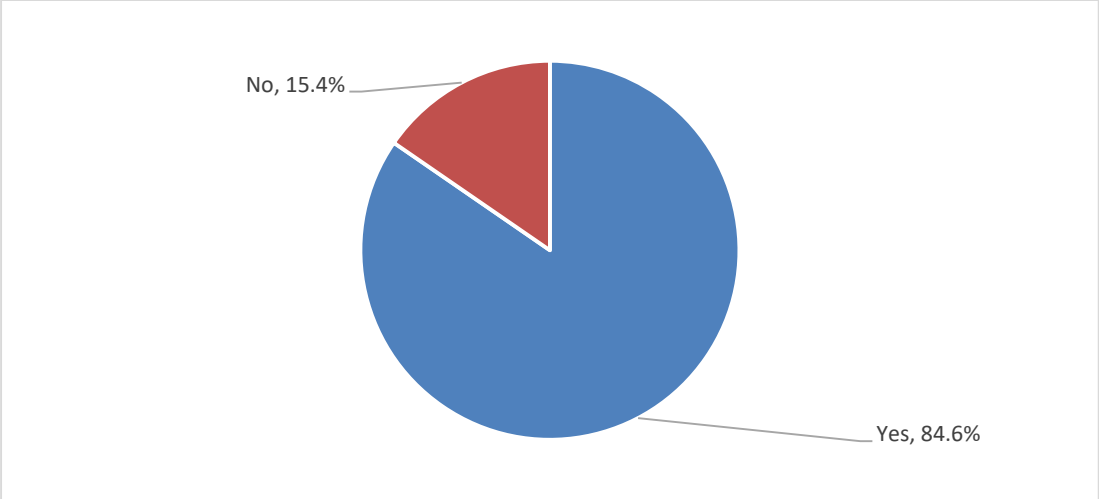

Figure 4.7: Livelihoods has Changed due to Forest Boundaries to PH Households

About 84.6% of the households' respondents agreed that their livelihood had improved to a great due to user boundaries, while only 15.4% disagreed that their livelihoods had changed due to user boundaries. For those who disagreed this could be due to various reasons, such as a lack of awareness about the participatory approach to forest management or a lack of understanding of the impact of user boundaries on the way of life of local communities. Nevertheless, the survey results have indicated that the majority of respondents recognize the importance of user boundaries in protecting the forest and improving the livelihoods of local communities. This result was supported by the following quotes:

> PH2 said, *"life has changed tremendously after participatory forest management.* CF stated, *"Members had nothing in the past, but after being engaged in forest management, they have access to numerous forest resources.* PH5 said, *"members have been empowered to practice in numerous activities that generate income such as beekeeping and butterflies' collection as results of participatory forest management.*

While in the non-PH household it was summarized as follows:

> NPH4 said, *" boundaries have led to sufficient rainfall in the area. "The community can plant crops such as cassava and pepper and this has sustained their livelihood as a result of boundaries establishment"* (NPH9).

Thus, the livelihoods of the communities especially those in forest management, have been improved after participation in forest management and establishment of the boundaries. In past, there were no direct benefits from the forest and it was protected and no one was allowed to enter the forest (Ming'ate 2014, 2016 and Wily 2018). However, engagement in the participatory forest management and development of the resource use boundaries has enabled the participatory communities to engage in obtaining resources from the forest without fear since they are permitted to do so.

The livelihoods of the participatory members have improved in a greater magnitude compared to the non-participatory community members. The lives of those communities who depend on the forests for their survival have greatly improved from the air they breathe to the wood they use and other resources which they get from the forest. "*Fuel, wood, butterflies, building poles, medicine and textile dyes are the types of forest resources that we access from the forest"* (NPH 7). "*Being plant specialist, i take tourists to the forest and explain different functions of tree species, we dance to the tourists, show them our clothes, artifacts hence earning income"* (PH27). "*We earn income from the sale of honey, herbs, seedlings and firewood collection for cooking.*" PH37. "*The forest resources help people get what they lack, such as firewood and attract rainfall, enabling the region to have continuous agricultural activities*" (PH45)."*The community forest association and groups sell the forest resources e.g. pupae to get money for buying goods which has greatly improved their living standards"* (PH40 and VE).

The study examined whether the way of living has changed for non-participatory community members due to user boundaries and the summary of the results is presented in Figure 4.8. About 52.4% indicated that their livelihoods had improved while about 47.4% indicated that their livelihoods had not improved. This is due to the rainfall benefits because of the conservation of the forest.

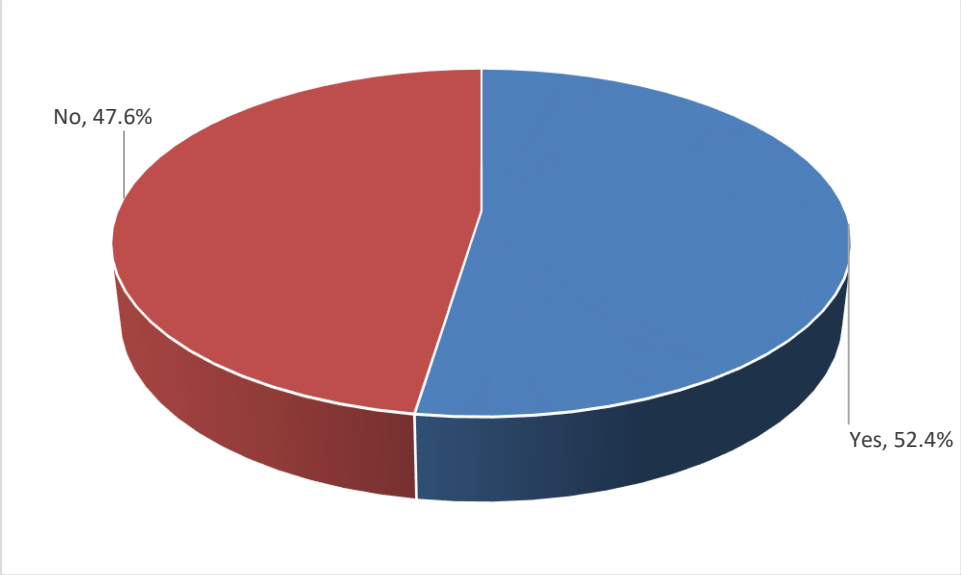

Figure 4.8: Non-Participatory Community Members Due to User Boundaries

Finally, the opportunity costs of forgoing alternative economic activities or employment opportunities due to their engagement in forest-based livelihoods. Costs related to obtaining permits or licenses for regulated activities such as firewood collection, grazing, or non-timber forest product harvesting. Expenses incurred in protecting their crops or property from wildlife conflicts resulting from living in close proximity to the forest reserve. Potential health costs associated with exposure to forest-related hazards or diseases. Indirect costs related to limited access to forest resources due to conservation efforts, which may impact their traditional livelihoods or coping mechanisms.

Communities living adjacent to forests often face a range of costs associated with their proximity to these natural resources. One significant cost is the loss of agricultural land, which can be encroached upon by expanding forest boundaries or designated conservation areas, reducing the available land for farming and grazing. This can lead to decreased agricultural productivity and food security for the local population. Additionally, there are opportunity costs related to restricted access to forest resources, such as timber, non-timber products, and game, which could otherwise contribute to household incomes and livelihoods. Implementing and enforcing forest conservation measures may also require local communities to invest time and resources, whether it's participating in patrols, attending meetings, or

engaging in reforestation activities, which diverts their labor from other income-generating activities.

Furthermore, there may be social costs, such as conflicts between community members and conservation authorities or between different community groups over resource access and land rights. Environmental costs, such as increased human-wildlife conflicts, can lead to property damage and loss of life or livestock, imposing additional financial burdens on the communities. Lastly, the psychological and cultural costs associated with restricted access to lands that hold spiritual and ancestral significance for local communities cannot be overlooked, as these restrictions can lead to a sense of loss and alienation from traditional practices and cultural heritage.

The study highlights several nature-based enterprises and non-timber forest products derived from the Arabuko-Sokoke Forest Reserve by the local communities. The nature-based enterprises mentioned include beekeeping, butterfly farming/collection, ecotourism activities like guiding tourists and cultural performances, and operating restaurants/facilities that cater to tourists visiting the forest reserve. Distinct from these enterprises, the non-timber forest products extracted from the reserve encompass firewood, herbs/medicinal plants, grass for thatching, mangrove and tree seedlings for nurseries, mushrooms, edible caterpillars and other wild foods, as well as resources like snake specimens and textile dyes. While the nature-based enterprises generate income through value-addition and service provision related to the forest ecosystem, the non-timber forest products are raw materials directly harvested from the reserve for subsistence use or trade by the local communities.

The gender composition confirming higher female forest product utilization (69%) in Table 4.1 supports the findings that participatory forest management improved livelihoods through firewood, nurseries, herbs and handicrafts - activities predominantly involving women (Figure 4.5). Conversely, for non-participants, the male majority (57.83%) aligns with agricultural livelihoods like cassava and pepper farming benefiting from rainfall/conservation (Figure 4.5). Correlating proximity (Figure 4.6) with livelihood changes (Figures 4.7, 4.8) could reveal how communities closer to boundaries experienced larger improvements.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter includes a recap of the study, conclusion and recommendations. It also includes the recommended areas for more research to improve important knowledge under the study.

5.2 Summary

The summary is based upon the study's findings especially per the study goal. The study was based on three objectives and answers three research questions, how are participatory forest management boundaries developed, how reliable are the government policies in regulating the Arabuko-Sokoke forest resources and resource user's boundaries and how have the livelihoods of the forest dependent communities improved as a result of forest resource use and resource user's boundaries. The study used qualitative approach. The summary of the finding is found below as follows:

5.2.1 Examining Development of Participatory Forest Management Boundaries in Arabuko-Sokoke

The study's first objective was to examine the extent to which participatory forest management boundaries in Arabuko-Sokoke are developed. It was evident that the majority of participatory communities understood the significance of resource users and resource boundaries, while a few did not. Both participatory and non-participatory households indicated the existence of boundaries for collecting forest resources from the Arabuko Sokoke Forest Reserve. These boundaries are applicable as long as the resource users are registered members or part of a user group and are granted permits to access resources in an acceptable manner that does not threaten species extinction.

The boundaries enhance the security of the forest reserve and promote sustainable resource use by controlling illegal exploitation of precious forest resources. The establishment of boundaries is necessary to curb encroachment, degradation, reduce human-animal conflicts, and ensure that resources are not overused. The study indicated

that resource collection from the forest is permitted only for members belonging to a registered conservation group and possessing a membership card signed by the forester in charge. The boundaries of the forest are demarcated through fencing and designated distances inside the forest, limiting access to those authorized.

The boundaries are being extended to include a one-kilometer distance inside the forest for resource access and a two-kilometer radius for adjacent communities. The research discovered that the development of boundaries has been primarily undertaken by government agencies such as the Kenya Forest Service (KFS) and Kenya Wildlife Service (KWS). Forest boundaries are crucial in reducing human activities like degradation within the forests, which have negative future impacts and affect biodiversity conservation. Due to the boundaries, there has been an improvement in forest protection, attracting rainfall and enabling non-members to benefit from farming activities. The introduction of forest management and resource use boundaries has allowed participatory communities to access forest resources without fear, as they possess the necessary documentation. The boundaries have transformed the forest reserve into a hub for essential cultural sites, leisure places, traditional, religious, spiritual, and sacred sites, which, if appropriately utilized, can benefit neighboring communities and provide alternative sources of income.

5.2.2 Evaluating the Effectiveness of Government Policies in Regulating Forest Resources and User Boundaries

The second objective of the study was to analyze the effectiveness of the government policies in governing the Arabuko-Sokoke forest resources and resource user boundaries. The research discovered that forest protection policies have been effective in directing the surrounding locals to minimize the destruction of forest resources extensively. Based on the research of the participatory communities, the resource users are permitted to gather only dead logs and prohibited from cutting down live ones. Reducing mangrove trees is also prohibited, as detailed in the forest act and participatory forest management plan. Moreover, the Kenya Forest Act 2016, KWS Act 2018, and the participatory forest management plans have assisted the locals and resource users in fully recognizing sustainable conservation of the forest.

Government policies have granted community members different individual rights, such as collecting firewood, keeping butterflies, timber, natural medication, grass for roof thatching, grazing animals, leisure activities, and scientific research. However, only those with government licenses have access to the forests. Non-participatory community members have limited information regarding the performance of government plans on managing resource users and resource boundaries since they are indirect recipients. The research found that the national forest policy is considered a contract between the government and forest users, either directly or indirectly. The national forest plan promotes mutual understanding between forest managers and the surrounding communities.

The study noted that sanctions, including fines or barring from accessing forest resources, are applied to those found guilty of trespassing the forest. The study further revealed that, in some instances, community leaders do not report lawbreakers due to intimidation and lack of security to protect themselves and their families. A few community leaders are provided with security, which puts their lives at risk. The implementation of government policies is done through enforcing laws, bylaws, and policies. Effective policies and regulations are necessary for forest governance and forestry management.

It was found that there are Community Forest Association (CFA) laws governing community members, and awareness creation for adjacent dwellers' associations together with the Kenya Forest Service (KFS) works together on the management of forest resources. The study noted that there is no specific government law or policy to protect forest scouts from the community. The communities' representatives are protected through awareness creation meetings, and villages have formed community conservation groups who work together with government agencies to protect the forest and scouts. The government policy on the protection of leaders is essential and can enable them to execute duties without fear or coercion.

5.2.3 Assessing Income Increase from Forest Resource Use and Boundaries for Communities

The third objective of the research was to assess if the livelihoods of communities have been enhanced as a result of forest resource usage and resource user's boundaries. According to the study, the livelihoods supported by forest resources include beekeeping, firewood collection, gathering natural herbs, establishing nursery seedlings, operating tourist attraction sites where visitors can observe the rich biodiversity, developing restaurants and resorts for visitors, grass harvesting, snake keeping, harvesting building poles, and butterfly farming. The study noted that being a member of the participatory forest management program is beneficial and enables the communities to enjoy resources from the forest, thereby enhancing their livelihoods positively through revenue generation from access and use of forest-related resources.

The income generated from forest-related activities is used to pay school fees for their children, thus boosting the level of education in the area. The study indicated that even though boundaries restrict non-participatory households from accessing forest resources, their livelihoods have been improved by the forest boundaries as they are involved in other activities such as farming pepper and cassava. The farming activities of non-participatory households are possible due to the rainfall in the area, resulting from the conserved forest. Furthermore, most community members previously worked for others for survival, but currently, they have income and have positively enhanced their livelihoods, with poverty levels decreasing by 35% as a result of the establishment of boundaries.

5.3 Conclusion

Based on the findings from the first objective that examined the extent to which participatory forest management boundaries in Arabuko-Sokoke are developed, research concluded that participatory forest management boundaries are essential in enhancing forest conservation. The advantages of forest limits are set to control the unsustainable exploitation of forest resources and only allows registered or authorized members to access these resources. Boundaries establishment are essential to suppress infringement,

destruction, boost conservation area, lower human-animal conflict and ensure that resources are not overexploited. Forest boundaries are made from different types, like fencing and the deployment of security officers, distance outside and inside the forest for PFM hence the resources are conserved for purposes like tourism attraction points and educational activities. In addition, the boundaries have created employment to the wardens who oversee the forest's resources.

Additionally, concerning the second objective of the research that assessed the efficiency of the government policies in regulating the Arabuko-Sokoke forest resources and resource user's boundaries, the study concluded that the effectiveness of the government policies in regulating the Arabuko-Sokoke forest resources and resource user's boundaries have been modest. The Forest Act gives a lawful framework for joint forest management, involving regional communities, organizations and other non-governmental organizations. The policies have yielded positive outcomes since there are no logging and ecological deterioration activities in the forest which results from poor management of the forest.

Government policies have enabled participatory communities to have different user rights like gathering fire wood, butterfly farming, research and for educational activities among others. Non-participatory members have no information concerning the effectiveness of government plans on handling the resource users and resource boundaries because they are indirect beneficiaries. The execution of government policies is done with enforcing regulations and bylaws as well as awareness creation through meetings and seminars.

Furthermore, regarding the third objective of the study on the extent to which the livelihoods of communities have improves as a result of resources access and use; the research concluded that engagement of forest management enables the beneficiaries to enjoy resources from the forest, improving their livelihoods positively through income generation. Livelihoods of the locals particularly the participatory teams have improved as a result of forest resources utilization and resources users' boundaries. User rights for participatory communities include but not limited to beekeeping, collection of firewood, herbs, the establishment of tree nurseries, tourist attraction sites and butterfly farming.

5.4 Recommendations

Based on the study findings on the first objective that sought to analyze the extent to which participating forest management limits in Arabuko-Sokoke are created, the research recommends that forest boundaries need to enhance to ensure sustainable conservation. There is need to guarantee financial benefits to the adjacent forest locals via a value addition chain and urge sustainable usage of natural resources like the honey from beekeeping. It must be packaged and sold to other communities that do not generate honey or even export it. The surrounding communities need continuous training and capacity building on development, new processing technologies, and marketing for their forest- related products. Government to offer sufficient financial incentive to promote prospective nature-based business. There is need for awareness creation to the Arabuko Sokoke CFA community members on emerging trends concerning team dynamics that improve management, openness, and accountability on joining natural resource management. This will assist them to be more successful in forest management.

Concerning the second objective that assessed the effectiveness of government policies in governing the Arabuko-Sokoke forest resources and resource users' boundaries, the study recommends strengthening the government policy on the protection of forest resources. The specific issues or areas for improvement in the existing policy should be clearly identified based on the research findings. Collaborative efforts between the government, concerned groups, and organizations are needed to enhance forest conservation. Additionally, the study suggests providing security to community leaders who face intimidation and lack of protection when reporting lawbreakers, enabling them to execute their duties without fear.

Furthermore, regarding the third objective that analyzed the extent to which the livelihoods of communities have improved due to forest resource utilization and resource users' boundaries, the research suggests encouraging non-participatory members to join forest management initiatives. The study should clarify the reasons why non-participatory members have not joined and the specific benefits of participation that could motivate them.

Finally, the study recommends conducting further research on other forest reserves in the country to enable comparisons with the findings from the Arabuko-Sokoke forest reserve. This could help identify knowledge gaps for further studies and provide adequate information for policy formulation regarding forest conservation and addressing overexploitation of forest reserves.

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APPENDICES

Appendix 1: Questionnaires

The responses you provide will be used for academic purposes and will be strictly confidential.

SECTION I: INDEPTH SEMI STRUCTURED QUESTIONNAIRE FOR CFA HOUSEHOLDS

SECTION A: CONSULTEE INFORMATION

1. Names **……..…….....**

   Contacts**…….....……..**

   Date**…….....…….**

   Signature**……..…....…….…..**

   Gender : Male ☐ Female ☐

2. For how long have you lived in the study area?

   ……

3. How far do you stay from the study area?

   ……

SECTION B. TO EXAMINE THE EXTENT TO WHICH PARTICIPATING FOREST MANAGEMENT BOUNDARIES IN ARABUKO-SOKOKE ARE DEVELOPED.

1.0 Do you know the meaning of resource users and resource boundaries?

Yes ☐ No. ☐

If yes please give a brief explanation

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……

2.0 Kindly explain the types of forest resources that you access from the forest.

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3.0 Kindly explain the procedure for collecting the resources you have mentioned above.

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4.0 Mention the benefits associated with forest resource use and resource users boundaries.

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5.0 Please explain the rules governing the collection of the resources from the forest.

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6.0 Are those rules adequate? Yes ☐ No ☐

7. 0 Are there sanctions for the rules breakers? Yes ☐ No ☐

If yes please give a brief explanation

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……

8.0 Are there full government/ community protection for communities representatives involved in the execution of rules? Give a brief explanation.

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SECTION C: TO EXAMINE THE EFFECTIVENESS OF THE GOVERNMENT POLICIES IN GOVERNING THE ARABUKO-SOKOKE FOREST RESOURCES AND RESOURCE USER'S BOUNDARIES

1.0 Are you aware of any government policy governing the management of the forest?

Yes ☐ No ☐

If yes kindly explain this policy

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2.0 How has this policy/policies assisted in the management of the forest?

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3.0 How have they assisted on the management of the resource users and resources boundaries?

……

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4.0 How is the implementation of these policies done to enhance the management of resource users/ resource boundaries?

……

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……

SECTION D. TO EXAMINE HOW THE LIVELIHOODS OF THE COMMUNITIES HAVE IMPROVED AS A RESULT OF THE FOREST RESOURCES USE AND RESOURCES USERS' BOUNDARIES.

1.0 Kindly explain the livelihoods that you depend from the forest.

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2.0 Please explain how you depend on these livelihoods.

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3.0 Before the participating forest management how were your livelihoods like?

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4.0 In your own opinion, do you think your livelihood have improved as a result of the resource use boundaries?

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Interview Guide for Heads of Institutions

1.0 Please explain how the resource users and boundaries were established in this forest.

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2.0 Explain why this establishment was necessary

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……

3.0 In your opinion, do you think these boundaries were correctly established?

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4.0 Kindly explain how the livelihoods of the CFA members were before the establishment of the boundaries?

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……

……

5.0 In your opinion, do you think the resource users boundaries have support from the government?

……

……

……

……

Appendix II: Appointment for Supervision

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: N50/CTY/PT/37649/2016

Date: 8th October, 2019

Dr. Felix Ming'ate
C/o Department of Environmental Studies & Community Development

REF: APPOINTMENT AS A SUPERVISOR FOR LONZI ZIPPORAH REG. NO. N50/CTY/PT/37649/2016 MASTERS THESIS

This is to inform you that following recommendations from the **Department of Environmental Studies & Community Development** and the **School of Environmental Studies** and approval by the Graduate School Board, you are formally appointed as a Supervisor for **Lonzi Zipporah's Masters Thesis.**

Your principal responsibilities as a supervisor will include, among others:-

(i) Directing, guiding and advising the student as he/she does the work.
(ii) Holding regular and effective contact meetings with the student at least once a month; and recording dates of such meetings in the student's Progress Report forms.
(iii) Responding to any written materials by the student within the shortest time possible.
(iv) Suggesting to the student the most relevant literature available and other sources of information for reference.
(v) Introducing and linking up the student to other researchers working in related fields.
(vi) Criticizing, appraising and evaluating the student's ideas and findings objectively so as to improve the quality of his/her work.
(vii) Advising the student on the form and structures of a quality thesis and the conventions of scholarly presentations.
(viii) Advising the student on the importance of submitting Progress Reports on time and participating in seminars for Postgraduate students.
(ix) Filling the supervision tracking tool every time a supervision meeting is held with the student.
(x) Screening for plagiarism and countersigning the Plagiarism Clearance Certificate and the Declaration for Originality Form to ensure that the work is within the acceptable similarity index before submitting the proposal and project to Graduate School for any processing.

Thank you.

ANNBELL MWANIKI
FOR: DEAN, GRADUATE SCHOOL

CC: Chairman Department of Environmental Studies & Community Development

Appendix III: Research Approval Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Internal Memo

FROM: Dean, Graduate School

DATE: 8th October, 2019

TO: **Ms. Lonzi Zipporah**
C/o Department of Environmental Studies & Community Development

REF: N50/CTY/PT/37649/2016

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that Graduate School Board, at its meeting on **2nd October, 2019**, approved your Research Proposal for the M.Env. Studies Degree entitled, **"Establishment of Boundaries for Sustainable Conservation and Enhanced Livelihoods of Forest Dependent Communities in Arabuko Sokoke Forest Reserve, Kilifi County, Kenya."**

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

ANNBELL MWANIKI
FOR: DEAN, GRADUATE SCHOOL

CC. Chairman, Environmental Studies & Community Development Department

Supervisors:

1. Dr. Felix Ming'ate
   C/o Envi. Studies & Community Development Dept.
   Kenyatta University

2. Dr. Joseph Kurauka
   C/o Envi. Studies & Community Development Dept.
   Kenyatta University

AM/ww

Appendix IV: NACOSTI Research License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 903836

Date of Issue: 26/November/2019

RESEARCH LICENSE

This is to Certify that Ms. Lonzi Zipporah of Kenyatta University, has been licensed to conduct research in Kilifi on the topic: ESTABLISHMENT OF BOUNDARIES FOR SUSTAINABLE CONSERVATION AND ENHANCED LIVELIHOODS OF FOREST DEPENDENT COMMUNITIES IN ARABUKO SOKOKE FOREST RESERVE KILIFI COUNTY, KENYA for the period ending : 26/November/2020.

License No: NACOSTI/P/19/2821

903836

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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