Improving Ngong Hills Forest Conservation Efforts through Raising Local Community Awareness of Biodiversity Conservation

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Cover Photos: Thumbnails: From top clockwise

     i.   A horned chameleon gracefully perched on a tree branch in the serene Ngong Hills forest, highlighting the biodiversity of the region.

    ii.   A panoramic vista capturing the expansive beauty of the Ngong Hills landscape from its highest vantage point.

   iii.   Community members engaged in informative sessions on effective restoration techniques amidst the verdant backdrop of Ngong Forest during Kenya's National Tree Planting Day.

   iv.   Community members exchanging insights during the initial phases of constructing a communal nursery for conservation efforts, fostering collaboration and shared responsibility.

    v.   Educational sessions held at Uppah Matasia school to empower students with awareness and knowledge, promoting environmental stewardship and sustainable practices.

   vi.   Junior high school students exude enthusiasm as they prepare for a tree-planting activity within their school compound.

  vii.   Students and representatives from Ngong Umoja Environmental Management unite to plant a sapling, symbolizing their collective commitment to environmental conservation.

 viii.   Potted tree seedlings by community members following comprehensive nursery management training, demonstrating their dedication to sustainable ecosystem restoration efforts.

Abstract

Over the years, the Ngong community has relied heavily on livestock keeping, intertwining their livelihoods with the utilization of forest resources for various necessities like fodder, firewood, timber, and medicinal plants. However, this reliance has intersected with climate oscillations, particularly dry-wet seasonality, further impacting the delicate balance of ecosystems. Understanding changes in the landscape necessitates a comprehensive grasp of vegetation and climate patterns, illuminating the intricate relationship between human activities, environmental changes, and ecosystem resilience.

Over the years, climate change has imposed significant challenges on ecosystems like Ngong Hills, exacerbating existing threats such as overutilization and change in land use and introducing new risks to biodiversity and ecological stability. The continuous overuse of forest resources, for instance, grazing livestock, hampers forest succession and ecosystem vitality. Livestock grazing on seedlings disrupts the natural process of forest regeneration, resulting in decreased biodiversity and ecological robustness which interferes with forest succession by hindering young tree growth and preventing new vegetation layers from forming. Consequently, Ngong Hills Forest now displays a unique canopy structure with limited succession, diminishing its ability to support diverse flora and fauna. Addressing the impact of anthropogenic activities on forest ecosystems is therefore crucial for enhancing ecosystem resilience and ensuring the long-term health of Ngong Hills Forest, especially in light of climate change exacerbating environmental pressures.

This project addresses these challenges by initiating a pilot program in Ngong Hills Forest, focusing on community-based conservation through awareness creation and training. By involving local communities, the project aimed to fortify the forest against threats like habitat loss. It aligns with the global paradigm shift towards Participatory Forest Management (PFM), decentralizing management responsibilities to local communities. Despite the historically centralized approach to forest management, the project emphasizes the vital role of community participation in fostering a more inclusive and sustainable conservation model.

Through tailored awareness programs and training sessions, the project seeked to empower local communities with the knowledge and skills necessary for active participation in forest conservation. Stakeholder engagement strategies encompassed involvement, capacity-building plans, and ecological, social, and economic perspectives. In this study, extensive consultations were conducted to grasp stakeholders' economic needs and cultural values regarding conservation.

Community members' perceptions revealed concerns about forest degradation, with extractive uses, settlements, and pastoralism activities identified as key contributors. While respondents showed moderate familiarity with indigenous plant species, awareness of climate change varied, with limited understanding of its implications.

Despite challenges like invasive species, pastoralism, and deforestation, the project made significant strides in mass seedling propagation, establishment of nurseries, and species identification. The initiative also prioritized awareness creation, training, and community engagement to promote genetic diversity and resilience.

Through partnerships with local agencies and communities, over 9,000 trees were planted, and educational programs were conducted in schools. These efforts underscored the importance of community involvement in forest conservation and highlighted the potential for sustainable management practices to address complex environmental challenges.

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Chapter 1 Project Overview

1.1 Introduction

Forests play a crucial role in mitigating global warming and fostering sustainable societies. The imperative to safeguard and nurture them cannot be overstated. Forests serve various functions, including land conservation, ensuring water sources, climate regulation, and providing natural habitats essential for human existence. Unfortunately, contemporary challenges, such as deforestation, pose serious threats to these vital ecosystems, necessitating urgent efforts to curb or slow down the destructive practices.

In Kenya, deforestation and forest destruction result from multiple factors, including logging, agriculture, natural disasters, urbanization, and mining. The issue is particularly critical in tropical and dry forests, leading to a rapid decline in fauna and flora. Historical practices, such as clearing native trees for fast-growing exotic varieties, have degraded soil health, disrupted waterways, and adversely affected communities.

Kenya heavily relies on its natural environment, with the majority of sectors, including agriculture, tourism, wildlife, and energy, intertwined with it. The country's dependence on wood for 80% of its energy and minimal forest cover raises concerns over sustainable resource management (Africa Development Fund, 2005). To address these challenges, the government has emphasized the importance of protecting and conserving forests, as highlighted in Forest Policy Sessional Paper No. 9 of 2005 and the Forest Bill 2005 (Africa Development Fund, 2005).

The repercussions of forest loss are profound, leading to the extinction of species, habitat destruction, and contributing to environmental hazards like flooding and drought. The impact on climate change is also substantial. Raising awareness about the negative consequences of deforestation is crucial, especially considering the limited knowledge about sustainable practices.

In the past, Kenya implemented a policy of planting two trees for every one felled, but the enforcement has waned, resulting in adverse effects on communities and the global environment. This underscores the need for renewed efforts in education and awareness to encourage responsible land use and the long-term benefits of preserving forests.

Addressing the existing gap in community-based conservation initiatives in Kenya, this project aims to initiate a pilot program in Ngong Hills Forest. The objective is to assess the potential for community engagement through awareness creation and comprehensive training programs on biodiversity conservation. By actively involving local communities, the project aims to fortify Ngong Hills Forest against threats like habitat loss, illegal logging, and shifting land use patterns.

The rationale behind the project is rooted in the urgent need to champion sustainable land use practices and enhance the forest's resilience against climate change impacts. The lack of a robust conservation framework exacerbates the challenges faced by Ngong Hills Forest, highlighting the importance of community participation. The project envisions restoring the forest and establishing a sustainable conservation model by aligning conservation goals with the needs of local communities.

Recognizing the documented lack of community empowerment in existing initiatives, the project aims to design tailored awareness programs and training sessions based on successful models from

other regions. These interventions seek to empower local communities with the knowledge and skills necessary for active participation in preserving Ngong Hills Forest, fostering a sense of ownership and responsibility.

1.2 Justification

The imperative to involve local communities in the conservation efforts of Ngong Hills Forest is deeply rooted in the historical approach of centralized forest management adopted by Kenya. Traditionally, the state has borne the primary responsibility for forest management, a model that has contributed to a decline in forest cover and overall deteriorating forest conditions. Acknowledging the limitations inherent in this centralized model, there has been a global paradigm shift towards the adoption of Participatory Forest Management (PFM), decentralizing management responsibilities to local communities (Kagombe et al., 2017).

Globally, community participation is widely recognized as an effective and sustainable approach to forest resource management (IUCN, 1992). However, research underscores that participation levels in PFM schemes in developing countries, Kenya included, often fall below optimal levels (Lund et al., 2018; Chomba et al., 2015). This participation gap is of paramount importance, as the success of conservation initiatives is intricately linked to the extent of involvement by local communities and the benefits they derive from adjacent forest resources (Bremer et al., 2014).

In many developing countries, particularly in Africa, historical forest management policies tended to overlook the crucial role of communities living around forests in sustainable resource management (Mbeche et al., 2021). Recognizing the potential for community participation to enhance tree cover and mitigate forest degradation, Kenya introduced the concept of Participatory Forest Management, supported by legislative measures such as the Forest Act of 2005 and the Forest Policy of 2007.

In line with this historical context and the global recognition of community participation in forest management, the Ngong Hills Forest conservation project aligns with the broader narrative of PFM adoption in Kenya to address participation deficiencies highlighted in existing literature, fostering a more inclusive and community-driven conservation model. The initiative thus complements the national shift towards PFM and responds to the specific challenges facing Ngong Hills Forest, ensuring a more comprehensive and sustainable conservation strategy.

1.3 Research Questions

1. What are the key drivers of forest degradation in Ngong Hills, and how do they impact biodiversity and ecosystem stability?
2. How can local communities be effectively engaged in forest conservation efforts, and what strategies can be used to raise awareness of the importance of biodiversity conservation?
3. What are the economic, social, and cultural factors that influence local communities' attitudes towards forest conservation, and how can these factors be addressed in conservation initiatives?
4. What is the current state of Ngong Hills Forest in terms of species diversity, forest structure, and ecosystem services, and how has it changed over time?

1.4 Objectives

1.4.1 Primary Objectives:
1. To explore the perceptions of local communities regarding forest conservation and climate change.
2. To assess the impact of anthropogenic and climate change on the ecological and socio-economic aspects of Ngong Hills Forest.
3. To identify the most effective strategies for raising awareness and building capacity among local communities regarding forest conservation.

1.4.2 Specific Objectives:
1. To analyze the impact of human activities on forest succession and biodiversity.
2. To conduct a survey of local community members to determine their level of awareness and understanding of forest conservation and climate change.
3. To develop and implement tailored awareness and capacity-building programs for local communities and schools
4. To establish partnerships with local agencies and communities to promote sustainable forest management practices.

Chapter 2 Background Information

2.1 Conceptual Framework

2.1.1 Study Design:

1. **Research Approach:** This study employed a qualitative research approach to delve into the intricate perspectives of the local communities involved in the Ngong Hills Forest Conservation Project. This approach was chosen to gain profound insights that go beyond numerical data, focusing on the richness of community experiences and perceptions.
2. **Data Collection Methods:**

Key Informant Interviews: Engagement with key stakeholders was crucial. Conversations with community leaders, project coordinators, and government officials provided a comprehensive understanding of diverse viewpoints shaping the conservation landscape.

Focus Group Discussions: Collective opinions and insights were gathered through structured discussions with representative groups from local communities. This method aimed to capture shared values, concerns, and aspirations.

Field Surveys and Observations: Direct observations of community practices, resource utilization, and ongoing conservation efforts in the Ngong Hills area were conducted. This on-the-ground approach aimed to validate verbal accounts and capture nuanced aspects of community engagement.

Literature Review: Exploration of existing literature played a pivotal role in shaping the study design. It informed the development of data collection tools and provided a comparative context to anchor the findings.

3. **Data Categories:**

Knowledge: The study focused on assessing the community's knowledge of the benefits of forest conservation, including socioeconomic gains, awareness of climate change impacts, and familiarity with indigenous tree species.

Attitude: Investigation into the current or preferred economic and livelihood activities within the Ngong Hills Forest Project area shed light on the community's disposition towards forest conservation.

Practices: Exploration of community experiences and practices related to forest conservation delved into the actual implementation of conservation efforts, including the extent of resource use and sustainable practices.

Challenges and Constraints: Identification of key constraints affecting tree planting, biodiversity conservation, and community livelihoods provided crucial insights into the obstacles faced by the local communities.

4. **Data Sources:**

Primary Data: Data collection was conducted through key informant interviews, focus group discussions, field surveys, and direct observations, ensuring a firsthand understanding of community dynamics.

Secondary Data: Existing data was utilized for comparative purposes and to enhance the contextual understanding, enriching the study with historical and external perspectives.

5. Sampling:

Population: The study focused on local communities residing in the Ngong Hills surroundings including Ngong town, Nalepo, Kahara,matasia-Lekuruki ensuring a representative sample for a comprehensive analysis.

Sampling Methods: Purposeful sampling was employed for key informants and focus group participants, ensuring diverse perspectives. Random sampling for field surveys guaranteed a balanced representation of the area.

6. Data Analysis:

Qualitative data analysis techniques, such as thematic coding and content analysis, were employed. Findings were interpreted based on the identified categories of knowledge, attitude, practices, challenges, and constraints.

7. Ethical Considerations:

Stringent ethical considerations were adhered to throughout the study. Informed consent was obtained from all participants, and measures were in place to maintain confidentiality and privacy.

2.2 Study site

Situated approximately 25 kilometers north of Kajiado County and in close proximity to the city, the Ngong Hills forest stands as a distinctive natural entity in Eastern Africa.Covering an expansive area of 3077.6 hectares, the forest graces the knuckle-shaped peaks of the Ngong Hills

Figure 1 Map of Ngong Hills Forest showcasing the overview of the area we focused our restoration activities.

In 1981, the Government of Kenya officially established the Ngong Forest under notice 90, designating it as a forest reserve of ecological and socio-economic significance. Positioned at coordinates 1°18'59.12"S 36°44'30.13"E, the hills extend over an area of approximately 21,105 square kilometers, characterized by an elevation ranging between 1961 and 2483 meters above sea level. The geological formation of Ngong Hills Forest is marked by open rolling land, occasional volcanic hills, and valleys. The forest experiences a climate that is partly sub-humid and semi-arid, with short rains occurring between October and December and long rains between March and May. The eastern side of the hills is adorned with montane dry forest and wooded grassland, while the western side is predominantly bushland. The average annual potential evaporation ranges from 500mm to 800mm, resulting in a moisture deficit for a significant part of the year.

Beyond its geographical and climatic attributes, the Ngong Hills Forest holds paramount importance for its role as a catchment area for Kiserian, Ngong areas, and Rivers Athi, thereby supplying water to Nairobi residents. The forest stands as a vital natural resource, encompassing valuable agricultural, vegetative, hydrological, recreational, and wildlife resources. However, the overexploitation of these resources poses a significant challenge to the forest's restoration.

In addition to being a forest reserve, the Ngong Hills bear immense historical and cultural significance for the Maasai people, referred to as 'Oldoinyio Ooloolaiser' or the 'mountain of Laiser.' This holds cultural importance for one of the Maasai clans, the Laiser, from which the renowned 'laibon,' Olonana (Lenana), descended. Restoring this forest is an environmental imperative and a cultural preservation effort, contributing to the safeguarding of Maasai heritage.

Ngong Hills Forest emerges as a multifaceted ecosystem intertwining ecological, socio-economic, and cultural dimensions. Understanding and addressing the diverse facets of its significance are crucial for comprehensive restoration efforts.

2.3 Target Spp

Olea Africana, Olea capensis, Warburgia ugandensis, Prunus Africana, Croton megalocarpus, Vitex kenesiensis, Cordia Africana, Markamia lutea, Acacia xanthophlea, Verchellia Seyal, Olea europea and *Vepris. Vepris simplicifolia, Grewia similis*

Chapter 3 Materials and Methods

3.1 Collection of Baseline Information

3.1.1 Vegetation Surveys

A comprehensive baseline survey was conducted on the site to assess the forest's health and degradation levels, serving as a crucial measure of its biodiversity. The survey aimed to identify native plant species within the forest ecosystem. Subsequently, a rapid assessment of the forest was undertaken using a rapid site assessment form. Diversity data for was gathered, including species names. Assessment criteria encompassed health, canopy cover, and the quantity of weed/invasive species, measured on a 0-3 scale. Additionally, a baseline survey was conducted within the designated planting site. The objective was to determine the number of trees required for optimal spacing, utilizing a planting distance of 1.8 meters apart between trees, equivalent to 3100 trees per hectare.

The inclusion of ecological research techniques was instrumental in ensuring the attainment of high-quality planting material and informed decision-making regarding species selection for specific sites. This holistic approach aimed at establishing a strong foundation for the project's subsequent restoration and monitoring phases.

3.1.2 Assessment of Land Use and Land Cover Changes

The restoration of degraded ecosystems is a global priority aimed at reinstating biodiversity, enhancing ecosystem functions, and ensuring sustainable forestry and ecosystem services. Effective management of these ecosystems requires a thorough understanding of changes in land use and land cover over time.

In this study, we utilized multi-temporal Landsat 7 and 8 satellite imagery to assess land use and land cover changes in a specific study area spanning from 2013 to 2023. The baseline year for comparison was set at 2013, enabling us to analyze trends over a 10-year period. Data acquisition was conducted during the dry season to minimize cloud cover and ensure data precision. We compared the images together with the analysis from previous studies done by (Simiyu, 2019)

3.1.3 Assessment of Local Community Perception Towards Biodiversity

Key Stakeholder Consulted

The importance of prioritizing people in tree planting and restoration activities was emphasized. The tree planting and nursery initiatives were based on the expressed demand of future beneficiaries and local networks of seed sources and nurseries rather than short-term production. Additionally, the project carefully considered how the planted trees would affect nearby communities and strived to create landscapes that would benefit all community members regardless of gender, age, economic and social status. This involved encouraging the community

members to plant fruit trees in their homesteads, which would further contribute to restoration practices.

The project further underscored the importance of involving communities actively and equipping them with essential tools and resources to guarantee the effectiveness of tree-planting endeavours. This encompassed equipping communities with the necessary resources, imparting relevant skills, and delivering training that could contribute to the cultivation of robust and thriving trees. The goal was to empower communities, ensuring their active participation and fostering the cultivation of healthier and more productive trees. This holistic approach aimed to create a sustainable and mutually beneficial relationship between the project and the communities involved.

Consultation was been undertaken with the following key stakeholders:
Kenya Forest Service, Forest Manager Ngong Hill Forest
Ngong Hills Community Forest Association
Community living in adjacent areas to the forest
Chief Ngong Lekuruki and Nalepo area
Assistant Kajiado County DC

3.1.4 Documentation of Threats

The assessment identifies several key factors contributing to the complex scenario in the forest:
1. Literature Review:
We conducted an extensive review of existing literature related to forest ecosystems, focusing on studies that examined anthropogenic impacts, invasive species, pastoralism, overutilization of resources, and disturbance drivers. This literature review provided foundational knowledge and context for understanding the complex scenario in the forest.
2. Field Surveys:
Field surveys were conducted in the target forest area to collect firsthand data on the identified key factors. These surveys involved systematic observations of habitat destruction, evidence of overexploitation, presence and distribution of invasive species, extent of pastoral activities, and signs of plant encroachment.
3. Remote Sensing Analysis:
Geographic Information System (GIS) tools were utilized to analyze land cover changes, quantify forest disturbance, and assess the impact of anthropogenic activities.
4. Expert Consultations:
Expert consultations were conducted with the forester of Ngong. These consultations aimed to validate our findings, gain additional insights into the identified factors, and gather expert opinions on the significance and implications of the observed trends. Experts provided valuable input on the methodologies used and suggested potential management strategies.

3.2 Restoration of Ngong Hills

The activity targeted restoring Ngong Hills forest areas, including farms and schools. This was geared towards the restoration efforts of restoring the forest for water, soil conservation and the

stability of agroecosystems. Community-based organisations (CBO) , including the Ngong Hills Community Forest Association, Empakasi Green Movement Environment Association (EGMEA), Ngong Umoja Environmental Management (NUEM) and Go Green initiatives, actively participated in the conservation work. This created learning opportunities and fostered ownership for enhanced sustainability. About 40% of the seedlings were supplied to the community and schools.

3.2.1 Establishment of Nursery and Propagator

As part of our initiative to enhance biodiversity conservation in the Ngong Hills Forest, a nursery and propagator was established. This served as a central hub for the propagation and cultivation of indigenous plant species crucial to the restoration and preservation of the forest ecosystem. The following species were selected for propagation:

Olea Africana, Olea capensis, Warburgia ugandensis, Prunus Africana, Croton megalocarpus, Vitex kenesiensis, Cordia Africana, Markamia lutea, Acacia xanthophlea, Verchellia Seyal, Olea europea and *Vepris. Vepris simplicifolia, Grewia similis*

3.2.2 Seed Collection

Seeds were systematically gathered from mature specimens of the selected plant species within the Ngong Hills Forest. Special attention was given to ensuring genetic diversity and the sustainability of seed harvesting practices.

3.2.3 Seed Methods

Upon collection, seeds underwent meticulous sorting and cleaning to remove any debris or contaminants. They were then categorized based on species and prepared for the propagation process.

3.2.4 Seed Processing

Seed processing involved treatments such as scarification or stratification, depending on the specific requirements of each plant species. These treatments helped break dormancy and improve germination rates, thereby enhancing the success of propagation efforts.

3.2.5 Seed and seedling Germination

Seeds and seedlings were carefully potted and placed under controlled environmental conditions conducive to germination in the nursery. Monitoring and regular maintenance ensured optimal germination rates and healthy seedling development.

3.3 School-Based Restoration Programs

During the implementation of school-based restoration trainings, partnerships were established with Uppah Matasia Primary School and Nalepo Primary School, where tree-planting activities were conducted. A total of over 300 trees were planted across these school compounds.

In conjunction with the tree-planting activities, a training session was conducted to raise awareness and impart best practices in tree planting. Students were educated on the importance of conservation and sustainable tree management practices. Additionally, they were trained on monitoring techniques using locally available materials, such as recycled jerricans, for watering and dried leaves and grass for mulching.

To ensure the long-term success of the planted trees, students were assigned specific trees to care for until maturity. This approach aimed to instil a sense of responsibility and ownership among the students, fostering their commitment to the conservation effort.

Furthermore, trees were distributed to school-going students to plant in their homesteads, extending the impact of the program beyond the school environment. The enthusiastic participation of the students demonstrated their keen interest in tree planting and conservation efforts.

3.4 Creation of Awareness on Biodiversity Conservation

To raise awareness among local communities about the significance of conserving target species and their habitats, we organized workshops and small groups across various locations. Recognizing the challenges posed by participants' work schedules and availability, we adopted flexible approaches, sometimes conducting meetings under trees to accommodate larger numbers with minimal inconvenience.

In assessing the effectiveness of the training, we focused on evaluating the opinions and attitudes of the trainees at the conclusion of the sessions. Prior to the training, we conducted surveys to establish baseline data regarding participants' knowledge, attitudes, and perceptions concerning biodiversity conservation. Following the training, we administered post-training surveys to gauge any changes in these aspects. During these assessments, we employed simple methods, such as hand counts, to determine the level of understanding among participants. Additionally, we facilitated practical demonstrations where participants actively engaged in activities, such as removing tree potting bags and planting trees, to reinforce key concepts and ensure a high success rate in their application.

Chapter 4 Results and Discussion

4.1 Collection of Baseline Information

4.1.1 Assessment of Land Use and Land Cover Changes

The study assessed the time period in 10-year intervals, specifically focusing on the years from 2013 to 2023. During this period, unsupervised learning techniques were employed to detect vegetation changes.The specific objectives of the study were twofold: (i) to detect and quantify spatial-temporal trends of land-use/cover changes, particularly forest cover, between 2013 and 2023; and (ii) to identify the drivers of past and current land-use/cover changes (LULCC) in Ngong Forest through key informant interviews and focus group discussions to understand the dynamic of LULCC. The analysis revealed an increase in the loss of forest cover between 2013 and 2023. A previous study on the spatial analysis of Kenya between 1990 and 2010 indicated a decrease in forest cover from 7.89% to 5.90%, equivalent to a loss of 1.18 million hectares(Muhati et al 2018).. The principal causes of forest loss were attributed to overexploitation of ecosystem services, overgrazing by livestock, unclear forest management regimes, selective logging, agricultural expansion, and human settlement in formerly forested areas. LULCC, especially forest cover changes, pose significant challenges to livelihoods and the environment worldwide, impacting the availability of ecosystem goods and services (La et al. 2016).
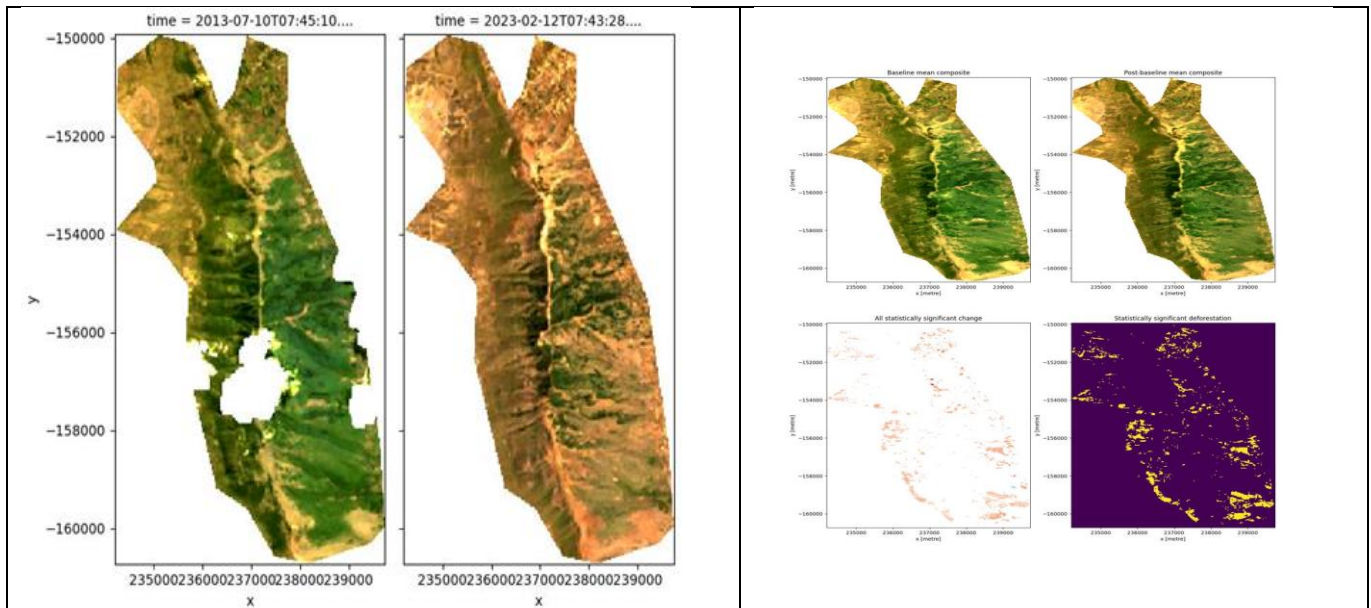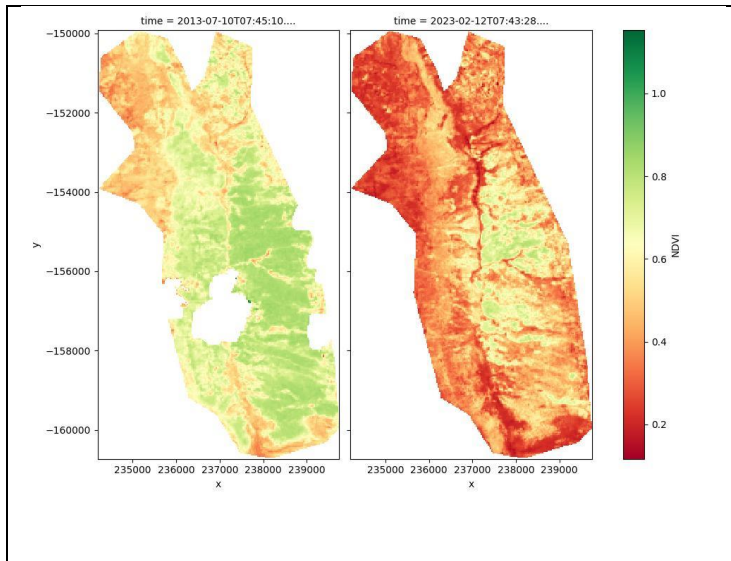
Figure 2 The map illustrates the land cover amd vegetation change of Ngong Hills Forest

The Figure 2 illustrates a concerning decrease in vegetation cover within Ngong Hills Forest. Despite ongoing restoration efforts aimed at increasing dense vegetation, many of the planted seedlings are yet to reach maturity, resulting in a sparse canopy cover. Conversely, the reduction in forest cover primarily stems from illegal logging activities and the overutilization of forest resources. However, pastoralism emerges as the predominant anthropogenic activity, significantly contributing to forest degradation due to the lack of a healthy forest strata and low succession rates.

Raising community awareness emerged as a crucial step in addressing these challenges and understanding their long-term implications for forest sustainability. Some members of the local community expressed a lack of understanding regarding the detrimental effects of activities such as pastoralism on the forest ecosystem. Given that a majority of trees in Ngong Hills are mature, their loss would substantially diminish the forest's resilience, thereby affecting the livelihoods, water, and food security of the broader community.

The depletion of water springs underscores the urgent need to restore the forest's water catchment function. More than 80 water springs have disappeared in Ngong Hills due to encroachment and the depletion of forest cover. Ngong Water catchment area encompasses Thogoto, Kibiko, Oloolua, and Ngong. This thus highlights Ngong Hills critical role as water catchments by intercepting rainfall with their canopies, facilitating gradual water trickle down to the forest floor. Additionally, trees absorb water from the soil through their roots, releasing it into the atmosphere through transpiration, thus regulating the local water cycle. Their roots also stabilize the soil, create pore spaces for water infiltration, and access groundwater, thereby reducing water table levels and preventing excessive water loss through runoff.

Moreover, trees regulate soil moisture levels, decrease evaporation, and enhance water retention capacity, ensuring water availability for plant uptake and groundwater recharge. They further regulate streamflow by capturing and storing water during periods of high rainfall, gradually releasing it during drier periods. This process maintains stable water levels in streams and rivers, thereby mitigating the risk of floods and droughts.

4.1.2 Community Perception Results and Discussion

Biodiversity conservation in consultation and partnership with local communities and stakeholders

The project engaged various primary stakeholders, encompassing individuals, local communities, and community groups, alongside secondary stakeholders like academic and research institutes, as well as donors and funding agencies. Stakeholder engagement strategies encompassed political involvement, capacity-building plans, and the use of ecological, social, and economic perspectives to define the restoration project. Stakeholders experienced diverse benefits, including employment opportunities and community empowerment. For instance, the project established a nursery to produce seedlings for restoration efforts and trained both seed collectors and nursery attendants. Extensive consultations leveraging scientific and local knowledge were conducted to grasp stakeholders' economic needs and cultural values regarding species selection.

Community Members' Understanding of Forest Conservation and Climate Change:
When asked about their perceptions of the state of the Ngong forests, the findings revealed that the majority of households, constituting 90%, viewed the forests as degraded. Conversely, only a small minority, accounting for 10%, believed the forests were in good condition.

Causes of Forest Degradation: Several factors contribute to the degradation of the forests, including:

- Extractive Uses: Practices such as unsustainable collection of firewood and harvesting of timber.

- Settlements: Expansion of human settlements encroaching on forest areas.

- Pastoralism Activities: Over grazing of livestock, which adversely affects the health of the forest ecosystem.

Knowledge of Plant Species: Respondents were queried about their familiarity with tree species, and on average, each respondent could identify approximately six indigenous plant species by their local names.

Table 1 The 6 most commonly recognized plants.

Rank	Indigenous Plant Species
1	Croton Megalocarpus (Local name- Mokindori)
2	Ficus thonningii (Local name- Mugumo or Oreteti)
3	Azadirachta indica (Local name -Mwarubaini)
4	Verchellia Seyal (Local name -Olerai or Mugaa)

Rank	Indigenous Plant Species
5	Olea europea (Local name Oloirien or mutamaiyo)
6	Markhamia lutea (Local name Siala)

This information indicates a moderate level of familiarity with indigenous plant species among community members.

These findings offered valuable insights into community perceptions of forest degradation, the identified causes, and the extent of knowledge regarding indigenous plant species. Such knowledge is crucial for implementing effective conservation and education initiatives within the Ngong forest region.

Climate Change Awareness:

Industrialization has led to the emission of greenhouse gases, resulting in global warming and subsequent climate change. The effects include extreme weather events such as prolonged droughts, storms, and irregular rainfall patterns. While over 70% of households reported awareness of climate change, only 10% associated changes in weather patterns with it. Approximately 30% claimed to have no idea about climate change, suggesting potential gaps in understanding.

Households were further asked about their perceptions of climate change indicators over the last 30 years. About 50% observed a significant decrease in rainfall and increased susceptibility to floods and landslides. Many reported the drying up of springs and changes in the local climate, with hotter and drier conditions during the day, especially in the dry season.

Attitude Towards Forest Conservation:

Attitudes toward forest conservation were gauged through nine questions. The aggregate results are summarized in Table 8. Notably, 89% of households considered forest conservation to be a positive endeavour, while 20% believed forest destruction could be justified for direct economic benefits.

Table 2 Community Attitudes Towards Forest Conservation

Attitudes Towards Forest Conservation	Yes	No	Unsure
1. Do you believe forest conservation is important for the well-being of the community?	20%	50%	20%
2. Exploitation justified if done sustainably for future generations	80%	5%	15%
3. Are you aware of any ongoing forest conservation initiatives in the Ngong Hills area?	70%	10%	20%

Attitudes Towards Forest Conservation	Yes	No	Unsure
4. Are you willing to engage in activities that promote forest conservation in Ngong Hills?	99%	1%	0
5. Some indigenous trees are sacred and should not be cut.	100%	0%	0%
7. Do you believe that forest destruction can be justified for direct economic benefits?	70%	20%	10%
8. Conservation of forests is a good thing	99%	0	1%

These results provide valuable insights into the community's attitudes toward forest conservation, highlighting the majority's recognition of its importance despite some justifying destruction for immediate economic gains. Continued education and awareness efforts may help bridge this gap.

4.1.3 Documentation of threats

Assessment and Challenges in Ngong Forest Ecosystem: Striking a Balance between Conservation Successes and Ongoing Threats

The evaluation reveals a complex scenario in the forest, marked by achievements in conservation alongside persistent threats affecting biodiversity, genetic diversity, ecosystem structure, and resilience. Human-induced factors significantly shape the ecosystem, demanding continuous efforts to confront and alleviate these challenges for the long-term well-being of the ecosystem and the preservation of biodiversity. The forest encounters several hurdles across diverse aspects: anthropogenic impacts, the presence of invasive species, albeit at lower levels due to clearing of land, pastoralism and plant encroachment, persistent overutilization, and lingering threats from disturbance drivers. Around 20% of the forest area is covered by non-native invasive plants, impacting its composition. Certain essential processes like decomposition and habitat provision show reduced levels compared to a healthy ecosystem. Genetic diversity has declined considerably due to habitat destruction, overexploitation, and climate change. The ecosystem displays a considerable gap between high canopy and ground cover, highlighting spatial differences in canopy structure, species diversity gradient, edge effects, and resource distribution patchiness.

Spatial variations in canopy structure, species diversity, edge effects, and resource distribution patchiness are evident, with a noticeable gap between the high canopy and ground cover. The forest's canopy structure lacks a well-defined vertical projection, comprising a high but sparse canopy formed by surviving older mature trees. Forest succession is hindered as seedlings fail to reach maturity due to disturbances like herbivory from grazing animals. Concerns arise over tree species reaching maturity only to rot, highlighting potential challenges in the forest's health. Evidence of tree deforestation activities, as indicated by tree stumps, adds to the concerns about the forest's sustainability. Resilience is notably low, attributed to invasive species impeding native plant growth and overexploitation hindering the ecosystem's recovery potential. Trophic complexity and spatial patterning in this ecosystem are still dissimilar, and notable discrepancies

in spatial structure. Despite these challenges, limited positive interactions exist with the surrounding environment through landscape flows and genetic/habitat links. Addressing the complex interplay of factors affecting the forest's health requires concerted efforts in sustainable conservation and management practices to promote its long-term ecological well-being.

Assessment of Presence or Absence of Invasive Species

Figure 3 The invasive Euryops chrysanthemoides (*African bush daisy*), which accounts for over 60% of the total invasive species coverage in Ngong Hills

The assessment of invasive species revealed a significant number of direct drivers contributing to their proliferation. The overall prevalence of nonnative, invasive, or undesirable plants remains alarmingly high, covering more than 30% of the assessed area. Cleared land in forest edges and patches within the forest is particularly concerning, hosting invasive species such as *Prosopis juliflora*, *Solanum mauritianum*, and notably, the dominant *Euryops chrysanthemoides* (African bush daisy), which accounts for over 60% of the total invasive species coverage. This trend suggests an increase in invasive species due to a lack of effective management efforts. Of particular interest among the invasive species is the Euryops African Daisy (*Euryops chrysanthemoides*), characterized by its evergreen, nearly hairless, and bushy growth, reaching heights of 0.5–2 meters. The plant features tender stems and extensive branching, with bright yellow daisy flowers that adorn it throughout the majority of the year. Its adaptability allows it to thrive in various environments, including roadsides, disturbed area, and forest edges or gaps. However, the adaptability of *Euryops chrysanthemoides* poses ecological challenges, as it rapidly forms dense stands that may displace native plant and animal species. This invasive behavior has been documented in Kenya with notable intrusion into disturbed forests (Witt and Luke 2017). Ngong Forest, in particular, has witnessed extensive colonization by this weed, occupying vast areas within fragmented sections of the forest. Efforts by the local community to control its growth have proven challenging, as the plant exhibits resilience and regrows rapidly, displaying increased aggressiveness. The plant's ability to perform better when cut back adds to the difficulty of implementing effective control measures. Additionally, its hardiness and adaptability to heat, coupled with drought tolerance, categorize the Euryops African Daisy as a "transformer species" capable of altering ecosystems' character, condition, form, or nature.

Understanding and managing the impact of invasive species like *Euryops chrysanthemoides* are crucial for effective conservation and biodiversity preservation in various ecosystems. Addressing these challenges requires a concerted effort to develop and implement sustainable management strategies to mitigate the adverse effects of invasive species on native biodiversity.

Pastoralism

Figure 4 Grazing animals including goats and cattle in Ngong Hills forest interfere with the natural life cycle of growth, as they browse on or trample seedlings, leading to habitat degradation.

Pastoralism exerts various detrimental effects on the delicate equilibrium of Ngong Forest's ecosystem. The continuous presence of grazing animals induces plant encroachment, causing vegetation disruptions and interfering with plants' natural growth patterns. This interference hampers the forest's capacity to regenerate, impeding its vitality and health. This negative impact extends to the process of forest succession. Grazing animals, browsing or trampling on seedlings, obstruct the natural life cycle of growth. This impediment results in a struggle for seedlings to attain maturity, disrupting the seamless progression of the forest's life cycle.

Furthermore, pastoralism is implicated in activities that lead to tree deforestation within the forest. Grazing animals contribute to ecosystem degradation by consuming young trees, preventing them from reaching maturity. This not only stunts the growth of the forest but also poses a threat to mature trees, potentially causing irreversible damage. The adverse effects of pastoralism manifest in the altered canopy structure of Ngong Forest. The vertical projection of tree crowns becomes poorly defined, and the canopy appears sparse, dominated by surviving older mature trees. This structural modification may disrupt light penetration, thereby influencing the overall ecological dynamics of the forest. The continual presence of pastoral animals introduces habitat disturbance into the ecosystem. Over grazing activities disrupt the natural habitats of various species, resulting in an imbalance that adversely affects overall biodiversity and the ecological equilibrium of the forest.

A concerning consequence of pastoralism is the compromised resilience of Ngong Forest. The relentless pressure on vegetation, coupled with the disturbance caused by grazing animals,

hampers the forest's ability to recover from both natural and human-induced disturbances. This reduced resilience renders the ecosystem more susceptible to environmental changes, posing long-term challenges to its health.

While acknowledging these negative impacts, it is imperative to emphasize that a harmonious coexistence between pastoral activities and conservation efforts can be achieved through sustainable management practices and active community involvement. This approach ensures the preservation of Ngong Forest's ecological integrity while addressing the livelihood needs of local communities, making it a comprehensive and educational perspective on the challenges posed by pastoralism in the forest.

Deforestation Activities

Figure 5 *Illustration* of a tree felled through illegal logging, depicting deforestation within Ngong Hills Forest

Ngong Forest faces an imminent and substantial threat in the form of deforestation, presenting a formidable challenge to its unique ecosystem. The ongoing loss of trees within the forest not only unravels the intricate tapestry of biodiversity but unravels the intricate tapestry of biodiversity and also disrupts the delicate equilibrium sustaining life within this natural sanctuary. On a global scale, the consequences of deforestation extend beyond local boundaries, contributing significantly to the complex dynamics of climate change. Once a robust carbon sink, Ngong Forest is witnessing a loss of its inherent capacity to absorb and sequester carbon dioxide. This reverberates globally, intensifying the broader environmental imbalance through the released carbon amplifying the global greenhouse effect.

The consequences of deforestation extend to the soil, once shielded by the extensive root systems of the forest flora. The eroding topsoil and the looming threat of landslides stand as direct outcomes, highlighting the profound impact on the land's fundamental foundation as the trees' protective mechanisms diminish.

Local communities intricately connected to Ngong Forest face the severance of traditional livelihoods. Subsistence farming, resource gathering, and the extraction of herbal medicines become increasingly precarious, contributing to the gradual erosion of indigenous ways of life.

Furthermore, deforestation disrupts the integral role of Ngong Forest in shaping local water cycles, nurturing rivers, and sustaining streams. The alteration in the natural flow of water profoundly impacts its availability and quality, with implications for the ecosystem and the communities

reliant on these vital water resources. Increasing the forest restoration will contribute to a cleaner environment that can help rejuvenate over 80 water springs that disappeared due to the encroachment and depletion of the forest cover.

Culturally and recreationally, Ngong Forest undergoes a transformation marked by the loss of its lush beauty. The diminishing cultural significance and the erosion of recreational experiences within the forest underscore the far-reaching consequences of deforestation. In the aftermath of tree felling, Ngong Forest becomes less resilient, making it vulnerable to climate change, pests and diseases.

Amidst these challenges, hope persists through strategic approaches grounded in sustainability, reforestation initiatives, and active community engagement. The preservation of Ngong Forest extends beyond local boundaries, representing a commitment to the global imperative for climate resilience and biodiversity conservation. In the narrative of preservation, Ngong Forest prompts the crafting of a story of rejuvenation, where the resilience of a determined community echoes through the whispers of the trees reclaiming their natural heritage.

Assessment of genetic diversity and resilience

Facilitating the advancement of genetic diversity and fortifying resilience is a critical imperative in conserving Ngong Hills' ecosystem. The assessment highlighted the presence of a relatively modest percentage, approximately 40%, of unique native species dispersed across various sites within the forest. Evident in the evaluation is the significant occurrence of positive genetic flow, driven by the movement of individuals, pollen dispersal, seed distribution, and intentional infusion of genetic material through human-mediated interventions. A noteworthy instance of such intervention is through the establishment of the First community nursery through Rufford Foundation, strategically devised to introduce new species to the ecosystem, thereby cultivating genetic diversity within Ngong Hills Forest. This comprehensive strategy not only seeks to maintain the existing biodiversity but also aims to amplify the adaptive capabilities of the ecosystem, ensuring resilience in the face of evolving environmental dynamics.

Additional contributing factors assume a pivotal role in the endeavour to promote genetic diversity and reinforce resilience within Ngong Hills' ecosystem. Notably, the presence of restored sites, carefully enclosed to prevent herbivory, significantly enhances the overall conservation strategy. These restoration areas are surrounded by fencing, a protective measure spanning three years to shield the trees during their maturation phase. Throughout this critical period, the Kenya Forest Service (KFS) takes charge of the vigilant monitoring and upkeep of the restoration sites. This strategic amalgamation of promoting genetic diversity, fortifying resilience, and implementing targeted protective measures epitomizes a comprehensive approach to ensuring Ngong Hills Forest's enduring vitality.

Figure 6 In clockwise order, a lady from the NCA group engages in tree planting, while on the right, a fenced area designated for restoration in Ngong Hills is depicted. Beyond the fence, the African Daisy thrives, particularly in the degraded fragments of the forest.

4.2. Mass seedling Propagation and Restoration of Ngong Hills

4.2.1 Establishment of Nursey

Figure 7 showcases the inception of a community nursery, where local residents propagate seedlings to enhance genetic diversity within the forest ecosystem. This pioneering initiative marks the debut of community-driven conservation efforts in the region.

The foundational phase of the Ngong Hills restoration initiative involved the meticulous establishment of nurseries dedicated to the propagation of indigenous seedlings. This crucial component aimed to create controlled environments where optimal conditions for seed germination and sapling development could be ensured. The key elements of the nursery establishment process included:

Site Selection: The selection of suitable locations for nurseries was based on factors such as proximity to restoration sites, access to water resources, and favorable soil conditions. Strategic site selection played a vital role in the success of subsequent seedling propagation. The nursery was set up in the space where we did the restoration which had been fenced and had access to water. Another nursery was set up in the community residency ensuring ease of access and close

monitoring by the community members. The community was also trained to start and establish tree nurseries in their compounds to promote conservation.

Infrastructure Setup: The physical infrastructure of the nurseries was designed to accommodate the specific needs of seedlings. This included shade structures to regulate sunlight exposure, a simple propagator for nurturing seedlings, and protective measures like strong poles to protect against adverse weather conditions.

Species Identification:

Figure 8 The project team during a rapid baseline assessment of Ngong Hills to identify the species diversity and map areas of restoration.

The selected plant species for restoration in Ngong Hills encompass a diverse range of indigenous trees, each contributing uniquely to the ecological richness of the region. These include *Olea capensis, Warburgia ugadensis, Prunus Africana, Croton megalocarpus, Vitex kenesiensis, Cordia Africana, Markamia lutea, Acacia xanthophlea, Verchellia Seyal, Olea europea* and *Vepris*. Given the open nature of the restoration area characterized by minimal canopy cover, approximately 3%, a strategic decision was made to prioritize pioneer species. These species, known for their rapid growth and horizontal development, play a pivotal role in providing substantial shading. Additionally, special consideration was given to the selection of drought-tolerant species, with a focus on trees such as *Vepris spp and Verchellia spp*. These species exhibit resilience in challenging environmental conditions, particularly in dry and hot climates. This thoughtful selection process aimed not only to restore the native vegetation of Ngong Hills but also to address the specific ecological characteristics of the open restoration area. By prioritizing

pioneer and drought-tolerant species, the restoration initiative seeks to establish a resilient and thriving ecosystem that can adapt to the unique challenges presented by the local environment. Pioneer species share distinctive characteristics that equip them for thriving in challenging and barren environments. These adaptations facilitate their colonization of sterile landscapes, and they are characterized by rapid germination, growth, maturation, and reproduction, often in large numbers. Moreover, many pioneer species produce seeds and other propagules that are well-suited for low-moisture environments, enabling them to endure extended periods of dormancy. In our restoration efforts, we introduced seedlings of native but slow-growing species that are less resilient to harsh climatic conditions. This inclusion aimed to diversify the forest with trees that, while native, require a more gradual growth process and are less adaptable to extreme climates. Additionally, we incorporated species known for their appeal to pollinators, such as *Verchellia Seyal, Croton megalocarpus, Markamia for sunbirds, Olea,* and others. The deliberate mix of pioneer species, slower-growing natives, and pollinator-friendly varieties is a strategic approach to foster resilience and biodiversity within the forest. This comprehensive planting strategy aims to create a balanced and thriving ecosystem that can withstand environmental challenges while providing a favorable habitat for diverse flora and fauna.

Germination and Cultivation: We trained trainees to oversee the germination of the collected seeds and the subsequent cultivation of seedlings within the nurseries. This phase required careful attention to watering schedules, and protection from potential threats. During this crucial phase of germination and cultivation, our focus shifted to training key individuals who would oversee the intricate processes of seed germination and seedling cultivation within the nurseries. The training program was designed to cover multiple facets essential for the successful development of robust seedlings:

Firstly, we delved into the intricacies of watering schedules, emphasizing the significance of precise and well-timed watering throughout different stages of the germination and cultivation process. Participants gained a nuanced understanding of the varying water requirements crucial for optimal seed germination and subsequent seedling growth.

Protecting germinating seeds and young seedlings from potential threats was a key focus area. Participants were equipped with the knowledge and strategies needed to identify and address threats posed by pests, diseases, and environmental factors. This proactive approach aimed to create a secure environment for the healthy development of seedlings.

Potting strategies were also thoroughly covered, the process involved meticulous steps to create an optimal environment for plant growth. Combined with dried leaves, the nursery soil was thoughtfully placed into each pot. This approach aimed to prevent compression and avoid soil compaction. Notably, the pots were filled with a deliberate technique, leaving a small space at the brim. This space was strategically designed to facilitate water retention. To further enhance water conservation, the addition of leaves at the top of the pot was encouraged. This practice served the dual purpose of minimizing water loss and preventing soil hardening at the surface. Additionally, the soil was gently turned to maintain its desirable texture and prevent undesirable compaction.

4.2.2 Seed Collection and Mass Propagation:

Building on the foundation laid in the nurseries, the seed collection and mass propagation phase was a pivotal aspect of the Ngong Hills restoration initiative. This involved systematic approaches to collecting, processing, and cultivating seeds to achieve large-scale seedling production. The key components of this phase included:

Indigenous Seed Identification: Thorough ecological assessments guided the identification of indigenous plant species, ensuring that seed collection focused on those integral to the Ngong Hills ecosystem. This step contributed to maintaining the genetic diversity of the region.

Ethical Harvesting Practices: Seed collection adhered to ethical practices to minimize ecological impact. This included selecting mature seeds, avoiding overharvesting, and ensuring that the collection process did not disrupt natural habitats.

Mass Propagation Techniques: The propagation of seeds into seedlings occurred on a large scale within the nurseries. Mass propagation techniques included controlled germination, careful nurturing, and systematic management to produce healthy and robust seedlings.

Quality Control Measures: Rigorous quality control measures were implemented throughout the mass propagation process. This involved regular assessments of seedling health, addressing any issues promptly, and ensuring that only high-quality seedlings were deemed suitable for transplantation.

The synergy between the establishment of nurseries and the mass propagation of seeds formed a comprehensive strategy, laying the groundwork for successful large-scale restoration efforts in Ngong Hills**.**

4.3 Creation of Awareness

Figure 9 Community education and awareness training sessions aimed at fostering environmental conservation and sustainable practices within Ngong Hills.

Figure 10 Community members are seen actively gathering dry grass and plant leaves for mulching (left), while participating in a planting session within the restoration area (right), demonstrating local engagement in conservation endeavors in Ngong Hills. At the bottom left, communities and members of the National Construction Authority (NCA) gather for a photo following restoration activities in Ngong Hills. At the bottom right, an NCA member poses for a picture while Teresiah prepares to plant a seedling by removing a potting bag

The project facilitated external exchanges to enhance genetic diversity nursery training and seed collection and supported training programs for local communities, especially women and youth, and practitioners to ensure proper site management. Communication strategies were employed to educate future generations about the project's trajectory and achievements, encouraging appreciation and learning. Furthermore, the project established a governance structure for ongoing stewardship and legal protection of restoration investments, emphasizing local community ownership and involvement. This included registering the nursey as a Community Forest Association where they would be able to get support from the Kenya Forestry Association.   The project also explored various income mechanisms and partnerships to expand restoration efforts in Ngong Forest. For instance, we collaborated with KFS and National Construction Authority Group and the community to plant over 1500 trees.

During the rainy season, we worked with the community living in Upper Nalepo, including the women, youth, children, and the elders. We educated them on the importance of tree planting, restoration and the protection of Ngong Hills. Simple ways of handling and planting the seedlings were also demonstrated, including how to mulch and care for a seedling to maturity. We organized a tree planting with the entire community and planted over 3000 trees in the space allocated in Ngong Hills.

We also collaborated with the Oloolua Forest Association, EGMEA and the Kajiado County officials, where we planted over 4000 trees and shared the best practices of seedling planting and monitoring. This event was featured on the Kenya Television Network (KTN News) which is a large television network with huge coverage in the country. This ensured that awareness on tree

planting and restoration was vocalized to the wider community. And the work of forest restoration and need for conservation was emphasized.

Figure 11 Clockwise, the Oloolua community engaging in active restoration planting within the Oloolua section of Ngong Hills during Kenya's National Tree Planting Day. In the second picture, they posed for a photo after completing the planting activity. At the bottom left, a tree planted by members alongside the County Administrator of Kajiado County, the Chief of Oloolua, and an official from the Friends of Oloolua organization. Bottom left,Youth members from Go Green and EGMEA are seen carrying seedlings for planting.

4.4 Green school Model

During the school-based programs for restoration, we partnered with Kahara school, Uppah Matasia Primary the Junior School and Nalepo Primary School, where we took part in tree-planting activities. Here we planted over 400 trees. During the tree planting, we held a training session on awareness and best practices of planting trees. We also trained the students on monitoring the trees using locally available materials for watering, e.g. recycled jerricans. The students were assigned trees to care for to maturity to ensure high success rates. We also shared trees during the tree

plantings with school-going students to plant in their homesteads. Overall the students were very enthusiastic about planting and conservation of trees.

Figure 12 Community-based restoration activities and training sessions involving schools. Top left: Students from Upper Nalepo, along with teachers and partners from Rufford, Green Ngong, and Ngong Umoja Environment, gather for a photo after a productive tree planting session. Top right: Teresiah leads training sessions on restoration and biodiversity conservation at Uppah Matasia Primary School. Bottom left: Students from Uppah Matasia Junior High School pose with their seedlings before planting. Bottom right: Students from Nalepo receive training before embarking on planting activities within their school compound.

Chapter 5

Conclusion and Recommendations

In conclusion, the Ngong Hills Forest Conservation project has made significant strides in raising local community awareness of biodiversity conservation. The project's focus on community-based conservation through awareness creation and training has empowered local communities with the knowledge and skills necessary for active participation in forest conservation. Through partnerships with local agencies and communities over 9,000 trees were planted, and educational programs were conducted in schools, highlighting the potential for sustainable management practices to address complex environmental challenges. The project's success underscores the importance of community involvement in forest conservation and the potential for Participatory Forest Management to foster a more inclusive and sustainable conservation model. Despite the challenges posed by climate change and human activities, the Ngong Hills Forest Conservation project provides a blueprint for effective community-based conservation initiatives that can help safeguard forests, promote biodiversity, and ensure the long-term health of ecosystems.

Recommendations

Implement Monitoring and Management Protocols: Prioritize the urgent implementation of monitoring and management protocols for restored sites to ensure the survival and maturity of the trees and seedlings planted, making them self-sustainable and resilient to harsh climate conditions.

Expand Mass Propagation and Restoration Initiatives: Extend mass propagation and restoration initiatives to address remaining areas in need of rehabilitation, enhancing biodiversity and ecosystem health across the Ngong Hills region.

Engage Local Communities in Conservation: Increase the network of community nurseries to involve more individuals in conservation efforts and boost seed collection, thereby augmenting genetic diversity. Additionally, provide additional education and training on alternative livelihoods to alleviate pressure on biodiversity.

Explore Climate-Smart Agriculture: Investigate climate-smart beekeeping practices and conduct socio-economic research on wild vegetables and fruit trees to harness economic and nutritional benefits for residents.

Document Traditional Indigenous Knowledge: Preserve traditional indigenous knowledge on medicinal plant use by documenting diversity, usage, abundance, and distribution of wild medicinal plants. Educate and train on sustainable extraction practices to safeguard this valuable heritage.

Conduct Resource Mapping and Market Strategy Development: Undertake resource mapping exercises to inform locals about value addition and marketing strategies, fostering economic opportunities and community engagement.

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Appendix

Some of the topics highlighted before planting were;

What is a forest, and what benefits do we get?
How to plant trees and cheaper after care through leveraging local resources in restoration
The main cause of forest destruction?
How do we protect the environment and sustainably use forest resources?
Benefits of restoration?