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Characterisation of Forest Resources and the Local Communities for the Choice of Sustainable Forest Management Strategies in Uganda

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The decline in natural forest resources in the tropics due to ineffective management practices has reached unprecedented levels with the most affected forests being in developing countries. Efforts to manage these resources sustainably have proven futile. Understanding the nature and status of the forest resources and the communities is crucial for devising effective management strategies. The study was designed to characterise forest resources and the local communities to aid in the choice of effective management strategies for forest resources. The study was conducted in Yumbe district, northwestern Uganda, using a cross-sectional research design. It targeted communities living in the sub-counties of Kei, Kerwa, and Midigo. Data were collected using questionnaires, key informant interviews, focus group discussions, participant observations, and remote sensing. Pearson correlation and regression were used to analyse quantitative data, while thematic analysis was used to analyse qualitative data. The correlation p-values (Sig.) of less than .05 were statistically significant, implying a strong relationship between socioeconomic and demographic characteristics of households and the choice of forest management strategies. The results further showed that the local communities were poor, illiterate, and dependent on subsistence farming and forest resources. The forest resources both in public and communal lands were in a state of serious decline. They were non-timber-based, accessible to the local community and dominated by woodland and other grassland mosaics. The local community used sustainable management practices, such as selective harvesting, tree planting, and gazettement of some sites as sacred places. The management strategies used were forest type-specific, e.g., traditional for community forests and modern for public forests. The most important factor influencing the choice of management strategy was the level of education with an R Square value of .112. The study, therefore, recommends an improvement in the education of the local communities and the integration of local skills and practices to promote community-based approaches in sustainable forest resource management.

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INTRODUCTION

Forests are a complex ecological system that continues to support naturally occurring animal and plant resources (FAO, 2020b). FAO defines a forest as an area larger than 0.5 hectares, having trees that are at least five metres tall and a canopy cover of at least ten percent, or trees that can naturally grow to "these" heights (Fraser, 2019; Keenan et al., 2015). About 90 percent of terrestrial biodiversity on Earth is found in forests (FAO, 2020a; Nwakile et al., 2018). However, due to changes in natural resource dynamics, many researchers and resource managers have since the 1980s shifted their focus away from "real" forests towards the woodland and grassland mosaics that cover a significant portion of Sub-Saharan Africa, South America, Oceania, and other parts of the world (Chapman et al., 2005). Because forests feature sizable sections of woodland that offer comparable products and services to "real" forests, woodlands are frequently mentioned when evaluating the condition of forest resources (NEMA, 2017). In addition, the dynamics of man-environment interaction leading to the transformation of grasslands into woodlands may result in an increase in tree cover.

Forests provide goods and ecosystem services that are critical for socioeconomic development, agriculture, energy supply, livelihood

improvement, and adaptation to the adverse impacts of climate change (NEMA, 2017). For instance, forests store carbon, conserve soil, support a diversity of species, and provide humans with a range of goods like wood fuel, building materials, and hydrological functions. Despite the huge contributions they make, history has demonstrated that forests have been severely depleted by human mismanagement and overexploitation (United Nations University, 2010). The degradation of these resources has transformed forests into woodlands and, consequently, ecosystems worse off.

To ensure sustainable management of forest resources, the high levels of deforestation have to be brought under control (NSOER, 2019). In Uganda, the trend of forest cover analysed from 1990 to 2017 showed a decline in the national forest area (NSOER, 2019). The decline was higher in woodlands than in tropical high forests (THF). Whereas the current trend shows a halt in that the overall decline in forest cover has been halted and, for the first time since 1990, a net forest gain has been recorded between 2015 and 2017 of 9.5 to 9.9 percent, respectively, the FAO cautions that this should not be celebrated as the majority of the increases are due to an increase in the area of planted forests, which are of limited ecological value (FAO, 2020b). Otherwise, most of the natural forests in the country are under

severe threat, especially those that are communally owned since the majority are unrestricted sources of wood, charcoal, and land for agricultural purposes, which has led to present levels of depletion.

To promote sustainable management of the available forest resources, the focus should first be placed on conserving trees "outside" gazetted areas and, second, developing best management practices to enable the forest to adequately and continually perform its natural roles in the ecosystem (Fraser, 2019; Tengö et al., 2017). In 2007, the United Nations General Assembly recognised sustainable forest management as a dynamic and evolving concept that aims to maintain and enhance the economic, social, and environmental values of all types of forests for the benefit of present and future generations. The assembly considered six thematic elements as a reference framework: the extent of forest resources; forest biodiversity; forest health and vitality; productive functions of forests; socioeconomic functions of forests; and legal, policy, and institutional framework (IUFRO, 2017). Management practices to enhance forest resource sustainability would include selective exploitation, encouraging prolonged fallow systems for adequate regeneration and replenishment of resources, afforestation and reforestation, and agroforestry (FAO, 2020a). The type of management options adopted depends on both the characteristics of the forest and the socioeconomic situations of the local community (Nwakile et al., 2018). Yumbe is a district in northwestern Uganda characterised by largely woodland and Tropical High Forests (THF) in valleys. In a bid to satisfy their basic needs from the forest resources, the rate of exploitation by the local users and other users from other parts of the country could lead to the complete depletion of these resources. Hence the need for effective management strategies. This study therefore characterised forest resources and the local communities in Yumbe district in Uganda and determined the local strategies for sustainable management of forest resources (SMFR).

LITERATURE REVIEW

Characterisation of Forest Resources

Forest resources are materials obtainable from forest lands to satisfy a need in production or direct utilisation. (Keenan et al., 2015; Nwakile et al., 2018). There are several potentially useful ways of characterising forest resources. For instance, Pomeroy et al. (1992) characterised forest resources based on conservation importance, important wildlife in the forest, goods and services, and resource-based options, while (Nwakile et al., 2018) characterised forest resources based on their classification as natural and planted. In Natural Resource Management (NRM), forest resources are classified as renewable resources (FAO, 2020b). But the most comprehensive characterization of forest resources has been done by the Forest Resources Assessment (FRA). The FRA characterises forest resources based on status, trend, ownership, type, spatial distribution, and forest products (Fraser, 2019). Based on FAO classification, these resources may be subdivided into two categories: timber-based and non-timber-based resources of both plant and animal origin. Timber-based resources are wood-producing plants, while non-timber-based resources are plant and animal resources of value uniquely found within forest lands. The unique value may be tourism, herbal, biomass, food, environmental protection, or cultural. The 2020 assessment of trends in forest area by the Global National Forestry Association (GNFA) from 1990 to 2020 showed that during this period, the global forest cover declined by about 178 million ha, but the rate of net forest loss was on the decrease due to reduced deforestation and increase in planted forests (FAO, 2020b).

Africa had the highest net loss of forest area between 2010 and 2020, while Asia registered the highest net gain in forest resource area in the same period (FAO, 2020a). The global spatial extent of forest resources indicates that they are very limited in Central Asia and the arid and semi-arid regions of the world owing to incompatible ecological conditions (Fraser, 2019). The distribution of forest resources by region in

Uganda shows imbalances as well (NSOER, 2005, 2019). The largest area under THF, both well-stocked and depleted, is found in western Uganda, followed by the central region, and the lowest is found in northern Uganda. Of the forest resources characterised as woodland, over 50 percent are found in the northern part of the country, and the lowest are found in eastern Uganda. Based on type, the FRA and National Forestry Authority (NFA) identify two broad categories of forest resources: natural forests and plantation forests (FAO, 2020b). Naturally regenerating forests account for 93 percent (3.75 billion ha) of the total forest area worldwide, while planted forest resources only cover an estimated 7 percent of the world's forest area.

According to Nwakile et al. (2018), natural forest resources could further be classified into deciduous, evergreen, tropical rainforests, or tropical savannas (savanna woodlands), depending on the geographical location. The National Forestry and Tree Planting Act of 2003 further categorises forest resources in Uganda as central forest reserves (CFR), local forest reserves (LFR), community forests, and private forests (NSOER, 2019). The world's forest resources are mostly publicly owned, but the share of privately owned forest resources has been steadily increasing since 1990. For example, 73 percent of the world's forest resources are under public ownership, 22 percent are privately owned, and the remaining 5 percent are classified as either unknown or others. On the contrary, in Uganda, 70 percent of forest resources are privately or communally owned, which has significant implications for SMFR (NEMA, 2017). Available data has shown that most of the publicly owned forests are protected by law. Such protection plays a crucial role in sustainable management efforts (Fraser, 2019).

According to World Bank data, in the year 2017, the proportion of the world's land area that had protected status was 14.4 percent (FAO, 2020a). For example, tropical countries have almost double the proportion of their land area protected compared with countries in the temperate region.

Based on user rights, forest laws in many parts of the world permit local communities within or in the neighbourhood of forests to continue to exercise a range of different user rights in forests (Jackson, 2004). However, these rights are least restricted in forests on private land and highly restricted or prohibited in some protected forests. The biggest challenge with this type of characterization is that user rights vary from one country to another and from public to private or community forest resources. Hence, there is a lack of uniformity in user rights. In addition, there are illegal user rights on these forest lands that continue to exist. Just like other parameters, forest resources in many parts of the world have also been characterised based on classification. For example, in Uganda, various ways of classification have been used, ranging from Langdale-Brown et al., who used species composition, to Green et al., who ranked the zones in Uganda into nine based on conservation importance, and the National Biomass Study Project (NFA, 2002), whose classification was based on biomass (stock, growth, and dynamics). In this study, the FAO and National Biomass Study were considered because they remain the most comprehensive.

Characteristics of Forest Communities

It is important to analyse the socioeconomic conditions of the communities living in or around the forested areas in order to make the right choice on the most effective forest management strategies. The forest communities are people who live in the forest or surrounding areas. Due to their proximity to the forest, they over-rely on forest resources for food, herbal medicine, shelter, wood fuel, income, and fresh farmland. Because of the remote location of most forests, these places have limited socioeconomic infrastructure, such as roads, hospitals, and schools, that are critical in influencing people's standards of living. As a result, the majority of the community members have a very low level of education (Ekasari et al., 2021; Parrotta et al., 2016); the main occupation they are involved in is subsistence farming, and in some extreme cases characterised by shifting

cultivation (Asante et al., 2017). In addition to farming, they also practice hunting, fruit gathering, and fishing for home consumption (Fraser, 2019). In terms of income, the majority of the communities in forest areas are ranked among the poorest in the world and the most neglected and vulnerable by their respective governments and the international community (United Nations, 2021); in recent times, these areas have experienced an influx of people from densely populated areas, people fleeing from conflicts or local and foreign investors creating yet another pressure on the forest resources (FAO, 2020a; NEMA, 2017).

Management Strategies for Forest Resources

Forest management has become an increasingly complex process in recent years as societal values have shifted and governments have adopted multiple-use doctrines with respect to forested lands (Nwakile et al., 2018). Yet conservation of forest resources through sustainable practices ensures a continuous supply of forest goods and services. It's important to observe that overexploitation of these resources will continue, even when Sustainable Forest Management (SFM) principles have been acknowledged and accepted for decades (FAO, 2020a). Complex problems involving human interactions with diminishing forest resources usually cannot be solved by a single approach. An understanding of why accepted principles and practices do not produce expected outcomes or are not implemented at all is critical (Fraser, 2019). Refining old management practices and strategies at multiple scales to achieve SMFR to benefit the rural poor is equally important. Management practices meant to ensure forest sustainability include selective exploitation, encouraging prolonged fallow systems for adequate regeneration and replenishment of biodiversity, the practice of planting seedlings to replace the harvested trees, afforestation and reforestation, and mixed farming system (Nwakile et al., 2018). Another way of ensuring sustainable management of forests is through the proper enabling of forest institutions (NEMA, 2017). These institutions

conduct research and make recommendations on sustainable management practices while inventing plans for maximum utilisation of forest resources. Similarly, controlled bush burning is a sustainable management practice that can reduce the death of tender tree seedlings by fire (Nwakile et al., 2018).

Over the past decades, natural resource managers have come to recognise the value of community-based approaches. Collaborative Forest Management (CFM), also known as the participatory approach, is one of the best strategies for managing forest resources that involves working with the local communities (FAO, 2020a). It is built on the principle that people living with forest resources should benefit from them so that they become responsible managers of these resources (Kazoora et al., 2020). It incorporates holistic, adaptive, and pluralistic approaches to resource management, and involving the local communities can tap into indigenous knowledge and gain acceptance for management strategies (Cunningham & Cunningham., 2004). The effectiveness of this approach is premised on the assumption that people have more commitment to plans they have participated in developing. Adaptive management (learning by doing) is yet another approach currently favoured by many resource managers. It is an approach to resource management that rigorously combines management, research, monitoring, and changing existing practices so that credible information is obtained and management activities are modified by experience (Ayferom, 2019). Rather than assume that what seems to be the best strategy will remain so, it sets up scientific experiments to monitor how conditions are changing and the effect our action or inaction will have on the forest ecosystem (Cunningham & Cunningham, 2004).

Regular sensitization, monitoring, and analysis provide feedback that is essential in making credible decisions in the management process. It is best suited to forest management activities due to the ever-changing socioeconomic and demographic characteristics of the resource users and the regulatory measures in place. It can be

used to protect wildlife, rare plants, recreational opportunities, and so on. Another strategy that is widely used in the management of forest resources is the ecosystem approach. This approach attempts to integrate sustainable ecological, economic, and social goals in a unified systems approach (Cunningham & Cunningham, 2004). Some of the principles of the new philosophy include managing forest resources across landscapes and generating meaningful stakeholder involvement for collective decision-making. The former is important because every tree counts. Any effort to conserve forest resources should start with that "tree" outside forested lands. Forest managers must therefore consider the viability of the existing management strategies in order to protect the ecological integrity of the forest in a way that does not put the livelihoods of the local communities in danger.

According to the Contingency Management Theory (CMT) propounded in 1981 by William Scott, the best way to manage forest resources depends on the socioeconomic and demographic characteristics of the environment to which the managing authorities must relate (Luthans & Stewart, 1977). This relates to this study in that even though there are general management practices and strategies for managing forest resources that have succeeded elsewhere, the socioeconomic characteristics of the Lugbara community and the state of the forest resources in the area have to be considered before making a choice of management practices and strategies that would be acceptable to the community.

MATERIALS AND METHODS

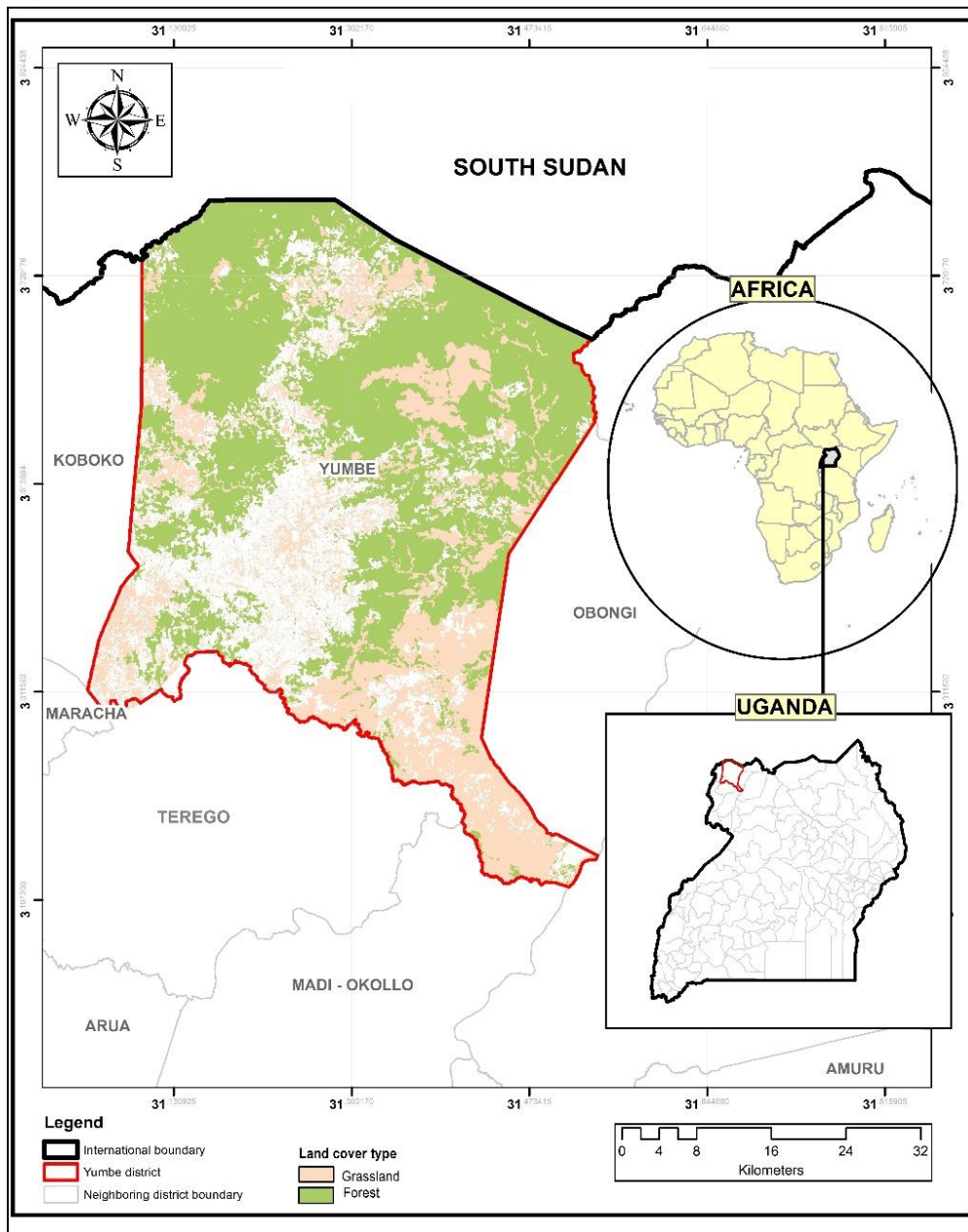
Yumbe district is located in the West Nile sub-region, northwestern Uganda (*Figure 1*). In absolute terms, it is bounded by latitudes 3°11'18"N and 3°47'56"N and longitudes 31°02'58"E and 31°31'56"E. The region lies in the climatic zone sub-type "Aw"- tropical savanna climate with mean annual rainfall ranging from 1,200-1,400 mm and mean temperature of 24.4°C or 75.9°F (NEMA, 2010). The soils are

predominantly ferrallitic in nature, covering more than 75 percent of the land area (NEMA, 1995).

The topography is generally flat, with some notable residual hills in the north (Mount Kei and Midigo) and several minor hills to the east. According to the UNHCR, by 2022, there were 736,400 residents in the district. Approximately 92 percent of them live in rural areas and are primarily engaged in subsistence agriculture (UBOS, 2016). The Kochi River, which flows from west to east and divides the district into two blocks, north and south, is the major stream that runs through the Yumbe district. The majority of the streams have a cyclical nature, which reflects the seasonal rainfall regime. Yumbe is generally recognised as a district with huge potential for the conservation of forest resources in northwestern Uganda (MoWL&E, 2002; NEMA, 2017). Due to past local land use practices and natural and man-made disruptions like agriculture, wood fuel, fire, and logging, the district may not necessarily contain tropical forests (NEMA, 2017; UNDP, 2014). It has large areas under forest cover, including Mt Kei Central Forest Reserve, the biggest in the West Nile subregion (NSOER, 2019). However, forest resources have come under serious threat owing to commercial charcoal production and logging and increased demand for farmland due to rapid population growth of over five percent (NEMA, 2017).

A cross-sectional survey design was adopted for the study. The targeted population included respondents from 15,436 households spread across three sub-counties of Kei, Midigo, and Kerwa (UBOS, 2016). From the population, the study derived a sample of 375 households using Krejcie and Morgan's formula. These households were purposively and randomly selected. Finally, 371 respondents were interviewed using self-administered questionnaires, with sixteen key informants interviewed and four focus group discussions conducted. Four households later withdrew, citing security reasons. The forest cover change statistics were obtained from Landsat data for 1990 and 2021.

Figure 1: Location of Yumbe district



Source: (Remotely sensed data)

Data from self-administered questionnaires were analysed by using descriptive statistics, correlations, and regression models. The correlation was used to establish the relationship between the socioeconomic and demographic characteristics of the local communities and the management approaches used, while regression was used to establish which socioeconomic and demographic characteristics most contributed to the choice of the approach used in managing forest resources. Qualitative data were analysed using thematic analysis, while remotely sensed

data were analysed using the land cover change matrix.

RESULTS

Socioeconomic and Demographic Characteristics of the Participants

According to the findings, 64.8 percent of the population of the district was below eighteen years old; the illiteracy rate was found to be high, and 89 percent of the population either never went to school or had basic primary education.

Surprisingly, the majority of those who never went to school were children below eighteen years of age; 87 percent of the households engaged in subsistence farming; the monthly average income for 79 percent of the households was less than 100,000 shillings (US \$30), implying the majority of the people lived below the poverty line; 51 percent of the respondents were female, and 49 percent were male.

The Pearson correlation was run to establish the relationship between the socioeconomic and demographic characteristics of the local community and the knowledge system and practices used in managing forest resources, as shown in *Table 1*. The results showed meaningful relationships for the level of education (Sig. .000), age (Sig. .000), marital status (Sig. .000), years lived in an area (Sig. .000), religion (Sig. .000), occupation (Sig. .016), and sub-county of the household (Sig. .030).

Table 1: Correlation results exploring socioeconomic and demographic characteristics as determinants of household’s capacity to choose effective management strategy for forest resources

Variable	Pearson Coefficient	Sig. 2-tailed	N
Age	-0.258**	.000	371
Gender	0.025	.625	371
Education	0.334**	.000	371
Religion	-0.129*	.000	371
Marital status	-0.203**	.000	371
Occupation	0.125*	.016	371
Income	0.099	.058	371
Sub-county of households	-0.112*	.030	371
Years lived in an area	-0.194**	.000	371

** Correlation is significant at the 0.01 level (2-tailed)
 * Correlation is significant at the 0.05 level (2-tailed)

The result indicated that the education level of the respondents most predicted the management practices adopted by the local community in managing forest resources. A confirmatory test was run using regression to establish the

socioeconomic and demographic characteristics which predicted the greatest variations in management practices used by the local community in conserving forest resources. (*Table 2*)

Table 2: Linear regression exploring socioeconomic and demographic characteristics of respondent’s capacities to choose effective forest management practices and strategies

Model	Variables	R	R Square	Standard error of the estimate
1	Age	0.258	0.066	0.484
2	Education	0.334	0.112	0.472
3	Religion	0.124	0.017	0.496
4	Marital status	0.203	0.041	0.490
5	Occupation	0.125	0.016	0.496
6	Sub-county	0.112	0.013	0.497
7	Years lived	0.194	0.038	0.491

The results indicated that all the socioeconomic and demographic characteristics of the respondents in varied degrees explained variations in the choice of management practices and strategies used by the local community in

managing forest resources except for gender and income. But education played the greatest role, as reflected by the R square value of 0.112, insinuating that it shared over eleven percent (11.2%) of the variability in the choice of effective

management practices and strategies in the management of forest resources.

The forests provided largely non-timber-based resources of value unique to forest land. Approximately 99 percent of the respondents

agreed that the forest cover was in a serious state of decline, estimated at a rate of 3,600 ha per year. This was confirmed by Landsat images that indicated the forest cover declined by 80.33% between 1990 and 2021, as shown in *Table 3*.

Table 3: Forest cover change statistics for Yumbe district (hectares & percentages)

Forest type	1990	2021	Percentage change
Tropical high forest well-stocked	3.06		
Woodland	138,937.50	25,974.70	-81.30
Bushland	638.37	1,485.11	132.64
Total	139,578.93	27,459.81	-80.33

Source: Landsat data for 1990 and 2021

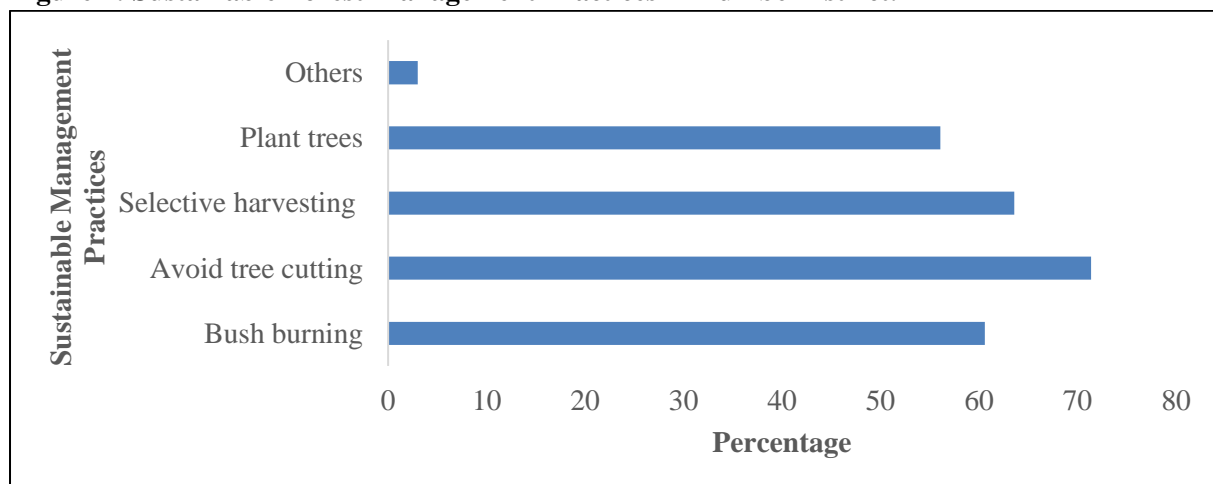
The spatial extent of the forest resources indicated that they largely existed in the northern part of the district, namely, the sub-counties of Kei, Kerwa, and Midigo; the rest of the district had limited natural forest cover, mostly communally owned. The natural forests were of two types: publicly owned and communally owned. The publicly owned forests were managed by the NFA as a Central Forest Reserve, while the community forests were largely managed by cultural leaders, the local community, and the local government. Eighty-three percent (83%) of the respondents confirmed that the local community had access to forest resources for some specific activities such as apiary, tree planting, fruit gathering, tourism, animal rearing, and firewood collection. However, these varied from public forests to community forests. The forest resources were

composed largely of woodland and some bushland following the depletion of well-stocked THF in the 1990s and degraded THF in the 2000s.

Sustainable forest management practices in the area included tree planting (56.1%), selective harvesting of forest resources (63.6%), a campaign against deforestation (71.4%), avoidance of bush burning (60.6%), and others including fining the culprits (3.0%) as reflected in *Figure 2*.

The approaches used in managing the forest resources were largely forest type-specific. For example, indigenous knowledge practices were used in the management of community forests, while modern approaches were used in the management of public forests.

Figure 2: Sustainable Forest Management Practices in Yumbe District.



DISCUSSION

Socioeconomic and Demographic Characteristics of the Local Community

The findings showed a youthful population in the community living in or around forested areas. One likely explanation, according to UBOS, was the very high rate of population growth of over five percent per annum (UBOS, 2016). But most of the people who argued in favour of conserving forest resources were the elderly. This was consistent with the findings in Maros, India, which associated conservation efforts with mostly the elderly people (Ekasari et al., 2021). This had serious ramifications for SMFR because the youthful population who were the majority, were so much into the charcoal business other than conserving forest resources. Whereas women had less encounter with the forest, they were more concerned about the current levels of forest degradation. This appears to have been influenced by walking long distances looking for firewood. In addition, the population was steadily increasing due to internal migrations from densely populated areas and an influx of refugees from South Sudan. The district was home to over 200,000 refugees, mostly from South Sudan. This crippled sustainable forest management efforts as the demand for forest products and farmland increased significantly, a finding consistent with the National Environment Management Authority (NSOER, 2019).

The level of illiteracy was also found to be high, yet education is an essential ingredient for environmental conservation. Education enables individuals to address environmental challenges and adapt to changing economic, social, and environmental conditions with ease. This was in line with the findings by Maurya et al. (2020) that educated people tend to be more conscious of environmental problems than the uneducated. The high level of illiteracy was largely associated with inaccessibility to schools and increased demand for child labour in farms, especially in protecting crops from destruction by wild animals. The high level of illiteracy was exacerbated by the overreliance on forest resources due to limited

skills for other lucrative jobs and widespread poverty. This was consistent with the findings by Fraser (2019) and the World Bank (2004) that most of the people who live in or near forests live in extreme poverty. This restricted their ability to invest in sustainable land use practices and seek alternative livelihood options. Contrary to the findings of Fraser and the World Bank, the low incomes of the local communities did not significantly affect their choice of management practices for SMFR.

The local communities in the area were almost entirely dependent on the forest resources for their livelihoods, such as firewood, herbal medicine, shelter, food, and animal rearing. As a result, most wanted the forest resources to be used sustainably. This was consistent with the findings of Rout (2022) in India, who observed that forest communities were more concerned about the state of forest resources than non-forest communities. The findings further revealed that the local population in the study area relied heavily on subsistence agriculture for their livelihoods. Yet the average income from subsistence agriculture was generally low compared to other sectors such as trade, industry and the service sector. The overdependence on agriculture led to soil exhaustion and low crop yields in arable lands. This drove many people to forest lands in a bid to open up fresh farmland with high yields. This confirms the findings of the UN that the leading cause of deforestation in the world is agriculture. (United Nations, 2021). The above conditions made SMFR extremely difficult.

Characteristics of Forest Resources

Just like most of the forests in sub-Saharan Africa, the forest resources in the study area were largely natural forests and non-timber-based, suggesting that the most valuable tree species for timber had been depleted. This happened somehow in the last ten to twenty years. As a result, in the last three decades, the area under forest cover declined significantly, largely due to increased demand for forest products and fresh farmland. Increased demand for charcoal and farmland were the leading causes of forest resource degradation.

This relates to two socioeconomic and demographic characteristics of the local communities. Namely, the dominance of subsistence agriculture and low-income levels, which are the main drivers of deforestation. This was consistent with the findings of FAO (2020a) that increased demand for forest products and fresh farmland on account of rapid population growth is a major driver of forest cover loss.

The declining trend affected the spatial extent of forest resources. As a result, the previously vast forest lands of Mt. Kei CFR have been reduced to patches or depleted altogether by human activities. This appeared to have been correlated with the overreliance of the local community on forest resources as well. Whereas both community and public forest resources existed in the district, the latter had the widest spread but were under serious threat from encroachers. User rights in these forests varied from community-managed forests to public forests managed by government agents such as the NFA. Access to resources in community forests was much easier than in public forests. As a result, there was more degradation and depletion of community forests. However, some community forests managed under strict customary laws were the most virgin in terms of biodiversity, e.g., *Menjere*, *Rikachu*, and *Totoro*. The forests in the study area were made up largely of woodland, though along river valleys, trees characteristic of tropical rainforests would be found. This was consistent with the findings of Obua et al. (2010) that the largest portion of forests in Uganda is woodland. This implies that the areas once covered by rainforest in the 20th century have been degraded to woodland due to human activities. Thus, efforts to sustainably manage forest resources should not focus entirely on "real" forests but on woodlands and other grassland mosaics, as recommended by the national environment management authority in Uganda (NEMA, 2017). In this fight, every tree must count, regardless of its location.

Sustainable Forest Management Practices and Strategies

The most dominant forest management practice was the avoidance of tree cutting. This was largely attributed to the frequent seasons of unreliable rainfall associated with climate change. The elderly testified that the rainfall pattern had deviated from normal in the last 50 years. As a result, several households resorted to tree planting, avoiding bushfires and selective harvesting of forest resources, especially on private and communal lands. Generally, the educated were more positive about these practices than the uneducated. However, similar attempts to do so in public forests met serious resistance from the local communities because they felt marginalised in the management of these resources. For instance, attempts by the NFA to plant trees on illegal farms on public forest land were unsuccessful. The trees that were planted by NFA on the illegal farms in 2022 were vandalised by the local communities. Suggesting that for any effective management practices to succeed, the local communities need to be involved. On the contrary, efforts to fine those who destroyed forest resources were unpopular among the local communities because of their overreliance on these resources. As noted, the approaches used by the communities in managing forest resources were largely forest type-specific. For example, indigenous knowledge practices were widely used in the management of community forests, while modern approaches were used in the management of public forests. This divide created more problems than solutions to SMFR.

The elderly people were more involved in the utilisation of IK-based practices than the youth. The use of IK practices in the management of community forests was attributed to the strong culture-nature bond and the fear of being punished by the spirits that lived in the forest. As a result, they found it more applicable than modern practices, which were limited, largely absent, or in some cases, perceived as ineffective by the local communities. This was consistent with the findings of Mbobda et al. (2018) among the Dja

communities in Cameroon. On the contrary, modern approaches were used to manage Mt. Kei CFR, a public forest. In this approach, the local communities were not physically involved in the management of the forest resources. This seemed to have been premised on the assumption that the local communities were to blame for the high levels of deforestation. For instance, they were excluded from the committees established to manage these resources at the sub-county, district, and national levels. Even in rare cases where the local communities were involved by NFA, their participation was more ceremonial. They were not parties to critical decisions regarding the management of forest resources on their land and the forests they grew up interacting with. This act clearly contravened the FAO recommendation for collaborative management of forest resources for sustainable development (FAO, 2020a; Fraser, 2019).

CONCLUSION

Forests play an important role in supporting the livelihoods of millions of Ugandans. The majority of these are poor people who rely heavily on forest resources for food, herbal medicine, shelter, and wood fuel. They also play vital roles in regulating the climate, providing wildlife habitat, purifying the air, and providing a host of other ecological services. In many cases, these competing land uses are incompatible, thereby exerting serious pressure on these resources. In a bid to save forest resources from depletion, sustainable management practices such as tree planting, selective harvesting, a campaign against deforestation, and the avoidance of forest fires were adopted. In addition, a variety of approaches were used to conserve forest resources, such as indigenous knowledge-based approaches for community forests and modern approaches for public forests. Despite these efforts, the area under natural forests continued to decline as a result of a number of human activities. Thus, understanding the socioeconomic and demographic characteristics of the local communities and the forest resources is critical to designing and implementing the most acceptable forest

management strategies. Education and income levels of the people as well as community-based approaches, ought to be promoted to enhance SMFR.

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Conflict of Interest Statement

The authors declare no known conflicting interests.

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