BIODIVERSITY INVENTORY FOR MARUNGU HILLS CONSERVANCY IN TAITA-TAVETA COUNTY

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Acronyms

IFAW	International Fund for Animal Welfare
TTWCA	Taita Taveta Wildlife Conservancies Association
BG	Biovision Global (Africa) Consultants Ltd
GIS	Geographical Information System
DBH	Diameter at Breast Height
RBA	Rapid Biodiversity Assessment
VES	Visual Encounter Survey
ATBI	All Taxa Biodiversity Inventory
RAM	Rapid Assessment Methodology
RAP	Rapid Assessment Programme
SPOT-HRVs	Satellite for Observation of Earth-High Resolution Visible Detectors
GPS	Global Positioning System
IUCN	International Union for Conservation of Nature
ESRI	Environmental Systems Research Institute
USA	United States of America
ANOVA	Analysis of Variance

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Chapter 1: Introduction

1.1 Background

Marungu Conservancy in Taita Taveta County is part of the formation for Taita Hills. Taita Hills being part of the Eastern Arc Mountains (EAM) form part of the larger Eastern Afromontane Biodiversity Hotspot (EABH), ranking 9th in hotspot importance (Hrdina and Romportl 2017). These ancient crystalline mountains, uplifted 30 million years ago, extend from the Taita Hills in Kenya to the Udzungwa Mountains in Tanzania (Burgess et al. 2007; Thijis et al. 2013). The EAM, is a center of endemism, features unique flora that evolved under environmental stability, making their vegetation fragile and susceptible to large-scale disturbances (Lovett 1998a).

Formerly part of the Eastern Arc Mountains and Coastal Forests of Tanzania and Kenya Hotspot, the EAM were considered highly likely to experience most extinction events following habitat loss (Brooks et al. 2002). An estimated 31% of species in the EAM are now extinct or endangered (Newmark 1998).

Taita Hills forests, among the most endemic-rich montane forests in the Eastern Arc (Lovett 1998a), are the smallest in size, with only 6 km2 of natural forests remaining and having lost 98% of their original forest cover (Newmark 1998; Burgess et al. 2007). Despite their small size, high fragmentation, and degradation, these forests host a diverse array of vascular and non-vascular plants, amphibians, reptiles, and are recognized as an Important Bird Area (IBA) (Beentje 1988; Bytebier 2001; Enroth et al. 2013, 2019; Birdlife International 2021).

Marungu Conservancy teaming with several hills form part and parcel of the Taita-Hills that include Marungu, Itinyi, Garawa, Malombe, Mango'ngonyi. However due to the human settlement and as a result of the establishment of the settlement schemes and the bourgeoning population, the Hills have become increasingly under threat due to human intrusion into this delicate ecosystem.

Plant collection records for Taita Hills date back to 1877, courtesy of the German botanist Johan Maria Hildebrandt (Beentje 1998). Subsequent botanical explorations, including a 1985 expedition by multidisciplinary experts, provided substantial herbarium collections but lacked sufficient literature on the flora and vegetation (Beentje 1988). Studies on the vegetation structure andhealth monitoring of Taita Hills forests indicate a 50% reduction in forest coverbetween 1955 and 2004. A notable 2% increase is attributed to the growth inexotic plantations.

Selective logging in heavily disturbed sites has led to the dominance of secondary successive species, and there is evidence of a loss of endemic species within forest patches due to fragmentation (Wilder et al. 1998; Chege and Bytebier 2005; Maria 2007; Rodgers et al. 2008; Spanhove and Lehouck 2008; Pellikka et al. 2009, 2013; Omoro et al. 2010; Aerts et al. 2011; Medley and Maingi 2014). These hills showcase high biodiversity in both vascular and non-

vascular plants (Enroth et al. 2013; 2019).

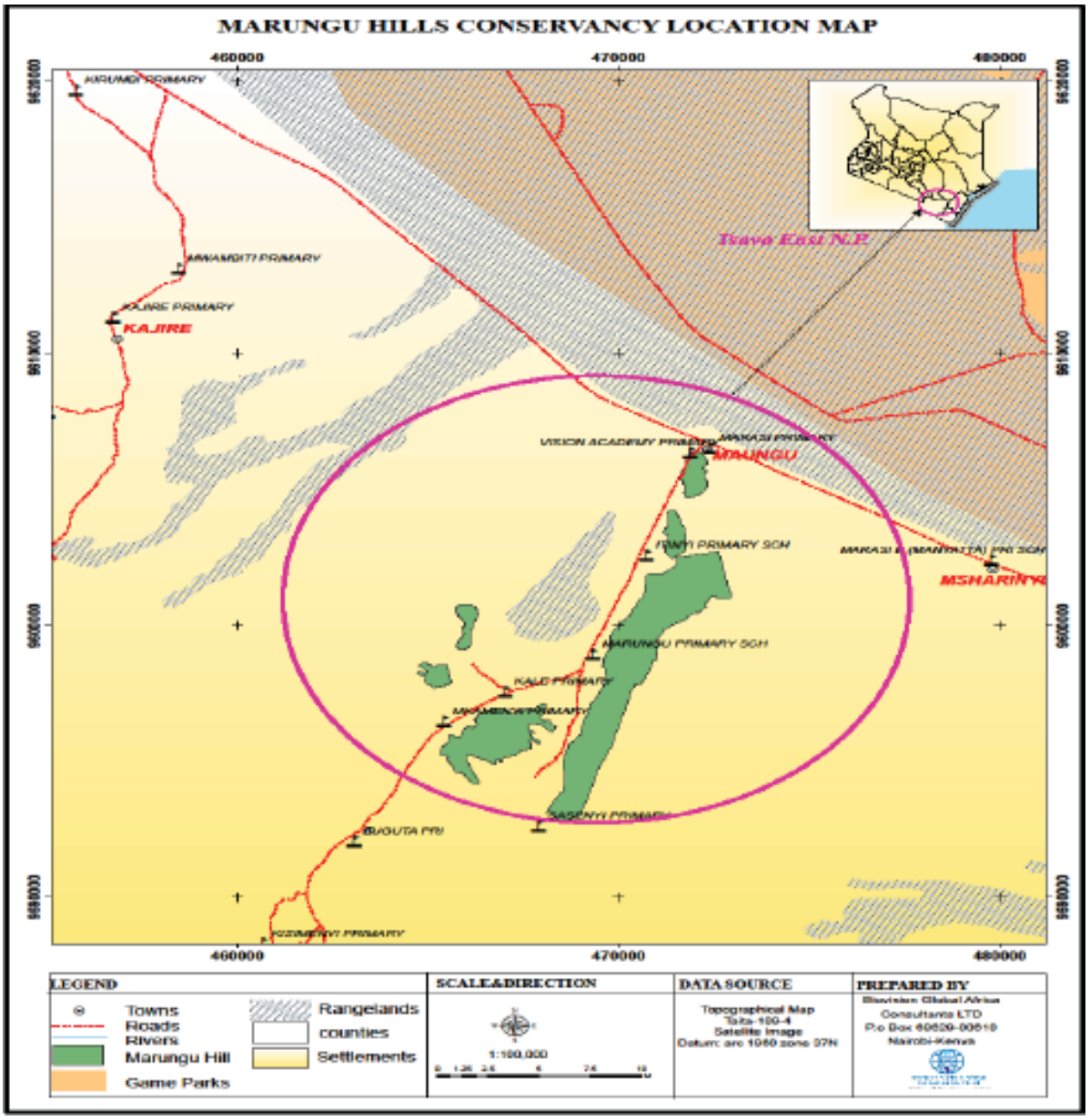
It is acceptable knowledge that floristic data for an area provides foundational tools for research, management, and policy-making for the preservation, restoration, and use of biodiversity (Palmer et al. 1995). The alarming rate of extinction, surpassing species recovery, underscores the crucial need for Biodiversity inventories (Wheeler et al. 2012). This underpins the significance of biodiversity inventory of Marungu Conservancy.

1.2. Strategy for Biodiversity Inventory

International Fund for Animal Welfare (IFAW) entered into agreement with Biovision Global (Africa) Consultants Ltd (BG) to undertake a biodiversity inventory of Marungu Hills Conservancy in Taita Taveta County. As a Partner in the implementation of the inventory, Taita Taveta Wildlife Conservancies Association (TTWCA) based at Voi Town was tasked to organize logistical support. The main goal for the inventory is to provide a baseline information on living organisms in Marungu Hills Conservancy to facilitate management decisions and enable sustainable investment in biodiversity conservation.

Taita Taveta Wildlife Conservancy Association (TTWCA) a Party to the implementation of Biodiversity Inventory, comprises 33 community Conservancies and Ranches all covering 4,046 Km2. These areas are important wildlife dispersal areas astride Tsavo East and Tsavo West National Parks. Usage and ownership of these areas categorized generally as community ranches (private or group) and community conservancies owe their existance to the enactment of Community land Act Cap 287 of 2022.

The major goal of TTWCA is to work with the community and promote the critical role of involving communities in the management of the land and resources therein. Key objectives are to facilitate generation of adequate income for community livelihood and ensure sustainable conservation of the flora and fauna within the ecosystem. Figure 1 below shows the location of Marungu Hills Conservancy



Maps 1: Marungu Hills Conservancy Location

Preliminary observations indicated that approximately 120,000 community members indirectly derive benefits from the nature-based activities within the Conservancies and Ranches under coordination of TTWCA. Out of these, 40,000 community members derive direct benefits from the nature-based activities either through direct employment or investments in activities in the Community Conservancies or Ranches.

The biodiversity inventory carried out covered Marungu Hills Conservancy hereafter collectively referred to as the "inventory area" in the report. Marungu Hill Conservancy is already categorized as a community conservancy. Marungu Hills Conservancy covers 2,538.48 acres. Informed by its locality, the hill provides habitats for wildlife and is migration corridors for wildlife from Tsavo East and Tsavo West National Parks especially during drought.

The provision of drought refuge for wildlife from Tsavo (East and West) National Park uplifts the strategic importance of Marungu Hills Conservancy nationally. In addition, proximity of the inventory area to the international borders between Kenya and Tanzania allowing access to Pare Hills with similar ecological niche underpins their regional significance for wildlife conservation. It is vital that the inventory areas continue to be managed so as to provide in perpetuity the essential ecosystem services that directly supports the wildlife populations found within the wider Tsavo National Park ecosystem.

This biodiversity inventory of Marungu Hills was carried out under contractual obligation from International Fund for Animal Welfare. Inc., (IFAW) to Boivision Global (Africa) Consultants Limited (BG) and collaboration with Taita Taveta Wildlife Conservation Association (TTWCA) Project Staffs and Community Beneficiaries. The findings of the inventory have bben validated by stakeholders and therefore represents true ground situation.

1.3 Rationale and Objectives for the Biodiversity Inventory

The biodiversity inventory main goal was to provide baseline information on the flora and fauna within the inventory area while giving focus to the endemic and endangered species within the ecosystems and habitats.

Appropriate assessment and recording protocols used in the inventory process led to the determination of distribution and composition of wildlife and wildlife habitats.

Emanating from the conservation and socioeconomic significance ofthe inventory area, information gathered are used in this report to inform management decision and guide investments in biodiversity conservation within the ecosystem. The inventory exercise was carried out with direct participation by the communities, Ranches Management Team and TTWCA staffs who provided a platform where indigenous knowledge got integrated into the biodiversity inventory findings for the first time in the region. The exercise also enabled communities to appreciate the importance of biodiversity, improve their awareness on the significance of biodiversity conservation and promoted ownership and associated benefits.

The Specific objectives of the inventory

- Assessment and determination of the flora composition and community
- Establishment of wildlife (fauna) species and their habitats.
- Assessment of domesticated animals that use the inventory area.
- Confirmation of roles played by the predominant flora and fauna species.
- Identification of the invasive, endemic, endangered species.
- Observations on other usages of the Conservancy by Communities.
- Provide opportunity for determination and resolution of the externalities that impact negatively on the Conservancy.
- Assess the conservation status of Biodiversity of Marungu Hills Conservancy by determining current and potential threats to the ecosystems.

- Document Land tenure issues as it relates to ownership and establish boundary delineation, demarcation.
- Provide spatial information (Maps) that underpins broad conservation agenda of the Conservancy.

1.4. Scope of the Inventory

BG consultants carried out Biodiversity Inventory for Marungu Hills Conservancy in-line with contractual agreement with IFAW.

Taita Taveta Wildlife Conservancies Association ("TTWCA") a Partner in the agreement provided logistical support for the inventory process. Additionally, TTWCA gave access to available baseline information on living organisms in the inventory area and also coordinated community participation in the inventory exercises.

The inventory exercises were carried out through a consultative process involving TTWCA Staff, Key Stakeholders, Beneficiaries and Communities. The process was informed by review of existing reports, reference to spatial data and maps available for the inventory area, readiness of community with indigenous knowledge to be involved in the exercise and management committees of the inventory areas approval of the biodiversity inventory exercise. Through appropriate consultative forum awareness was created, concurrence on community involvement agreed, allowing the launch and implementation of the inventory exercise to be realized.

On 27th November 2023 following a public "Barasa" convened and presided over by the Manager of Marungu Hills Conservancy, the scheduled biodiversity inventory exercises were discussed. The public "Barasa" attended by Local Community Members, Conservancy Committee Members, Area Chief and Representative of TTWCA provided a platform for briefings on the merits of the biodiversity inventory, the roles and significance of the inventory were emphasized and need for community members participation in the exercise explained. Necessary security arrangement and general approaches to be used during the exercise were clarified. Emanating from these fora, the inventory program was unanimously approved by the members during the "Barasa" and the exercise officially launched.

The biodiversity inventory exercise main goal is to establish a sustainable conservation pathway for the inventory area informed by the following parameters that were assessed and clearly documented during the inventor.

Parameters Assessed

- Document the current state of flora and fauna.
- Identify potential (resources) assets derived from use of flora and fauna.
- Document species richness and relative abundance and distribution.
- Assess potential for nature-based investment for the inventory area.
- Document conservation values (natural, social, cultural, and economic)

that are inherent in the Conservancy and define the objective for conserving them.
- Provide resource-based information important for development of management plans for the Conservancy

1.5 Key Deliverables

The key deliverables/outputs from the biodiversity inventory of Marungu Hills Conservancy to be submitted to IFAW are:

- Biodiversity Inventory Inception Report
- Electronic files with all data captured from the inventory
- Biodiversity Inventory Report (Draft).
- Stakeholders 'Validation Report'
- Validated Final Biodiversity Inventories of Marungu Hill and Oza Ranches.

1.6 Data Analysis and Results Generation

The type of data from the inventory fit within the following formats; grid, linear, pixels and geo-spatial time series. Such data set were analyzed using various statistical methods informed by the output/findings expected. For example, to determine biodiversity richness, a simple's species richness count was usedand summation made at the end of inventory.

In situations where the relationship between data points is to be determined and demonstrated, a mathematical regression analysis using list square based linear models to determine best fit was used. A further analysis was carried out to determine variance across different groups using (ANOVA).

Wildlife census records on Tsavo National Park was refered to during the inventory to facilitate interpretation of the observations made and findings packaged in the report. Due to the reciprocal nature of vegetation survey and wildlife survey within the same ecological niche, the timing of inventory during the rainy season favored accurate determination of vegetation. This is because the conservancy is a wildlife refuge area during drought, 'a fact which is now well confirmed from the findings and survey methods adopted during this inventory'.

1.7 Limitations

Conducting biodiversity inventories of Marungu Hills Conservancy in Taita-Taveta poses significant challenges, including rugged terrain, unpredictable weather, insecurity and limited local participation.

Solutions to the Foreseeable Limitations involved leveraging local expertise, application of ethno-botany, indigenous knowledge and use of satellite-based imagery for spatial data capture and analysis.

Community engagement through awareness campaigns and inclusive planning overcame local participation challenges. Rigorous pre-survey inductions, standardized protocols and a mix of survey methods were used toimprove data quality.

Considering seasonal variations, the field activities were tailored to fit within appropriate season in liaison with the local community and access to weather focused.

This biodiversity inventory is a one-off process in an area where there has never been established a permanent sample plots (PSP) especially for vegetation surveys. It is therefore important to plan for a systematic repeat of the inventory process for monitoring purposes and determination of temporal changes. However, we take note that due to proximity of the Conservancy to the Tsavo East National Park, the survey findings were bench marked with past survey results done within the Park.

Under ethical consideration, the project adhered to ethical guidelines, including obtaining informed consent from participants and ensuring minimal disturbance to the natural environment during data collection. The Contractor affirmed and adhered to the obligations under ANNEX A, under the USAID Cooperative Agreement No 72061522CA 00003 and all the clauses in the Contract.

Chapter 2: Timelines and Logistics

2.1 Work plan

Biodiversity inventory was carried out by Biovision Global (Africa) Consultants Limited (BG) working in close collaboration with Taita- Taveta Wildlife Conservation Association (TTWCA) with support from International Fund for Animal Welfare (IFAW). The inventory exercise directly involved the communities and beneficiaries of Marungu Hills Conservancy. Activities/tasks carried out during biodiversity inventory are here provided in the flow chart in figure 2.

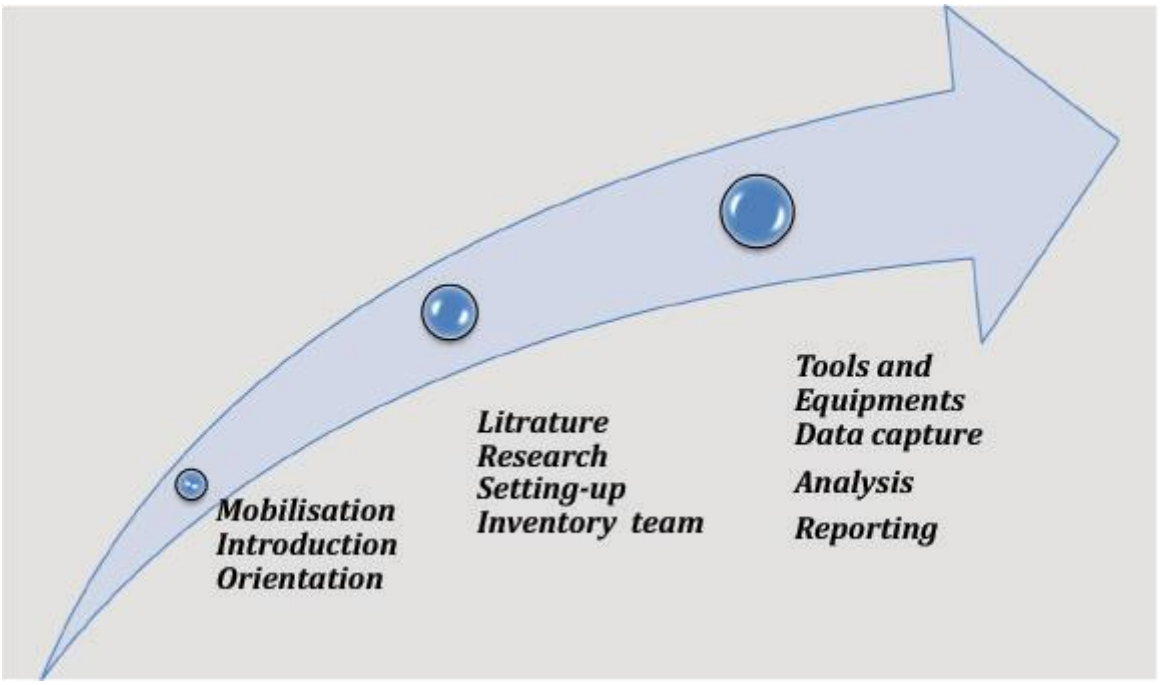


Figure 1: Flow Chart of Inventory Activity

2.2 Activity Schedules

Activity schedule for carrying out biodiversity inventory covered 3 months (12 weeks). During these period, the output realized include: Developmentof project inception report (1 week), Introduction and access to project for debriefing and gathering of available basic information (1 weeks); Field surveys mobilization that includes development of survey protocols and formation of survey teams (2 weeks); field surveys and data collection (2 weeks); Data capture in the database, verification, analysis (1 Week) Gap filling and ground truthing (1 week), Report writing and debriefing meetings (2 weeks); Final report compilation, presentation and dissemination (1 week). The schedules of activities described above are tabulated under Annex 2 provided in the report.

Chapter 3:
Biodiversity Inventory Methodology

A multifaceted and systematic survey methods were used to address the key objectives of documenting the current state of biodiversity and potential assets in Marungu Hills Conservancy. The approach entailed deployment of a combination of quantitative and qualitative methods for rapid results.

The quantitative methods deployed, included Zigzag transects surveys and point count surveys that resulted in acquisition of precise data on species presence, abundance, and distribution. These methods strategically deployed across diverse habitats terrains and geo-formations within the inventory area ensured comprehensive coverage of the inventory area.

Qualitative methods, that includes semi-structured interviews and focus group discussions, were also employed to gather insights into the conservation values "natural, social, cultural, and economic" held by local communities, conservation organizations, and other stakeholders. This participatory approach resulted to capture of the nuanced perspectives on the importance of biodiversity in the inventory area.

Additionally, adoption of Geographic Information System (GIS) technology especially leverage on the use of satellite based Geographic Positioning Systems (GPS) in the field enabled, laying of transects, confirmation of boundaries and geo-referencing the coordinates to determine the sampling positions in the field. Synthesis of the finding from the quantitative and qualitative surveys informed the decisions given in respect to potential of the inventory area for overall nature -based investments.

3.1 Approach

The biodiversity inventory program was executed in fulfillment of the contractual obligations awarded by International Fund for Animal Welfare, Inc (IFAW) dated 20/9/2023 for biodiversity inventory of Marungu Hill in support of Taita Taveta Wildlife Conservancy Association (TTWCA).

The Consultancy Company Biovision Global (Africa) Consultants Limited Company deployed a team of scientist with expertise on Vegetation Survey, Wildlife Ecology, GIS Analyst and Natural Resource Management to carry out the survey exercise, capture data, analyze data, and generate information to guide sustainable management of biodiversity within the inventory area.

Guided by the inventory time frame and available resources for the biodiversity inventory exercise led to the adoption of Rapid Biodiversity Assessment (RBA) methods as proposed by Beattie and Oliver, (1994). The method facilitated optimization of skills and expertise and enabled affordable and quick generation of results.

The inventory covered dominant taxa within the ecosystem that include vegetations, wildlife and avians and therefore provided essential baseline information on biodiversity. Field work adopted Visual Encounter Survey (VES) framework of, Crump and Scott, (1994). The approach included random walks, setting quadrats, prioritizing patches and setting transects.

Deliberate focus was given to the organisms that are well known and are keystone species within the habitats. Appropriate attention was also given to flagship species, endemic species, threatened or endangered species. Additionally, the impact of anthropogenic factors within the conservancy was reviewed. Under VES some of the anthropogenic factors reviewed include; encroachment, overgrazing, poaching (game meat and charcoal), place of competing land uses that include wood harvesting and charcoal production from the home stead were also recorded

Field testing of the inventory method was done through a reconnaissance survey exercise. Randomized vegetation surveys, plant identification protocols, laying of transects, trial of field recording sheets, sample collection preparation were tested and confirmed suitable for the inventory.

The sampling methods during the inventory exercise included; randomized walks, setting of quadrats and transects. Randomized walks entailed the observer choosing at random a sequential series of compass directions approximately 10 in number covering a distance in each walk of 100-200 meters. Quadrat method used entailed choice of 10x10 square meter or 10 meters radius quadrat. Quadrat location were determined by randomized choice of grids informed by landcover and forest cover maps produced through analysis and interpretation of satellite imagery from remote sensed data.

3.2 Vegetation Inventory Method

The inventory procedure adopted was based on the use of All Taxa Biodiversity Inventory (ATBI) *Janzen and Hallwachs, 1994.* Informed by the size of inventory area, time frame and resources available for the inventory led to the use of Rapid Assessment Methodology (RAM).

Taking into consideration the conservation utility of the inventory area, narrowed the inventory method to adopt a Rapid Assessment Program (RAP*) Tangley 1992* developed by conservation international especially for quick survey of areas of conservation importance. Based on this approach, the following activities were carried out during the inventory exercise.

- Reference made to available records that include; vegetation survey data available at the project and those published online.
- Accessed high resolution satellite imagery for the two sites from SLEEK data 0.5m otho-rectified, WSG 84 Datum and RMSE accuracy of 3.914 m
- Classified the spatial data acquired and mapped vegetation types, land-use cover, inventory area boundaries confirming demarcations and beacons position.
- Appropriate grid array size was superimposed on the maps and ground

sampling of transects, frames, and points were determined based on random sampling method.
- Ground truthing and gap filling exercises were carried out to confirm accuracy of the findings and inform any omissions and commissions.

Vegetation inventory adopted transects and quadrat survey methods. At Marungu Hills Conservancy due to the steep slopes and impassable boulders, a zig zag transect survey method was used to inventory vegetation. Along the transects, random areas were selection to locate the survey quadrats. Quadrants measuring a radius of 10 meters, area of 314 square meters were set on the ground as informed by random selection of the grids earlier mapped. Within the quadrats, all plant species were counted and recorded. The plants were categorized as either trees, shrubs or herbs. In the case of special interest species, either because they are endangered, not known or being over exploited, herbarium samples were collected, dried and submitted to the herbarium at NMK.

Generally, vegetation forms at the sample sites were described as either trees, shrubs, herbs, or grasses. The conservation status of the plants was further described according to the IUCN red list. At Marungu Hills Conservancy where the land cover is described as forested, the tree species were further grouped as either emergent, main canopy or under-storey or substratum.

Additionally, inventory of invasive species was integrated into the broad vegetation survey method. Targeted species were identified and their spread observed through random survey. Aim of the focus on invasive species was to answer specific conservation and economic questions that underpins the management of the inventory area.

Considering the fact that the inventory area is categorized as high value conservation areas, underscores the significance of knowledge of the impact of the invasive species on the ecosystem. Such knowledge is critical in informing management actions for sustainable conservation of the ecosystems.

At the general level, "looking Surveys" was used to identify conspicuous plants that are alien to the ecosystem. For ease of identification of the invasive species, the inventory depended on; local experience, para-taxonomist knowledge and field guides skills. Sample points for inventory of Marungu Hills Conservancy are Maped in Figure 3.

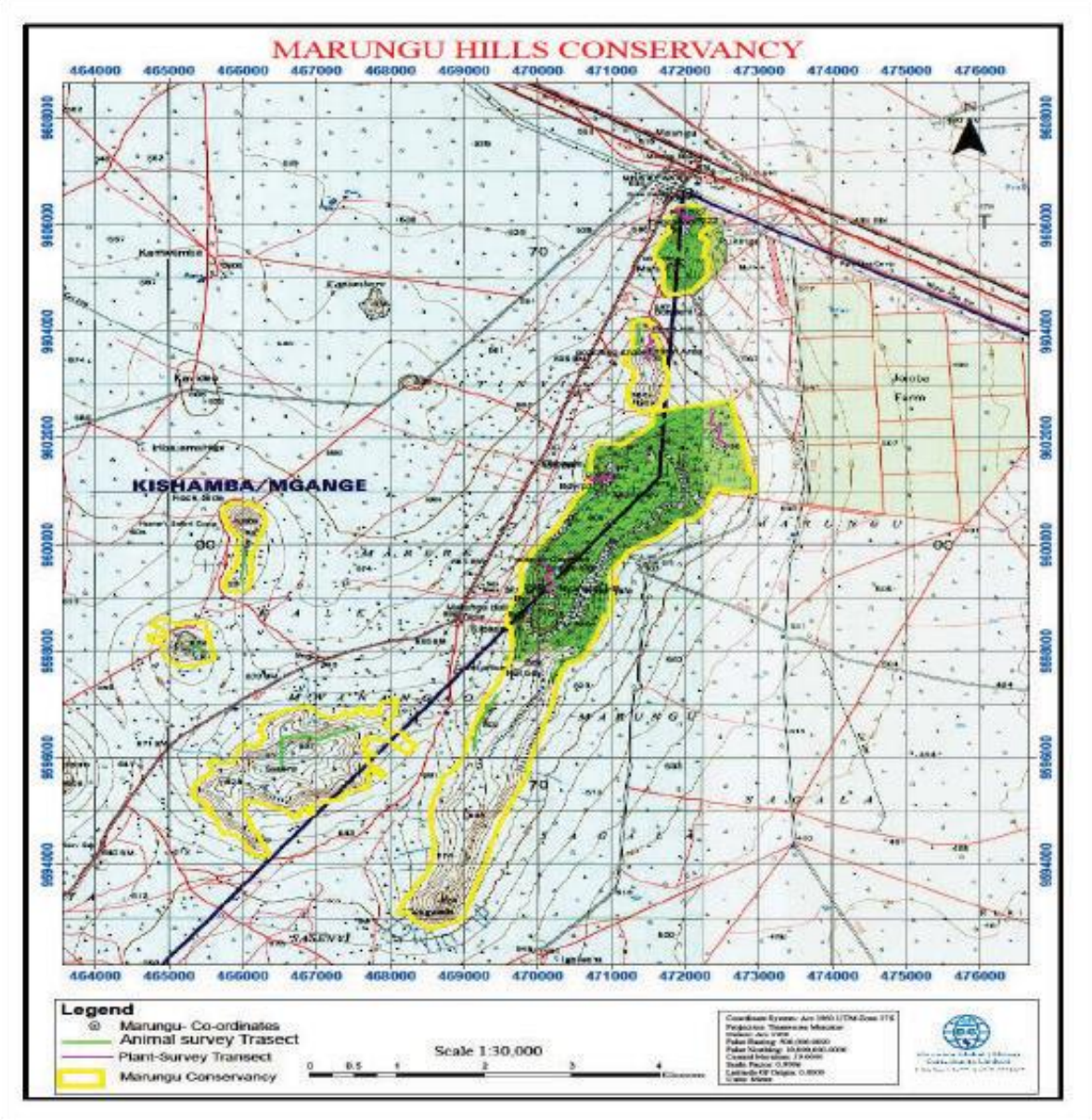


Figure 2: Marungu Hills Conservancy Sample Areas

The vegetation inventory method used here allowed close assessment of flora by introducing randomness as a factor in statistical calculation of the finding and avoided errors due to subjectivity.

The method led to the determination of the following biodiversity parameters of the vegetation within the inventory area: Vegetation types; Land cover and Use; Plant Species listing and Invasive species coverage.

3.3 Wildlife Inventory Method

Wildlife inventory was carried out to establish the following demographic and population parameters:

- Types of wildlife within the ecosystems
- Species abundance, temporal and spatial differences (informed by passed surveys)

Wildlife inventory method took into consideration the knowledge that Kenya Wildlife recently carried out the Wildlife Census of Tsavo Ecosystem. Therefore, in carrying out this inventory, reference was made to this dataset to establish linkages and seasonal population dynamics. This explained the variations in wildlife numbers observed during the inventory exercise noting that the inventory was carried out during wet seasons while the inventory areas are normally used as dry season grazing refuge areas for wildlife and livestock.

Data generated from the wildlife inventory include: Species types, Threats to Species, Community diversity, Domesticated Species Diversity and Species used by local residents.

The methods adopted for wildlife survey included: Point Count; Looking Survey and Camera Records. Further a mix of methods including distance sampling through indirect and direct observations, transect walks along hiking routes and questionnaires were used in the survey.

Point Count Method was also used to inventory Avians (birds). The inventory team assigned a route where at specific points within the route birds seen or heard within a given radius were identified and recorded. Inventory of Invasive species were also carried out through "looking survey" approach where conspicuous alien animals easy to identify during field surveys were recorded. This exercise was carried out by Wildlife Ecologist assisted by Local expertise and field guides. On the knowledge that Marungu Hills Conservancy is rocky with very steep slopes, dominated by forests and bush lands interspersed with small patches of grasslands that resulted to limited accessibility to wildlife habitats hence the decision to deploy a combination of several methods for the inventory.

Transects were laid across the gentle sloping sections of the hills while the hiking routes were used to sample steeper areas of the hills, and access watering points found at the top of the hills where they naturally influence animals' distribution. Wild animals were searched either directly or indirectly using signs observed along the transects and hiking routes. Domestic animals' signs and actual sightings were also recorded as well as human activities and any form of habitat destruction encountered. Additionally, questionnaires were administered to the nine community scouts and the manager of the conservancy about wild animals present in the area to gain more insight into the biodiversity profile of the conservancy. The approach was considered useful to tap into the conservancy staff indigenous knowledge and long-term work experience in the area.

Findings in the report contains ecological analysis of the mammal and avian community within the inventory area providing information on aliens, naïve occupancy, circadian activities and externalities.

Chapter 4 : Sampling Methodologies

The Sampling design of the biodiversity inventory program was preceded by a reconnaissance survey of the inventory area. During the reconnaissance survey, TTWCA staffs, Management Team from the Ranches and Representatives of the Beneficiaries were consulted at an office briefing and discussions forum.

The sampling design for the biodiversity inventory ensured primary data collected was representative and reliable. Sampling was systematic and random for the wider targeted sites. At special areas of interest such as watering points, animal corridors or migrating paths, targeting of the sample sites were informed by consideration of landscape, broad vegetation cover types and ecological significance of a given site. The targeted sampling areas included but were not limited to: Dense forested areas; Open grasslands; Hills and slopes. The design of inventory procedures used here was informed by available information on the site and direct assessments made during rapid reconnaissance survey that was carried out in advance.

A systematic sampling approach was employed to ensure a systematic representation of the selected areas. This involves dividing the landscape into a grid, and systematically selecting sample points within each grid cell. A GIS analysis of the Inventory area was done and appropriate Grid size superimposed and used to identify sampling sites. This approach helped to avoid bias and ensures a comprehensive coverage of the landscape.

To account for the heterogeneity of the landscape, the areas were stratified based on vegetation types, topography, and other relevant ecological factors, within each stratum, random sampling points were selected within a given transect. This ensured that each stratum is adequately represented in the inventory.

Photo 1: Biodiversity Inventory Team Debriefing Session at Marungu Hills Conservancy

The sampling frame covered flora and fauna within Marungu Hills Conservancy. Informed by the need to focus on biodiversity resource management problems, sampling frame for the inventory included the following:

- Flora or vegetation groups to be assessed shall include; herbs, shrubs, sub-canopy and canopy trees/other species.
- Fauna, specific animalia kingdom, that include vertebrate phylum, 'chordata groups' to be assessed shall include the following classes; Aves (Birds), Mammalia.
- Emphasis was given to Ungulates and Cats because most of them are at the apex of the food chain and therefore influence the ranch ecosystem significantly.

Note/ By virtue of the need for special survey techniques and requirements for authorization to capture and recapture, it was not possible to survey arthropods especially insecta and amphibians.

Sample sizes for the survey was informed by statistical principles, ecological variability, target population, and variability within a given area. Additionally, availability of resources for the inventory and time frame guided choice of sample size.

4.1 Data Collection Method

Data collection kicked off with access to secondary data on biodiversity of the inventory area. Approach adopted included desk-based assessment of records available at TTWCA Project office and holding discussions with line staffs. Thereafter, other custodians of relevant datasets including KWS, NMK and East African Herbarium were consulted and relevant information accessed and verified.

Primary data collection from the field was informed by the methodology outlined in the report. The primary data was collected through direct observations, camera-based imageries, Global Positioning Systems (GPS), Land records and published maps and records, access to indigenous knowledge from community representatives participating in the inventory exercises.

Abiotic and human variables that include data on extent of infrastructures; deforestation, encroachment, conversion to farming and harvesting pressure was estimated from traditional knowledge, focused group discussions with community and field observations and available records.

When carrying out field sampling, the species encountered were identified by GB Para- taxonomist/Botanist assisted by community members knowledgeable on local plant species. Communities were encouraged to give names in the local languages. In unique and rare cases where a plant wouldn't be identified in the field then nearest "Herbarium Centre" were contacted to identify the plant or use of online search from networked Botanic Gardens, Plant databases or direct discussions with International Peers clarified most of the cases.

The data collection procedures proposed therefore responded to the following concerns:

- The need to resolve conservation problems/issues associated with Marungu Hills Conservancy both at the ecosystem, habitat and species level.
- Inventory finding tailored to inform policy decisions and conservation management actions.
- Choice of appropriate scale and intensity of measurements at the local level dictated by the size of the inventory area.
- Careful identification of inventory tools that are available and determination of appropriateness for use in carrying out biodiversity inventory at the local level.
- Confirmed availability of human resources at the project disposal with the capacity to carry out biodiversity data collection and deployed to work alongside the consultant.
- Special focus was given to determine human impact on the ecosystem.
- Attention paid to the impact of weeds within the ecosystem and determination made on interactions of any alien species within the habitats.

Photo 2: Wildlife Ecologist and Community Members at Marungu Hills Conservancy

Data management tools used included relational database management systems, spreadsheets and tables all designed to receive data from field data sheets. The field data sheet was used to collect and organize data from the field based on appropriate format. Considering that biodiversity data can both be quantitative and qualitative; each team modified the data sheet to enable data variables to be appropriately tallied and recorded in the field.

It's however envisaged that during validation of the inventory findings, recorded data shall be revisited and confirmed. The generic data sheet used in the field for collection of biota data is based on the format provided in A*nnex 1*.

4.2 Variables Data Collection

To accomplish the inventory activities, a mixed working team of scientist, project staff and beneficiary communities were constituted to carry out a rapid assessment of important biological communities and social assets inventories found within the two inventory areas.

The evaluation criteria captured information on taxonomic biodiversity that include (kingdoms, phyla, orders, families, genera, species and subspecies). For field practical purposes, species identification was further informed by available herbarium data and published reports. Records from direct observation, transects and quadrats led to the determination of the following biodiversity variables.

- Plant Species identified by kingdoms, phyla, order, families, genera, species and subspecies.
- Wildlife Species identified by Species type, Threats, Community Diversity, Domesticated Species Diversity and Specie used by local communities.
- Habitat diversity and vegetation types (trees, shrubs, herbs) covering forests, woodland or shrublands, grassland, swamps and riverine.
- Threats that include; pollution, invasive species (weeds, feral, pests) and abiotic factors.
- Endemism and endangered species.
- Human usage impact.

To assess the variables, the consultant adopted several sampling methodologies that are here further outlined. Zigzag transect method used to avoid rock cliffs and out-growth.

Figure 3: Use of Zigzag Transect Survey Method at Marungu Hills Conservancy

4.3 Spatial Data Collection

This chapter delineates the methodology employed for conducting the assessment, providing a comprehensive overview of the procedures followed in respect to spatial data. Additionally, it furnishes a detailed description of the datasets utilized throughout the analysis and mapping process.

Primary and secondary data from different sources were used in this assessment to generate the final maps for Marungu Conservancy. Primary data, as defined by Jonathan et al. (2012), pertains to information collected directly or on a first-hand basis. In the context of this study, primary data encompasses high-resolution images that were meticulously processed and classified. These images were instrumental in generating the tree and forest cover maps for Marungu Hills Conservancy.

The satellite images used had the following resolution 0.5m, otho-Rectified, WGS 84 Datum and RMSE accuracy 3.914m. The high-resolution raster data type was used, while the vector data was collected using GPS by the mapping team.

Figure 4: Forest Survey Team Collecting Primary Data at Marungu Hills Conservancy

Inventory is based on the principle that accurate spatial information is fundamental to understanding the ecosystems. As a result, hand-held GPS devices were utilized to meticulously record geographical coordinates, ensuring precise documentation of observations throughout the Inventory exercise.

The establishment of waypoints for tracks was a strategic move to create a navigational blueprint of the study areas. This method facilitated easy mapping and was instrumental in subsequent analyses and presentations.

Defining the conservancy boundary was pivotal in outlining the geographical scope of our study. This demarcation provides clarity on the area under consideration and ensured a focused approach to biodiversity assessment within Marungu Hills Conservancy.

A diverse array of habitats was identified within the conservancies, ranging from open degraded areas, shrubs to densely wooded areas.

The documentation of these habitats is essential for a nuanced understanding of the ecological landscape and serves as a baseline for biodiversity analysis for informed conservation and management of the inventory area.

Systematic transects were laid out to facilitate structured biodiversity data collection. This approach ensures a representative sampling of the flora and fauna, enabling us to document species richness, relative abundance, and distribution patterns in a methodical manner.

Secondary data for setting transects were collected from existing GIS platforms. For this biodiversity inventory, auxiliary data that already exist from SLEEK, FPP and other sources were used to support the mapping exercises for broad vegetation classes, landuse and infrastructure networks. The overall workflow, spatial analysis and mapping procedures used are outlined in Figure 5.

Table 1: Secondary Spatial Data Sources

Data Type	Data	Data Source	Date
	SLEEK Land use Land Cover Maps	Ministry of Lands	
Vector	Topographical Map Layers	Ministry of Lands	
FPP	Forest cover datasets	Kenya Forest Service	

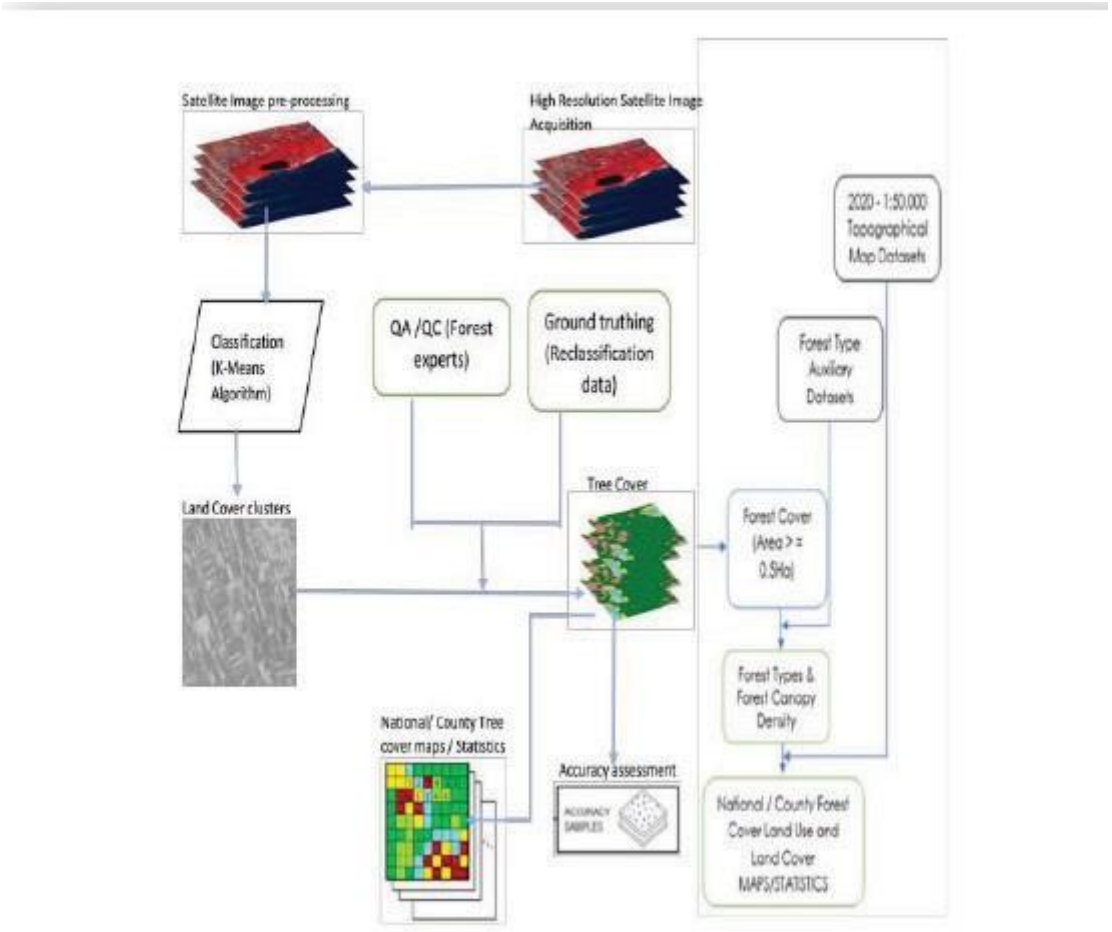


Figure 5: Overall Workflow in Spatial Analysis and Mapping

Chapter 5:
Biodiversity Resources Conservation and Management Findings

5.1 Marungu Hills Conservancy Description

The conservancy covers an area approximately 2,536 acres composed of hills, rocky outcrops, cliffs and steep slopes with patches of different vegetation. Informed by its locality, the conservancy therefore provide habitats and migration corridors for wildlife in Tsavo East National Park and the surrounding Ranches. It is therefore critical that Marungu Hills Conservancy should continue to be managed so as to provide in perpetuity the essential ecosystem services that directly supports the wildlife populations found within the wider Tsavo National Park ecosystem. This conservancy covers seven hills which are as named (Nyangala, Itinyi, Mlilonyi, Garawa, Marasi, Kale 1 and 2).

Marungu, a prominent mountain located in the Taita-Taveta County of Kenya, graces the landscape with its majestic presence. Rising to an elevation of 962 meters (3,156 feet), Marungu offers breathtaking views and stands as a significant geographical feature in the region. Situated near the localities of Ngasha and Nyika, the mountain is positioned at a latitude of approximately -3.60866° or 3° 36′ 31″ south and a longitude of around 38.74465° or 38° 44′ 41″ east.

Adjacent to Tsavo East, Marungu's proximity to this renowned national park enhances its ecological significance, contributing to the diverse ecosystems and climatic variations experienced in the area. Furthermore, it provides a crucial refuge for wildlife during periods of drought, acting as a sanctuary and offering a corridor for the seamless movement of wildlife between Tsavo East and the surrounding conservancy. Beyond its physical grandeur and cultural importance to local communities, Marungu serves as a vital lifeline for the region's biodiversity, embodying the delicate balance between nature and conservation efforts in the Taita-Taveta District.

5.1.1 Floral Diversity

Recent surveys and the past biodiversity survey of Taita-hills consider Marungu as part of Taita-Taveta as the most diverse terrestrial ecosystem, with an estimated 300 species of plant species including the endangered species such as *Encephalartos Kisambo*. Marungu has four vegetation types, which include Dense Forest, Grasslands, Scrubs/shrub lands and open ground.

The vegetative cover on the Rukinga Conservancy side has more of *Euphobiacee Species*, while the Top North part of Marungu Hills Conservancy is full of shrubs and rocks, it only has scattered vegetation along the slopes of mountain. Tending more to the north west, the conservancy is covered by forest teaming with thick forest canopy tending more to deciduous association of *Scorodophloeus fischeri*, *Caeasalpinia insolita.*

The ecosystem hosts significant population of economically important tree species such *as Newtonia buchananii, Combretum schumanii, and Brachyleana huillensis* which are used for carving especially in the coastal regions of Kenya. Figures 8 and 9 shows forest cover and land use cover for Marungu Hills Conservancy.

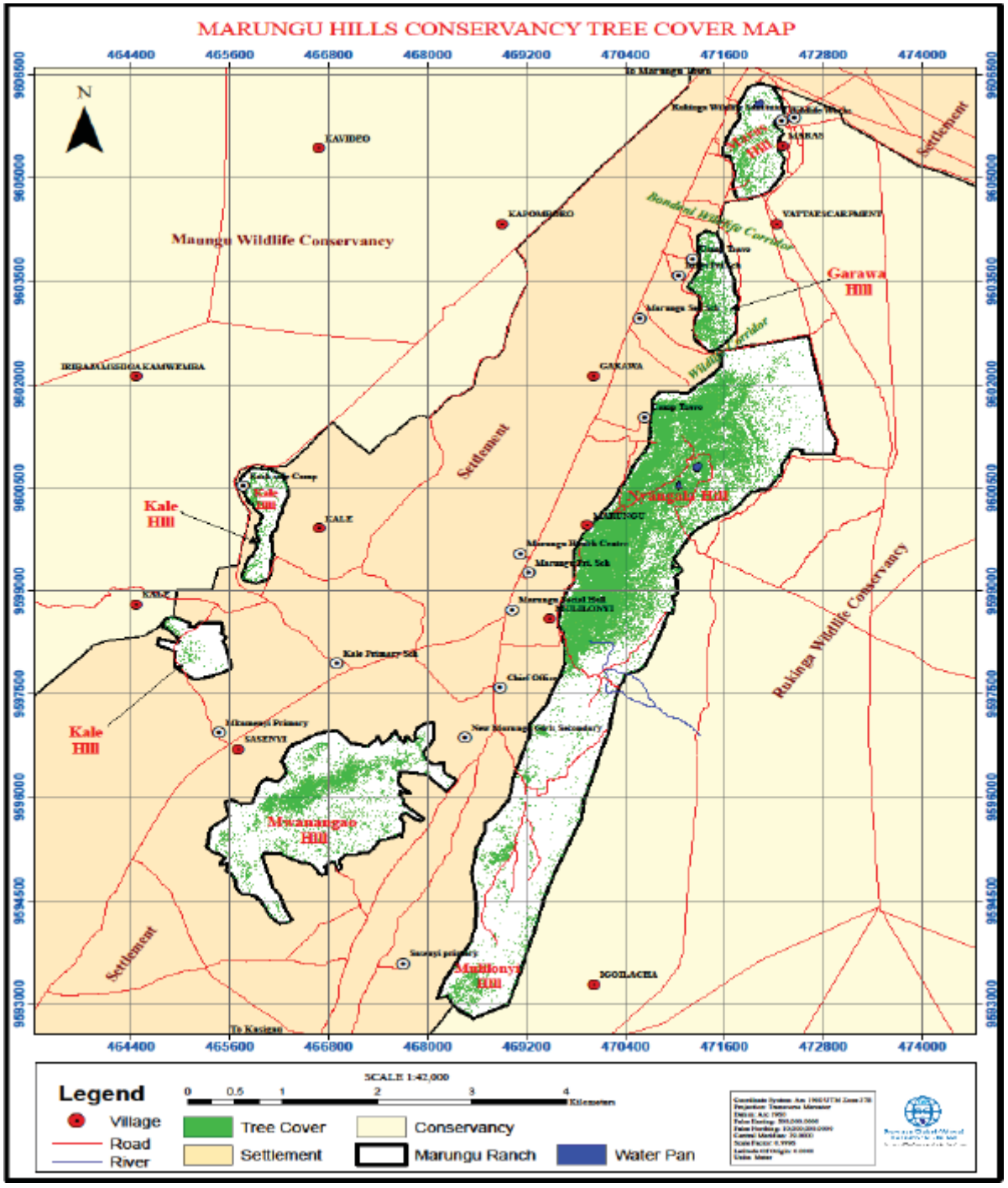
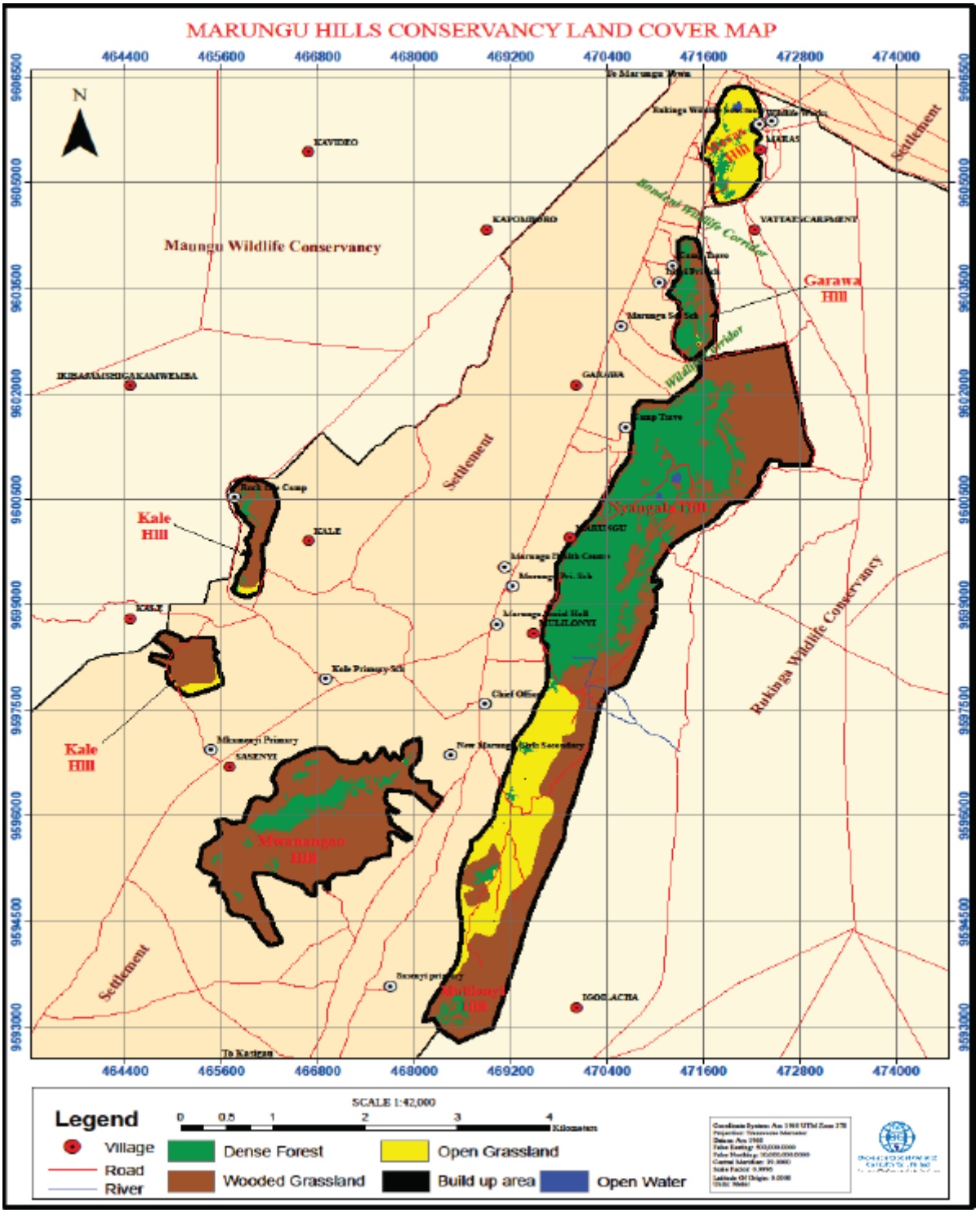


Figure 6: Marungu Hills Conservancy Tree Cover



Maps 2: Marungu Hills Conservancy Land Cover

5.1.2 Land Tenure and Utilizations

Besides the Ranches and the Conservancies, Land ownership in Taita Taveta County is under private ownership (Freehold or leasehold). In the neighborhood of Marungu Hills Conservancy there is a settlement scheme called Marungu-Buguta settlement scheme. Occupying the scheme are quite a number of households who to date do not have title-deeds to their lands as adjudication process was dogged with a lot of controversies.

As a result, the adjudication process was largely ignored by the immigrant Duruma who began to clear and occupy land initially within the community land zone, but when that ran short, their settlement extended to the conservancy boundary, this has seriously undermined conservation efforts within Marungu Hills Conservancy.

The community members predominantly utilize the land for small-scale subsistence farming. Nevertheless, agricultural activities in close proximity to the conservancy boundary have given rise to a range of environmental challenges, including issues such as Human-Wildlife Conflicts and encroachments into the forest area.

Photo 3: Conservancy Areas Degraded Due to Encroachment and Grazing

Significant resources and efforts have been dedicated to enhancing the conservation of Marungu Hills Conservancy. Despite achieving noteworthy milestones, substantial threats and ongoing conservation pressures persist.

These threats have resulted into depletion and degradation of the resources within the conservation in portions nearer to densely settled areas such as markets and large villages. The depletion and degradation of these resources has been as a result of unsustainable utilization of resources due to poverty and weak protection arrngement. The key threats in the conservation zone include encroachments, wildlife poaching, and human wildlife conflicts. From the inventory findings major conservation issues of concern in the Marungu Hills Conservancy can be grouped as follows:

Human Wildlife Conflicts

Human/wildlife conflict is as old as the existence of man. It has become more prevalent over the last decade due to increased interaction between human populations and wildlife that coexist and compete for scarce natural resources (Elisa 2005; Tweheyo Hill & Abua 2005; Chaminuka et al. 2008).

Numerous studies have highlighted a rising trend in human-wildlife conflicts, both at the local and global levels. The impact of these conflicts is significant, adversely affecting not only wildlife but also millions of residents in local communities, as noted by Eliza (2005) and Chomba et al. (2012a). Lamarque et al. (2009) further emphasized that human-wildlife conflicts in Africa have intensified in terms of frequency, severity, and pose a substantial challenge to conservation initiatives.

Human-wildlife conflicts, particularly attributed to elephants, have been documented in the Marungu Hills Conservancy. The situation has been exacerbated by the expanding human settlements and unregulated agricultural practices in the adjacent lands, creating a potential for clashes between elephants and local communities. This issue is particularly prevalent in wildlife corridors, which serve as migratory routes for animals during droughts.

At Marungu Hills Conservancy, the wildlife corridor that connect Tsavo East and the Conservancy is located near a densely populated market place, a situation that aggrevates conflicts between wildlife and humans sometimes leading to deadly confrontations especially during dry conditions.

Additionally, other wildlife species contributing to human-wildlife conflicts in the Conservancy include baboons, monkeys, and bush pigs. These species invade the farms to feed on cultivated crops. It is crucial to implement measures to mitigate these conflicts, aiming to safeguard the livelihoods of the local community and foster peaceful coexistence between people and wildlife in the ecosystem.

Poaching of Wildlife

Habitat loss and hunting stand as the dual threats to wildlife globally, with hunting reaching alarming levels, particularly in tropical regions. Recent studies indicate that wildlife extraction in some parts of Africa exceeds the sustainable rate by six times. The shift from subsistence to commercial motives for hunting for bush meat renders traditional methods, such as setting traps and snares, unsustainable.

Although sporadic wildlife poaching for bush meat persists in Marungu Hills Conservancy, the integration of former poachers into conservation efforts has significantly diminished this conflict. The primary method of wildlife poaching involves the deployment of wire snares to trap, kill, or harm the animals. It has been noted that poaching primarily takes place along and in proximity to the conservancy boundary. The species most frequently targeted are small and medium-sized herbivores, including duikers, buffalos, and dik-diks.

Photo 4: Snares Collected from Marungu Hills Conservancy

Invasive Species

Kenya has grappled with biological invasions, and their impact extends to the socio-economic well-being of affected communities. At the ecosystem level, theseinvasionsbringaboutalterationsincommunitystructureandcomposition. According to available data on invasive species in the East African region, Kenya has been invaded by 34 different species of invasive plants. Noteworthy examples include *Opuntia stricta* (Haw), water hyacinth (*Eichhornia crassipes), Prosopis juliflora*, and *Lantana camara*. These invasive species pose significant challenges, necessitating strategic efforts for management and mitigation to safeguard both the environment and the livelihoods of local communities.

In the Global Invasive Species Database (GISD), *Opuntia stricta* is listed among the top 100 world's worst invasive alien species (Lowe et al., 2000). *Opuntia stricta* forms dense stands that impedes movement and access across the landscape and is believed to transform the savannas and arid grasslands (Henderson, 2001) into waste shrublands.

The prevailing invasive species within Marungu Hills Conservancy ecosystem is *Opuntia spricta*, predominantly found in the upper regions of the hill. The expansion of this species is intensified by the presence of baboons, which consume the succulent parts of the plant, inadvertently aiding in its dissemination.

Another noteworthy invasive species is the formidable *Prosopis juliflora*, rapidly encroaching from the lower sections of Marungu Hill Conservancy. If left unchecked, this invasive species poses a significant threat to both the local population and wildlife.

Prosopis juliflora is a widespread invasive species listed on the Global Invasive Species Database (GISD) among the 100 most invasive species in the world. Introduced in Kenya in the 1970s–1980s, it has spread rapidly and is now found

in 2% of Kenya's landmass (KEFRI, 2020) with the ability to double its coverage every 5 years under favorable conditions (IUCN (International Union for the Conservation of Nature), 2010).

Additionally, *Lantana camara* has been observed spreading in the Marungu Hills Conservancy Dam area. If uncontrolled, this species contributes to the loss of pasture land for wildlife. An important characteristic of *Lantana camara* is its rapid coppicing ability, impeding eradication efforts. This resilience is shared among other invasive species, particularly *Prosopis juliflora*. Immediate attention and measures are essential to curb the detrimental impact of these invasive species on the ecology of the habitat of the local species before they spread and cover all ecosystem within the conservancy. This invasive species if not controlled adequately, will seriously hamper natural regeneration of important indigenous plant species.

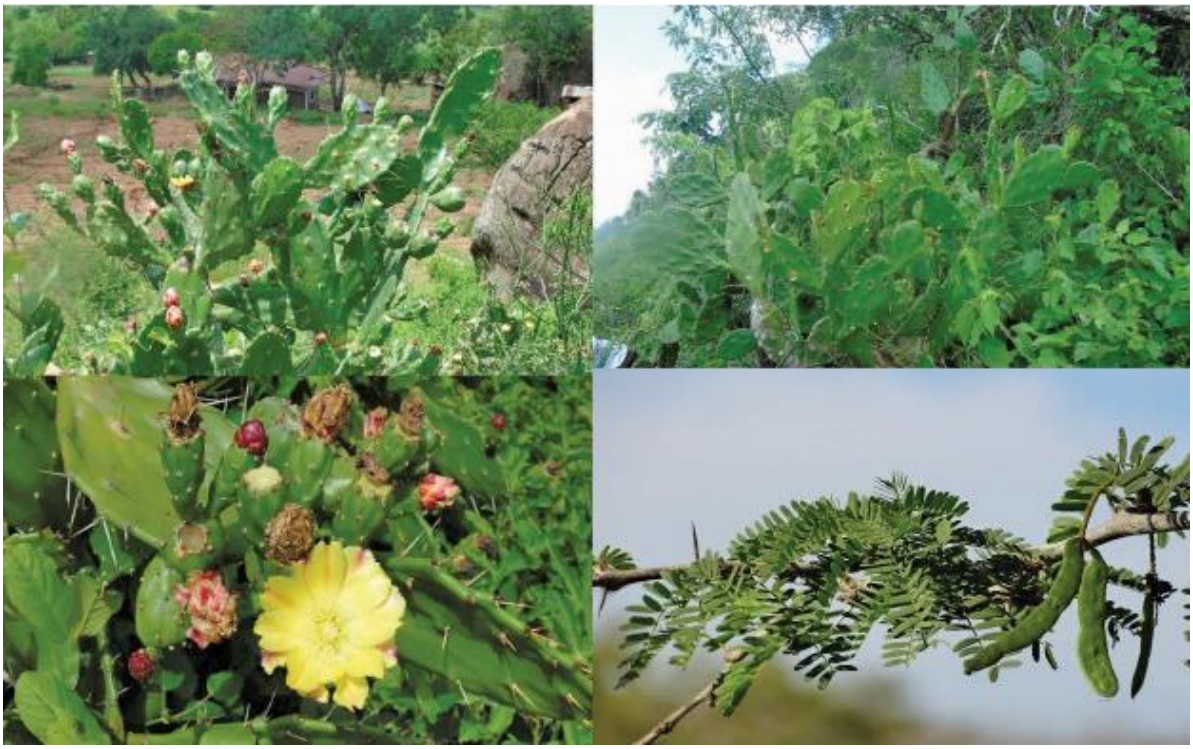


Figure 9: Opuntia spricta and Prosopis juliflora at Marungu Hills Conservancy

Human Influence

Increasing human population in areas adjacent to the conservancy has continued to exert pressure on land adjacent to the hills. This phenomenon is already playing out as some areas that are heavily encroached for settlement and farming. The areas affected are regarded by the local communities as highly productive in terms of agriculture. As more people settle close to this conservancy areas, there is the potential for increase in land use conflicts.

The impact of human activity on the conservation area has resulted to habitat loss, eutrophication, and excessive storm water run-off during rains, air pollution and introduction of invasive species. These adverse occurrences can only be forestalled by ensuring that there is urgent boundary realignment and erecting

beacons to delineate the boundary. As a long-term stop gap measure, there is need to put electric fence around the conservancy and only leave designated migratory corridors for the wildlife.

5.1.4 Values of Ecosystem Resources

Marungu hills ecosystem have resources with exceptional values. These resources provide outstanding values to local, national, regional and international stakeholders. The resources observed and recorded during the biodiversity inventory and relevant for consideration during the preparation of the conservancy management plan are categorized in table 2.

Table 2: Biodiversity Resources at Marungu Hills Conservancy

Category	Ecosystem Resources of Values
Biodiversity	Water Catchment, Climate and Carbon sequestration
	b) Faunal Diversity Endangered species African Elephants, Large Mammals, Africa Elephants, leop-ards, bush pigs Birds, Eurasian scoops owl Reptiles and amphibians Insects
	c) Floral diversity Endangered Trees Species: *Enchalatoh Kisambo*
Scenic/Aesthetic	Marungu view point Maungu view point, Itinyi view point Owl Cave.
Socio-Economic	Tourism Nature Trails Apiculture Recreation: Camping and picnic area Carbon Sequestration Butter Fly Farming Herbs and Medicine
Cultural and Spiritual	Historical Sites, Sacred Caves,

Chapter 6: Vegetation Inventory Results

6.1 Marungu Hills Conservancy Flora

Vegetation inventory of Marungu Hills Conservancy revealed very large plant biodiversity. The plants were observed to cover under-storey, mid-storey and top canopy with zones of emergent species while some areas were open shrublands with rocky bolders and outgrowths, cliffs and steep slopes. Plants recorded from the inventory of Marungu Hills Conservancy are here tabulated in *lists 3-9* that details information on threat levels, species diversity, origin, adoption, dominance, growth forms and usages as here outlined.

- Globally threatened species found on Marungu Hills Conservancy.
- Total number of family, species and variety.
- Indigenous, exotics, cultivated and introduced species.
- Species stipulated in CITES appendix I, II, III.
- The leading predominant genera.
- Species with indigenous Sagalla uses.
- Growth forms that includes trees, shrubs, herbs, climbers and hemi-parasites.
- Useful plants to Sagalla people i.e food plants, medicinal plants and other cultural usages.
- Invasive alien species.
- Level of endemism on Marungu Hills Conservancy and Oza Ranch.

During inventory, family *Poacea* and *Cyperacea* which are difficult to be identified accurately in the field were processed and forwarded to East Africa Herbarium at NMK for identification before being included in the check list.

The Plant inventory was informed by all taxa biodiversity inventory methods executed through rapid assessment methodology for quick results. The approach involved setting up of transects and quadrats then surveying individuals to confirm; species, forms, conservation status and community composition. One of the key objectives was to produce a comprehensive plant check list, bearing local and scientific names. The sampling technique adopted for Marungu Hills Conservancy was Zigzag Transects and opportunistic survey of likely biodiversity hot spots such as shrines. To assist in identification of difficult families, specimens were collected pressed and dried in the field using botanical dries and forwarded to the East African Herbarium at National Museums of Kenya.

In summary, the following findings and results on plant biodiversity have been recorded during the inventory.

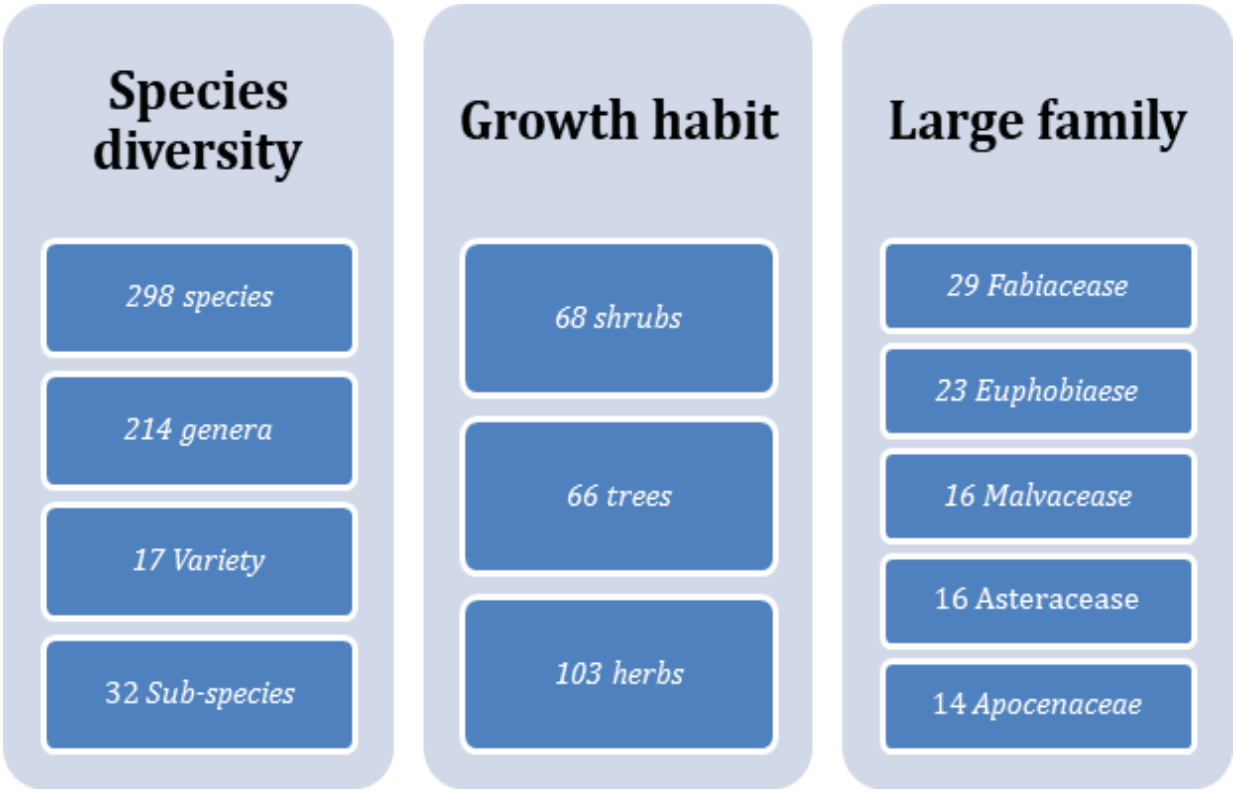


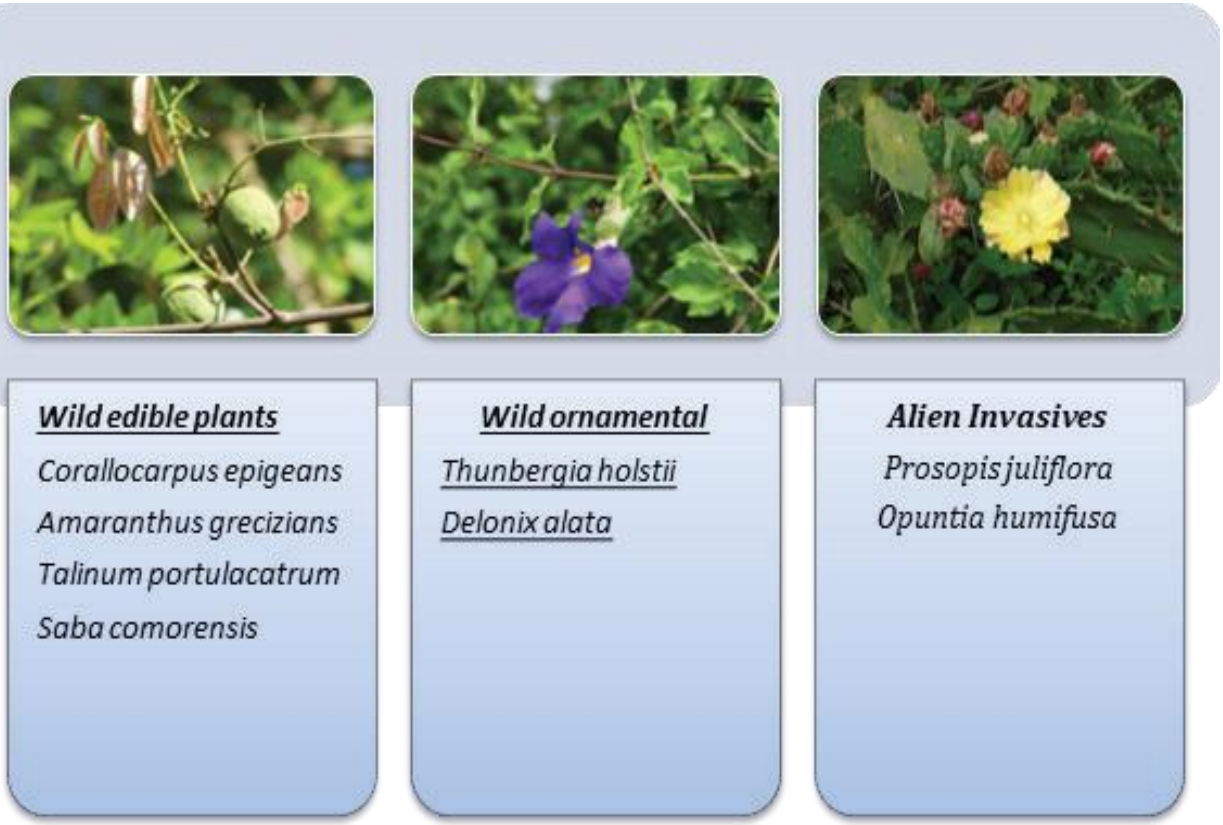
Figure **3**: Plants Diversity

Global threatened taxa

Marungu Hill Conservancy, nestled within Taita-Taveta County, Kenya, is a critical habitat for several globally threatened taxa, including *Encephalartos kisambo* and *Polystachya teitensis*. Among these species, *Polystachya teitensis*, a rare orchid endemic to the region, holds particular ecological significance.

Polystachya teitensis

Figure **4**: Encephalartos kisambo (family zamiaceae)



In particular the fact that MarunguHills Conservancy have has very high plant species biodiversity, some of which are endemic to the conservancy. Of interest was the finding of globally endangered species and those that are threatened or near threatened. Equally important is the high frequency of habitat type differentiations at various levels within the ecosystem. This points to resilience as explained by the diversity exhibited at the ecosystem level.

Families	Genus	Species
Fabaceae	23	29
Euphorbiacea	8	23
Malvaceae	11	16
Asteraceae	10	16
Apocynaceae	13	14

List 1: Largest Families and Genera of Vascular Plants of Marungu Hills Conservancy

Habit	No. of Species	Percentage
Trees	62	23.4
Shrubs	62	23.4
Climbers	47	17.7
Herbs	94	35.5

List 2: Growth Habit of Plants at Marungu Hills Conservancy

No	Family	Threat Level	
1	*Encephalartos Kisambo*	Endangered	
2	*Huernia Andreaeana*	Endangered	
3	*Jatropha Velutina*	Endangered	
4	*Osyris Lanceolata*	Endangered	
5	*Brachylaena Huillensis*	Near Endangered	
6	*Lannea Schweinfurthii*	Near Endangered	
7	*Craibia Brevicaudata*	Near Endangered	

List 3:Globally Threatened Species in Marungu Hills Conservancy

Family	Species	Locality
Zamiaceae	*Encephalartos Kisambo*	Kisigau And Maungu Hill

List 4: Endemic Species to Marungu Hills Conservancy

Family	Species	DAFOR Scale
Fabaceae	*Prosopis Juliflora*	Abundant
Fabaceae	*Leucena Leucocephala*	Rare[1]
Verbancaee	*Lantana Camara*	Rare
Cactaceae	*Opuntia Vulgaris*	Abundant

List 5: Alien Invasive Species

Family	Species
Amaranthaceae Subsp. *Trinervis*	*Digera Muracata*
Amaranthaceae Subsp.*Silvestris*	*Amaranthus Grecizians*
Cucurbitaceae	*Corallocarpus Epigeaus*
Talinaceae	*Talanum Portulacastrum*

List 6: Wild Edible Plant Species of Sagalla

Family	*Species*
Anarcadiaceae Subsp.*Acutifolia*	*Lannea Scwanfurthii*
Vitaceae	*Cissus Rotundifolia*
Vitaceae	*Cissus Quadrangularis*
Bursaraceae	*Commiphora Africana*

List 7: Medicinal Plants of Sagalla

The plant check list of Marungu Hills 2024 detailing Family, Specific Name, Infra-species, Life Form, Threat Levels and Local Names in Sagalla are tabulated in (*Table 10)* of the report.

Table 3: Plant List of Marungu Hills Conservancy

Family	Specific Names	Infra species	Life form[21]	Threat level/ CITES	Sagalla
POLYPODI-ACEAE	*Microsorum scolopendria* (Burm.f.) Copel.		H	EN/APP1	Kisambo
ZAMIACEAE	*Encephalartos kisambo* (Faden & Beenje		T		
ACANTHA-CEAE	*Asystasia gangetica* (L.) T. Anderson	var.*micran-tha*	H		
	Barleria ssp		H		
	Blepharis hildebrandtii Lindau in J.E		H		
	Blepharis maderaspatensis (L.) B. Heyne ex Rolth		H		
	Crabbea velutina S.Moore		H		
	Crossandra mucronata Lindau in E.J		H		
	Ecbolium subcordatum C.B. Clarke	var. *glabra-tum* Vollesen	H		
	Justicia ssp		H		
	Pseuderanthemum hildeb-randtii (C.B.Clarke) Lindau		H		
	Ruellia patula Jacq		H		
	Thunbergia guerkeana Lindau –		C		
	Thunbergia ssp		C		
AIZOACEAE	*Trianthema ceratosepalum* Volkens & Irmsch.		H		
	Trianthema portulacastrum L.		H		
	Zeleya pentendra (L.) C.Jef-frey		H		
AMARAN-THACEAE	*Achyranthes aspera* L.	var.*aspera*	H		
	Achyranthes aspera L.	var.*sicula*	H		
	Alternanthera pungens Kunth		H		
	Alternanthera sessilis (L.) R. Br. ex DC		H		

	Aerva javanica (Burm. f.) Juss. ex Schult.)		H		
	Amaranthus graecizans L.	Subsp. *silvestris* (vaill.) Brenan	H		
	Amaranthus ssp		H		
	Celosia schweinfurthianum Schinz		H		
	Centomopsis gracilenta (Hiern) Schinz		H		
	*Centemopsis kirki*i (Hooks.f.) Schinz		H		
	Dicoma spinosa		H		
	Digera muracata (L.) Mart.	Subsp. *Trinervis*	H		
	Digera muracata (L.) Mart.	Subsp.*macroptera*	H		
	Gomphrena celosioides Mart.		H		
	Sericocomopsis hildebrandtii Schinz		H		
	Sericocomopsis pallida (S.Moore) Schinz		H		
AMARYLLIDACEAE	*Cryptostephanus haemanthoides Pax*		H		
	Cyrtanthus sanguineus (Lindl.) Walp	subsp. *wakefieldii* (Sealy) Nordal			
	Scadoxus multiflorus (Martyn) Raf.		H		
ANARCADIACEAE	*Lannea alata* (Engl.) Engl.	subsp. *Multiflorus*	T		
	Lannea schweinfurthii (Engl.) Engl.	var.*acutifoliata (*Engl.) Kokwaro	T	NE	Mumbu
	Mangifera indica L		T		Muembe
	Searsia natalensis		S		Kitariki
ANONNACEAE	*Uvaria acuminata* Oliv		S		
APOCYNACEAE	*Acokanthera oppositifolia* (Lam.) Codd		T		
	Adenium obesum (Forssk.) Roem. & Schult.		S		Ingadaiyu
	Ancylobothrys petersiana (Klotzsch) Pierre		S		
	Baseonema gregorii Schltr. & Rendle		C		

	Calotropis procera (Aiton) W.T.Aiton		C		
	Ceropegia ssp		C		
	Ceropegia ssp		C		
	Cynanchum ssp		C		
	Huernia andreaeana (Rauh) L.C.Leach		H	EN	
	Pergularia daemia (Forssk.) Chiov	subsp.*daemia*	C		
	Saba comorensis (Bojer ex A.DC.) Pichon		C		Mtugo
	Sacleuxia newii (Benth.) BullocK		C		
	Secamone punctulata Decne.		C		
	Strophanthus mirabilis Gilg		C		
ARACEAE	*Crinum spp*		S		
	Gonatopus boivinii (Decne.) Engl.		H		
	Stylochaeton salaamicum N.E.Br.		H		
	Zamioculcas zamiifolia (G.Lodd.) Engl.		H		
ARALIACEAE	*Cussonia spicata* Thunb.		T		Kidango
ASPARAGACEAE	*Albuca abyssinica* Jacq.		H		
	Asparagus racemosus Willd.		C		
	Chlorophytum ssp		H		
	Dracaena parva N.E.Br. Byng & Christenh.		H		
	Dracaena raffillii N.E.Br. Byng & Christenh.		H		
	Draceana robusta		H		
	Drimiopsis botryoides Baker	subsp. *Dotryoides*	H		
ASPHODELACEAE	*Aloe* ssp		H		
	Aloe ssp		H		
ASTERACEAE	*Aspilia mossambicensis* (Oliv.) Wild		S		
	Bidens kilimandscharica (O.Hoffm.) Sherff		H		
	Bidens pilosa L		H		

	Blepharispermum zanguebaricum Oliv. & Hiern		H		
	Brachylaena huillensis O.Hoffm.		S	NE	
	Crassocephalum crepidioides (Benth.) S.Moore		T		
	Kleinia abyssinica (A.Rich.) A.Berger	var. *hildebrandtii* (Vatke) C.Jeffrey	S		
	Pulchea discoridis (L.) DC.		S		
	Senecio hadiensis Forssk.		L		
	Senecio syringifolius O.Hoffm.		L		
	Solanecio angulatus (Vahl) C.Jeffrey		L		Kilua-Ngonde
	Tridax procumbens L.		H		
	Vernonia wakefieldii Oliv.		H		
BASELLACEAE	*Basella paniculata* Volkens		C		
BORAGINACEAE	*Ehretia cymosa* Thonn.	var. *silvatica* (Gürke) Brenan	T		Mundana
	Cordia monoica Roxb.		T		Msasa
	Cordia sinensis Lam.		S		
	Cordia quercifolia (Klotzsch)		S		
	Heliotropium steudneri Vatke	subsp. *Steudneri*	H		
	Heliotropium zeylanicum (Burm.f.) Lam.	var.*arenarium*	H		
	Tecoma stans (L.) Juss. ex Kunth				
	Trichodesma zeylanicum (Burm.f.) R.Br.	var. *zeylanicum*	T		
	Kigelia africana (Lam.) Benth	subsp. *Africana*			Muratina
BURSERACEAE	*Boswellia neglecta* S.Moore		T		Mbambara
	Commiphora africana (A.Rich.) Engl.		T		Mwagari
	Commiphora campestris Eng	subsp. *Campestris*	T		
	Commiphora edulis (Klotzsch) Engl	subsp. *Boiviniana*	T		
	Commiphora eminii Engl.	subsp. *Trifoliolata*	T		

	Commiphora kua (R.Br. ex Royle) Vollesen		S		
CACTACE-AE	*Opuntia vulgaris* L.		S		
	Rhipsalis baccifera (J.S.Muell.) Stearn		S		
CAPPARA-CEAE	*Boscia coriacea* Pax		T		
	Cadaba farinosa Forrsk.		S		Msima-guare
	Capparis erythrocarpos Isert	var. *rosea* (Klotzsch) DeWolf	C		
	Capparis tomentosa Lam.		C		Wan-gombei
	Maerua angolensis DC.		T		
	Maerua decumbens (Brongn.) DeWolf		S		
	Mearua holstii Pax		S		
	Thilachium africanum Lour.		T		Mtunguru
	Thilachium thomasii Gilg		S		Mtunguru
CELASTRA-CEAE	*Eleodendron* ssp		S		
	Gymnosporia gracilis Loes. –		S		
	Gymnosporia heterophylla (Eckl. & Zeyh.) Loes.		S		
	Loeseneriella africana (Willd.) R.Wilczek		C		
	Mystroxylon aethiopicum (Thunb.) Loes.		S		
	Salacia stuhlmanniana Loes.		C		
CLEOMA-CEAE	*Cleome usambarica P*ax		H		
CLUSIACE-AE	*Garcinia volkensii* Engl.		H		
COMBRETA-CEAE	*Combretum aculeatum* Vent.		S		
	Combretum heroense Schinz	subsp. *He-roense*	S		
	Terminalia brownii Freesen		T		
COMMELIN-ACEAE	*Aneilema aequnoctiale* (P.Beav.) G.Son		H		
	Aneilema hockii De Wild		H		
	Commelina africana L.Var. Valloser (C.B Clarke) Brenan		H		

	Commelina benghalensis L.		H		
	Commelina bracteosa Hassk		H		
	Murdania semitres (Dalzel) Santapan		H		
CONVOL-VULACEAE	*Hildebrandtia sepalosa* Rendle		S		
	Ipomoea hildebrandtii Vatke	Subsp.*Hildeb-randti*	C		
	Ipomoea mobasana Vatke	Var.*mom-basana*	C		
	Ipomoea kituensis Vatke	var. *kituensis*	S		
CRASSULA-CEAE	*Kalanchoe ssp*		H		
CUCURBI-TACEAE	*Citrullus lanatus* (Thunb.) Matsum.&Nakai		C		
	Cossinia grandis Cogn		C		
	Corallocarpus epigeaus (Rotter) Hakf.		C		
	Cucumis dispaceus Ehrenb. ex Spach.		C		
	Gerrandanthus lobatus (Cogn.) C.Jeffrey		C		
	Mmordica boivini Bail		C		
	Momordica spinosa (Gilg) Chov		C		
	Peponium vogelii (Hooks.f.) Engl		C		
	Zehneria ssp		S		
DICHA-PETALACE-AE	*Dichapetalum ruhlandii* Engl.		C		Ludi
EBENACE-AE	*Diospyros natalensis* (Harv.) Brenan.		T		
ERYTHROX-YLACEAE	*Erythroxylum emerginatum* Thorn		S		
EUPHOR-BIACEAE	*Acalypha fructicosa* Forsk	var.eglandu-losa	S		
	Acalypha volkensii Pax		S		
	Croton dichogmus Pax		S		
	Croton pseudopulchellus Pax.		S		
	Euphorbia buseii		T		
	Euphorbia crotonoides Boiss	Subsp.*croto-noides*	S		

	Euphorbia cuneata Vahl	Subsp.spi-nescens (Pax) s.Carter	S		
	*Euphorbia cuneat*a Vahl	*Var.pumila* S.Carter	H		
	Euphorbia heterochroma Pax	Subsp. *tsavoensis* S,Cartw	S		
	Euphorboa hirta L		H		
	Euphorbia ingens E.Mey.ex Boiss		T		
	Euphorbia nyikae Pax ex Engl	*neovolkensii* (Pax) S.Carte	T		
	Euphorbia qunqueecostata Volkensii		T		
	Euphorbia Robechii Pax		T		
	Euphorbia scheffleria Pax		S		
	*Euphorbia tirucal*i L		T		
	Jatropha spicta Pax		H		
	Jatropha velutina Pax & K.Hoffin		H	EN	
	Spirostachys africana Sound		T		
	Surugeda zansibarensis Baill		T		
	Synadenium pereskiifolim (Baill.) Guill,		T		
	Ricinus communis L		S		
FABACEAE	*Aschynomene schimperi* Huscht.ex Rich		S		
	Albizia anthelmentica (A.Rich.) Brogn		T		
	Bauhinia Taitensis Taub		S		
	Craibia brevicaudata (Vatke) Donn		T	NE	
	Crotolaria polysperma Kotschy		H		
	Dalbergia melanoxylon Guill.& Perr.		T	NE	Muyingo
	Delonix alata Gamble		T		
	Delonix regia L		T		
	Entada leptostachya Harms		C		
	Erythrina abbysinica Lam.ex DC.		T		
	Indigoffera ssp		H		

	Mycrotyloma ssp		C		
	Milletia usaramensis (Taub)		T		
	*Newtonia buchananan*i (Baker) G.C.C Gilbert & Boutique		T		Mkuruma/ Mofu
	Platycelphium voense (Engl.)		T		
	Senegalia brevispica (Harms) Seigle & Ebinger		S		
	Senegalia mellifera (Vah) Seigler Ebinger	Subsp. *millifera*	T		
	Senegalia senegal (L.) Britton		T		
	Senna occidentalis (L.)		H		
	Spathionema kilimandscharica Taub		C		
	Stylosanthes fructicosa (Retz) Alston		H		
	Tarmarindus indical L.		T		Mkwaju
	Tepherosia villosa (L.) Pers.	Subsp. *enbrengiana*	H		
	Vachellia buseii (Harms ex Y.Sjosted) Kyal.& Boaywar		T		
	Vachellia nilotica (L.) P.J.H Horter & Mabb.	Subsp. *subalata* (Vatke) Kyal.& Boaywr	T		
	Vachellia reficiens (Wawra& Preyr,) Kyal.& Boatwar	Subsp.*misera* (Vatke) Kyal. Boatwar	T		
	Vachellia tortilis (Forsk) Gelasso & Banfi	Subsp. *Spirocarpa* Hoschts.ext. A.Rich.)	T		
	Zornia capensis Pers	Subsp. *tropica* Mine-Redh.	H		
ICACINACEAE	*Pyrenacantha kaurabassana* Baill		C		
LABIATAE	*Coleus* ssp		H		Bicharo
	Coleus ssp		H		Bicharo
	Erythrochlamys spectabilis Gurke		H		
	Hoslundia opposita Vahl		S		Mrunde
	Ocimum grattisumum L.	Var. *macrophyllum*	S		Mrumbawasi

	Tinnea eathiopica Hooks.f.	Subsp.*eathio-pica*	S		Wandanda
	Tinnea eathiopica Hooks.f.	Subs.*eathio-pica*	S		Wandanda
	Premna resinosa (Hoschst.) Schauer		S		Mugamia
MALPHIGIA-CEAE	*Caucanthus auriculatus* (Randl.K.)		C		
	Triapiz erlangeri Engl.		C		
MALVACE-AE	*Abutilon* ssp		H		
	Adansonia digitata L.		T		Mbuyu
	Corchorus triden L.		H		
	Corchorus urticifolius Wight &Arn		H		
	*Dombeya taylori*i Bak.f		T		Kidabita
	Grewia forbesii K.Schum		S		Mbavu mbavu
	Grewia nematopus K.Schum		S		Mgo-loa-Sho-shoti
	Grewia tephrodemis K. Schum		S		
	Grewia plagiophylla K. Schum		S		
	Grewia villosa Willd.		S		Mshoshote
	Hermania exappendiculata (Mast.) K.Schum.ex Engl		H		
	Hibiscus micrantha Hosch.ex A.Rich		S		
	Melhania velutina Forsk		H		Moja
	Sterculia rhynchocarpa K.Schum		T		
	Triumphetta rhomboidea Jacq.		S		
	Witheria indica L.		H		
MELASTO-MATACEAE	*Memecylon* ssp		S		
MELIACEAE	*Azadirachta indica* A.Juss.		T		Mwarui-bane
	*Melia volkensi*i Gurke		T		Mkumbutu
MOLLUG-INACEAE	*Hypertelis umbellata* (Forsk.)		H		
MORACEAE	*Dorstenia hildebrandtii* Engl.	Var. *hildeb-randtii*	H		

	Ficus glumosa Del.		T		Kishre
	Ficus ingens (Miq.) Miq.		T		
	Ficus natalensis Hoscht.		T		
	Ficus scassellatii Pamp		T		
	Ficus tremula Warb	Subsp.*a cuta* (De.Wild.) C.C.Berg	T		
MORINGA-CEAE	*Moringa oleifera* Lam.		T		
NYCTAG-INACEAE	*Boerhavia coccinea* Mill.		H		
	Boerhavia diffusa L.		H		
ORCHIDIA-CEAE	*Ochird* ssp		H	APP II	
OCHNACE-AE	*Ochna ovata* H.Hoffin		S		
OLEACEAE	*Jasminium fluminense* Vell.		C		
OPILIACEAE	*Opilia amentaceae* Roxb		C		
ONAGRA-CEAE	*Ludwigia* ssp		H		
PASSIFLO-RACEAE	*Adenia globosa* Engl.		C		
	Adenia gummifera (Haxy.) Harms		C		
	Adenia volkensii Harms		C		
	Basananthe hanningtonia (Mast.) W.J.de Wild		C		
PEDALIA-CEAE	*Sesamothamnus rivae* Engl.		S		
	Pedalium murex L.		H		Orombo
PHYLAN-THACEAE	*Bridelia teitensis* Vatke &Pax		S		
	Flueggea virosa (Roxb.ex Wild) Voight	Subsp.*virosa*	S		Mkuamba
	Phyllanthus maderaspaten-sis L		H		
	Phyllanthus ssp		H		
POACEAE	*Eleusine indica* L		H		
	Eragostris ssp		H		
	Heteropogon contortus (L.) P.Beav.ex Roem .& Schold.		H		
POLYGONA-CEAE	*Polygala kilimandjarica* Chodot		H		

POLYGONA-CEAE	*Oxygonum sinuatum (Hoscht.& Steud.ex.Mein.) Dammer*		H		
PORTULA-CEAE	*Calyptotheca taitensis (* Pax &Vatke) Brenan		H		
	Portulaca oleraceae L.		H		
	Portulaca weightiana Wall. ex Wight &Arn		H		
RUBIACEAE	*Coptosperma greveolens* (S.Moore) Degreaf	Var.*greovel-ens*	S		
	Gardenia volkensii K.Schum L.		T		
	Physchotria ssp		S		
	Rothmania ravae (Chiov.) Bridson		T		
	Rytiginia ssp		S		
	Tennantis senii (Chiov) Vedc.& Bridson		S		
	Vangueria ssp ?		S		
RUTACEAE	*Vepris glomerata* (F.Hoffin.)		S		
	Vepris euginifolia ?		T		
	Zanthoxylum cheylibeum Engl.		T		
SALVADOR-ACEAE	*Dobera glabra* (Forsk.) Juss. ex Poir		T		Msuaki
	Salvadora persica L.		S	EN	Kijulu
SANTALA-CEAE	*Osyris lanceolata* Hoscht.&S-teaud ?		T		Msuaki
SAPINDA-CEAE	*Allophyllus rubifolius* (Hoscht.ex.A.Rich.)		S		
	Haplocoelum folilosum (Hien)	Subsp. s*tron-gylocarpum* (Bullock) Verdc	T		
	Lecaniodiscus fraxinifolius Baker	Subsp. v*aughaniae*	T		
SAPOTACE-AE	*Manilkara mochisia* (Baker) Dubard		T		
	Manilkara sulcata (Engl.)		T		
SOLANACE-AE	*Nicandra physalodes* (L,) Gaertn,		H		
	Solanum icanum L.		S		
	Solanum tettense Klotzsch ?		S		
TACCACEAE	*Tacca leontopetaloides* (L.) Kuntze		H		

TALINACE-AE	*Talinum portulacifloium* (Forsk.) Achi ex.schwinf		H		Ikope
URTICACE-AE	*Obetia radula* (Baker) Baker ex B.D. Jacks		S		
	Pilea ssp		H		
VERBANCE-AE	*Lantana camara* L		H		Kideo
VELIOZIA-CEAE	*Xerophyta spekei* Bak		H		
VITACEAE	*Cissus quadrangularis* L.		C		
	Cissus rotundifolia Vahl		C		
	Cyphostema cyphopet-alum (Fresen.) Desc.ex Wild&R.B.Drumm.	C			
	*Rhoicissus revoili*i planch		C		Mgerugeru
XIMENIACE-AE	*Ximenia caffra* Sond		T		
ZYGOPHYL-LACEAE	*Balanite pedicellaris* Mild-br.&Chltr.	Subsp.*pedi-cellaris*	T		Msoko

Chapter 7: Wildlife Inventory Results

7.1 Marungu Hills Conservancy Wildlife Summary

Marungu hills conservancy consist of seven hills; Nyangala, Mlilonyi, Garawa, Marasi, Kale 1 and 2, and Mwanangao hills. The conservancy hosts both domestic and wildlife especially during drought. The hills Kale 1 and 2 are predominantly rocky habitats with limited vegetation cover hence making them relatively less preferable to some wild animals but predominantly good habitat for reptilians and amphibians. A few wild animal species including duiker and baboon were recorded at Mwanangao hills. However active livestock grazing involving goats and cattles were observed in several localities within the conservancy.

Most wild animals in the conservancy are found at Nyangala, Mlilonyi, Garawa and Marasi hills. Some of the wild animal species recorded include rock hyrax, ostrich, wild pig, klipsringer, porcupine, vervet monkey, baboon, dikdik, elephant, buffalo, impala, spotted hyena, Aadvark, warthog, civet, dwarf mongoose, eland, lesser kudu, black backed jackal, leopard, lion, pangolin, and giraffe. Recent droppings of elephants were observed in a section of the conservancy believed to be a migratory route for elephants to neigbouring Ranches such as Izera and Sagala. This movement is a source of perennial human elephant conflicts in the area according to the community. Actual wild animals sighted were vervet monkeys and rock hyrax.

Bush meat poaching using wire-snares is common in the conservancy while one sign of encroachment in the form of human settlement was recorded at Garawa hill. An old quarry was also recorded at Marasi hill. However, from the scouts' questionnaire feedbacks, a diversity of illegal activities occurs in the conservancy. They include illegal logging, charcoal burning, hunting of wild animals using bows, arrows and torch, illegal grazing among others.

The results of wildlife inventory for Marungu Hills Conservancy are detailed in table 6. Additional findings from the short questionnaire survey carried out duringinventoryaresummarizedinfigure 11. It isimperativetoappreciatethefact that the dangers wildlife face within this ecosystem are mostly anthropogenic. Figure 12-13 captures records of some of the adverse anthropogenic activities taking within the conservancy.

7.1.1 Results

Table 4: Check List of Wild Animals of Marungu Hills Conservancy

Common name	Scientific name	Local name (Taita)	Current IUCN Red List Category
Bush duiker	*Sylvicapra grimmia*	Asa	LC
Elephant	*Loxodonta Africana africana*	Chovu	EN
Buffalo	*Syncerus caffer*	Mbogho	NT
Lion	*Panthera leo*	Shimba	VU
Yellow Baboon	*Papio cynocephalus*	Fuye	LC
Rock hyrax	*Procavia capensis*	Mbimbi	LC
Crested porcupine	*Hystrix cristata*	Sasa	LC
Wild pig	*Potamochoerus larvatus*	Ngue	LC
Ostrich		Nyagha	
Warthog	*Phacochoerus africanus*	Jalo	LC
Common eland	*Taurotragus oryx*	Domu	LC
Kirk's dik dik	*Madoqua kirkii*	Mwakulu	LC
Cape hare	*Lepus capensis*	Kwaru	LC
Masai giraffe	*Giraffa camelopardalis tippelskirchi*	Ndigha	EN
Aardvark	*Orycteropus afer*	Loma	
Pangolin	*Smutsia temminckii*	Mwakumama	VU
Spotted Hyena	*Crocuta Crocuta*	Mbisi	
Klipsringer	*Oreotragus oreotragus*	Mwalwalenyi	
Lesser kudu	*Tragelaphus imberbis*	Ndanda	NT
Leopard	*Panthera pardus*	Ingwe	VU
Vervet Monkey	*Chlorocebus pygerythrus*	Mwandovo/ sawau/ngima	LC
African wild dog	*Canis pictus*	Turuga	
Black backed jackal	*Canis mesomelas*	Mbweya	LC
Banded Mongoose	*Mungos mungo*	Mkurukuru	LC
Dwarf mongoose	*Helogale parvula*	Mnyuru	LC

African civet	*Civettictis civetta*	Fungo	LC
Bush Squirrel	*Paraxerus ochraceus*	Mwatate	LC
Water buck	*Kobus ellipsiprymnus*	Domu	LC
Common zebra	*Equus quagga*	Punda mlia	LC

Threats to Biodiversity of Marungu Hills Conservancy

Illegal activity	**No. of responses**
Bush meat (snares)	8
Cutting of poles	7
Charcoal burning	7
Encroachment	3
Human wildlife conflicts	4
Bushfire	1
Illegal grazing	4
Quarrying	1
Grass harvesting	1

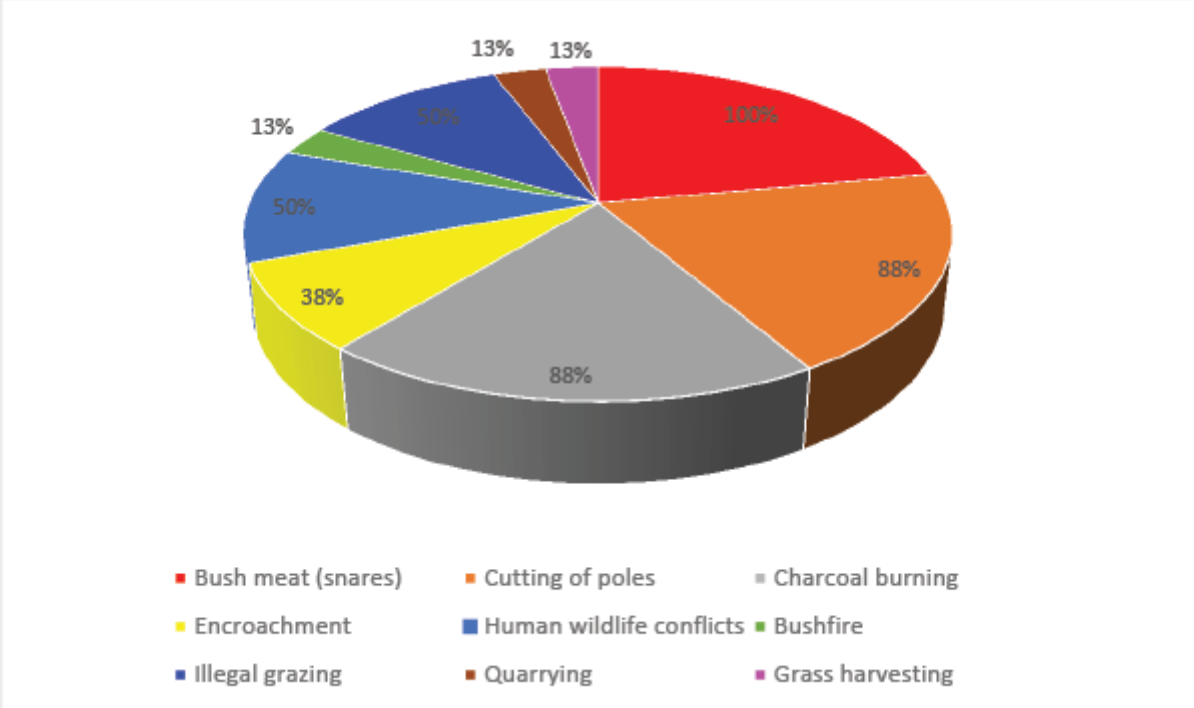


Figure 10: Levels of Threats on Biodiversity in Marungu Hills Conservancy

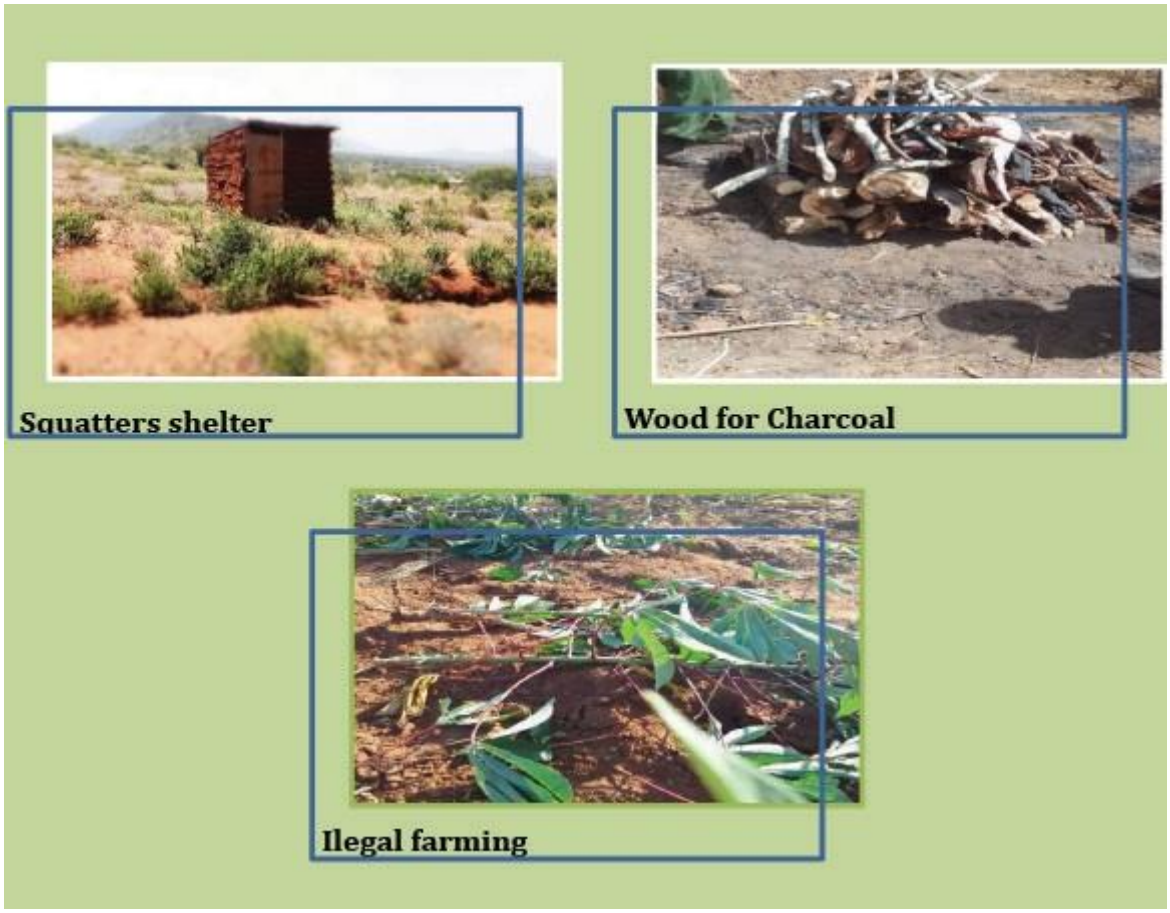


Figure 11: Anthropogenic Activities in the Conservancy

Figure 12: Goats and Snares Recorded in the Conservancy

Chapter 8: Avians (Birds) Inventory Results

Bird's inventory provides an overview of the avian species present in Marungu Hills Conservancy within Taita-Taveta County. The inventory documents the rich biodiversity of birdlife in the area. Aim of the inventory is to contribute valuable data for conservation and management efforts. Avifaunal data collection method involved transect survey, point counts and ad hoc observations conducted between 3rd January and 9th January 2024. While the primary focus was on sampling within the forest, efforts were extended to include sampling at the Conservancy forest edges.

Marungu Hills Conservancy are nestled in the scenic landscapes of Taita Taveta which is a critical habitat for various flora and fauna, especially avians. This inventory was conducted to assess and document the avian diversity with an aim of aiding conservation strategies and promoting biodiversity awareness.

The list of bird species recorded in Marungu Hills Conservancy during the biodiversity Inventory survey provides information on (Status: am-afrotropical migrant; pm-Palearctic migrant; mm-malagasy migrant; EN-Endangered; VU-Vulnerable; NT-Near-threatened, Forest dependency: FF-forest specialist; F-forest generalist; f- forest visitor; non-f – non-forest species) as detailed in table 7.

Table 5: Birds Recorded at Marungu Hills

S/No	Common Name	Scientific Name	Local Name	Status	Habit	Feeding Guild
	Numididae: guineafowl					
1	Guinea Fowl	*Vulturinum*	Ndosi		F	Granivore
	Phasianidae: quails, francolins, spurfowl and allies					
2	Crested Francolin	*Francolinus sephaena*			non.f	Granivore
	Anatidae: ducks and geese					
3	Knob-billed Duck	*Sarkidiornis melanotos*		am	non-f	Insectivore
4	African Pygmy Goose	*Nettapus auritus*			non-f	Insectivore

	Common Name	Scientific Name	Status	Habit	Feeding Guild
	Capitonidae: barbets and tinkerbirds				
5	Brown-breasted Barbet	*Lybius melanopterus*		F	Frugivore
6	D'Arnaud's Barbet	*Trachyphonus darnaudii*		non-f	Frugivore
7	Red-fronted Barbet	*Tricholaema diademata*		non-f	Frugivore
8	Spot-flanked Barbet	*Tricholaema lacrymosa*		non-f	Frugivore
9	Green Tinkerbird	*Pogoniulus simplex*		FF	Frugivore
10	Red-fronted Tinkerbird	*Pogoniulus pusillus*		non-f	Frugivore
	Indicatoridae: honeyguides				
12	Lesser Honeyguide	*Indicator minor*		F	Insectivore
13	Scaly-throated Honeyguide	*Indicator variegatus*		F	Insectivore
14	Greater Honeyguide	*Indicator indicator*		F	Insectivore
	Picidae: wrynecks and woodpeckers				
15	Nubian Woodpecker	*Campethera nubica*		non-f	Insectivore
	Platysteiridae: batises, wattle-eyes and Relatives				
16	Black-throated Wattle-eye	*Platysteira peltata*		F	Insectivore
	Malaconotidae: helmetshrikes, bushshrikes, tchagras and puffbacks				
	Campephagidae: cuckooshrikes				

	Common Name	Scientific Name	Status	Habit	Feeding Guild
17	Black Cuckooshrike	*Campephaga flava*	Am	F	Insectivore
	Monarchidae: monarch flycatchers				
18	Blue-mantled Crested Flycatcher	*Trochocercus cyanomelas*		FF	Insectivore
19	African Paradise Flycatcher	*Terpsiphone viridis*	am	f	Insectivore
	Hirundinidae: sawwings, swallows and martins				
20	Barn Swallow	*Hirundo rustica*	PM	non-f	Insectivore
21	Lesser Striped Swallow	*Cecropis abyssinica*		non-f	Insectivore
22	Red-rumped Swallow	*Cecropis daurica*		non-f	Insectivore
23	Common House Martin	*Delichon urbicum*	PM	non-f	Insectivore
	Cisticolidae: cisticolas and allies				
24	Red-faced Cisticola	*Cisticola erythrops*		non-f	Insectivore
25	Rattling Cisticola	*Cisticola chiniana*		non-f	Insectivore
26	Winding Cisticola	*Cisticola galactotes*		non-f	Insectivore
27	Tawny-flanked Prinia	*Prinia subflava*		f	Insectivore
28	Grey Apalis	*Apalis cinerea*		FF	Insectivore
29	Grey Wren Warbler	*Calamonastes simplex*		non-f	Insectivore
30	Grey-backed Camaroptera	*Camaroptera brachyura*		f	Insectivore
	Pycnonotidae: bulbuls				
31	Common Bulbul	*Pycnonotus barbatus*		f	Frugivore
32	Zanzibar Greenbul	*Andropadus importunes*		non-f	Frugivore

Figure 13 some Birds captured during Survey (Speckled Mousebird, Common-Bulbul, Stuhlmann's starling, Baglafechtweaver).

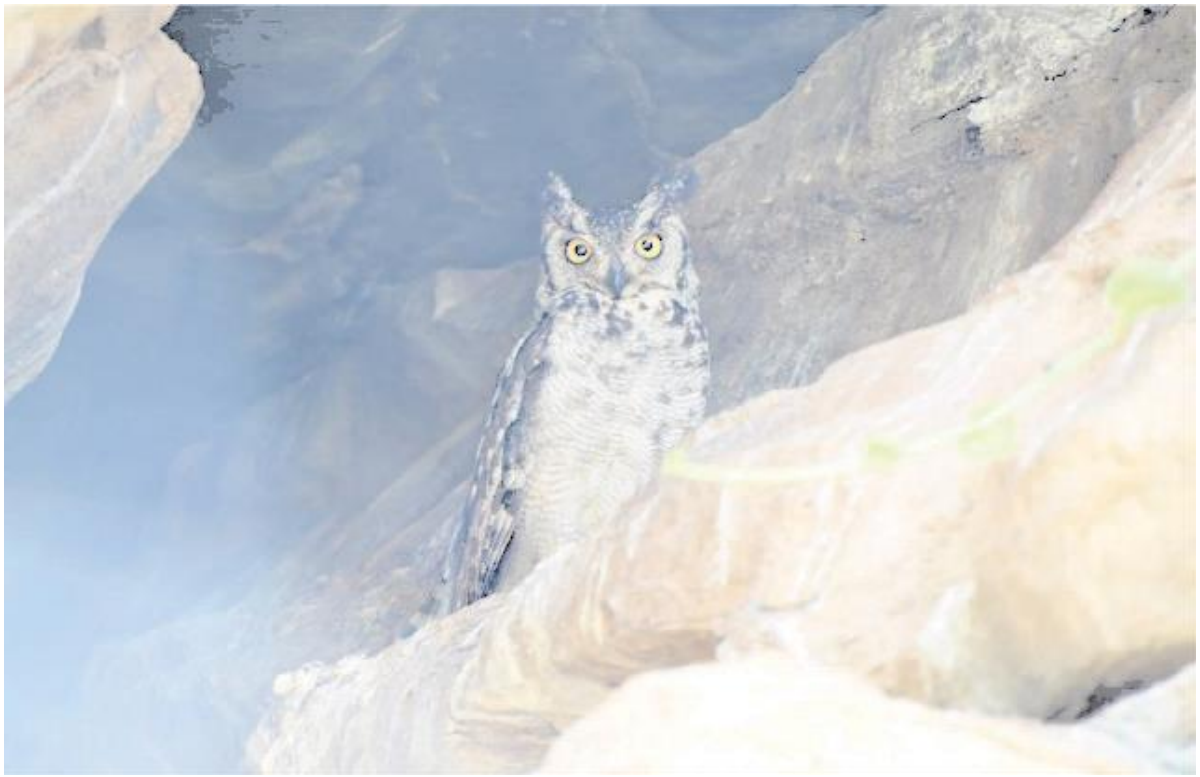


Figure 14 spotted Eagle Owl (Bubo africanus)

8.1 Key Findings

Interpretation of the records contained in the list of birds observed within the inventory area confirms the following findings:

- The conservancy exhibits a remarkable diversity of avian species, indicating a healthy and balanced ecosystem.
- The presence of endangered bird species underscores the importance of the conservancy in providing a sanctuary for vulnerable wildlife.
- Identification of migratory species provides insights into global bird migration patterns and emphasizes the need for international cooperation in conservation efforts.
- The Marungu Hills Conservancy face a limited level of encroachment that can be controlled through quick conservation policy intervention. It is obligatory for Conservancy Steering Committee to prioritize resolving encroachment threat because it has the potential to undermine ongoing conservation efforts and compromise the integrity of these vital ecosystems.

Chapter 9: Recommendations

9.1 Governance and Management

Informed by the information and knowledge gathered from the biodiversity inventory of Marungu Hills Conservancy the following policy, management, ecological and socio-economic recommendations are put forward for consideration and actualization.

- Tenurial, boundary demarcation and beaconing of the conservancy area should be done as a matter of agency.
- Subdivisions, encroachment, human settlement and farming within the conservation area should be stopped.
- Governance and management structures to be strengthened around management capability especially resource protection.
- Coordination of the conservancy should effectively plan for and promote nature-based investments that include eco-tourism and carbon credit payments through carbon sequestration.
- Dry season grazing of domesticated livestock that includes cows, goats and sheep should be discontinued to avoid spread of evident massive degradation that shall eventually lead to breakdown of ecological resilience of the conservancy.
- Cuting of wood for charcoal production within the homesteads must be stopped.
- Weeds are gaining foothold within the conservancy. Therefore, to avoid eminent habitat degradation, eradication measures should be instituted urgently to avoid massive and expensive investments in containment measures in the future.
- To ensure sustainable management and conservation of the inventory area, there is a need for community to commission a conservation fund either through collaboration with the County Government guided by enactment of a clear regulation that supports biodiversity protection and funding mechanisms.
- Conservancy areas that have been clearly degraded as a result of encroachment, conversion for settlement, charcoal burning and excessive grazing should be replanted with indigenous species or protected to allow natural regeneration by use of appropriate and well-designed drift fencing.
- To improve internal generation of revenue for conservation, nature trails, hiking routes, wilderness experience, viewpoints, sacred sites and camping sites require to be developed. In order to brand and conform to green nature-based interventions necessitate that the Guides, Scouts and Other Service Provides be appropriately trained and deployed or contracted to provide the needed services.

9.2 Vegetation Conservation

9.2.1 Global threaten species

The study areas of Marungu Hills harbors a number of global threaten species which are cited by the International Union of Conservation in the Nature Red list (IUCN). Some of the species found within the conservancy are listed as Near threaten, Vulnerable and Endangered.

Table 6: Plants under IUCN Red List.

Species	Infra taxa	Threat level	Endemism
Encerphalartos kisambo		Endangered	Kenya coast endemic
Huernia andreaeana		Endangered	
Lannea schwanfurhii	var.*acutifloliata*	Near threaten	Coastal forest of east Africa endemic
Craibia brevicaudata		Near threaten	
Brachylaena huillensis		Near threaten	
Dalbergia melanoxylon		Near threaten	

The conservancy must therefore be protected to ensure the posterity of the globally threatened species that are thriving within their endemic habitats.

9.2.2 Convention on International Trade of Endangered Flora and Fauna (CITES)

The study areas also harbor two family of plants whose members are cited in the CITES, these are the *Aspholidaceae* where three unidentified species of *Aloe ssp* and the *Zamiaceae* where the *Encepharlatos kisombo* belong to. *Encepharlatos kisambo* is endemic to Marungu Hills Conservancy and Kisagau Hill (Henk Beenje, 1994).

Management and conservation intervention should be put into place to ensure there is no trade or exploitation of the species within the habitat that are listed under CITES. Of special interest under this category are the species of *Aloe ssp.*

9.2.3 Alien invasive species

The study area has a number of alien invasive species; *Prosopsis juliflora, Lantana camara, Opuntia-ficus indica, Tacoma Stans and Leucena leucocephala.* Especially *Prosopsis juliflora* and *Opuntia ficus-indica*. The aliens are already dominating some section of Marungu Hills Conservancy, which may bring negative impact to the indigenous species associate. *Opuntia spp* is already a big threat in Tsavo East National Park that neighbors the conservancy.

All the sited invasive species should be contained before they spread to cover more areas within the habitats. Left unchecked, the aliens will change the ecosystem, destroy endemic species and degrade habitats for wildlife resulting to reduced resilience of the ecosystem.

9.2.4 Wild food plants

Based on the indigenous knowledge from the local Communities, Marungu Hills Conservancy are rich in food plants that can be researched and domesticated for improved food insecurity. A number of food plant were observed to belong to the family *Cucurbitaceae* and *Amaranthaceae*. *Corrallocarpus epigaeus. Digera muracata and Amaranthus graciziens* were the major food plants species based on anecdotal observation.

9.2.5 Over Exploitation of Woody Vegetation

Inventory findings confirm un-sustainable exploitation of woody vegetation. Mostly the trees are cut for making charcoal or used as fuel wood. Here, the exploiters cut wood, transport to the homestead where they make charcoal. The exploitation is unsustainable and should be stopped through policy decisions, enactment of appropriate by-laws and regulation and institutionalization of enforcement to ensure compliance.

9.2.6 Domesticated Livestock

Inventory confirms that the conservancy is subjected to grazing of domesticated animals that includes; cows, goats and sheep. This makes the habitat not suitable as a dry season grazing refuge for wild animals. To sustainably conserve these areas, the domesticated animal's access to the conservancy should be permanently discontinued.

9.2.7 Conversion through Farming; Settlement; Encroachment and Squatting

Farming, settlements, encroachment and squatting activities takes place at various levels that are deemed unsustainable and soon shall lead to serious negative impact on flora conservation within the conservancy. Informed by the fact that the conservancy is documented to be home to plant species that are endemic and endangered, the ecosystems is therefore an ecological hot spot for the survival of the flora in question. As a result, conversion of the areas to other land uses can only be interpreted to be an ecological suicide for the flora and genetic wealth for humanity. Consequently, appropriate intervention should be taken to reverse these ecologically destructive trends and protect Marungu Hills Conservancy.

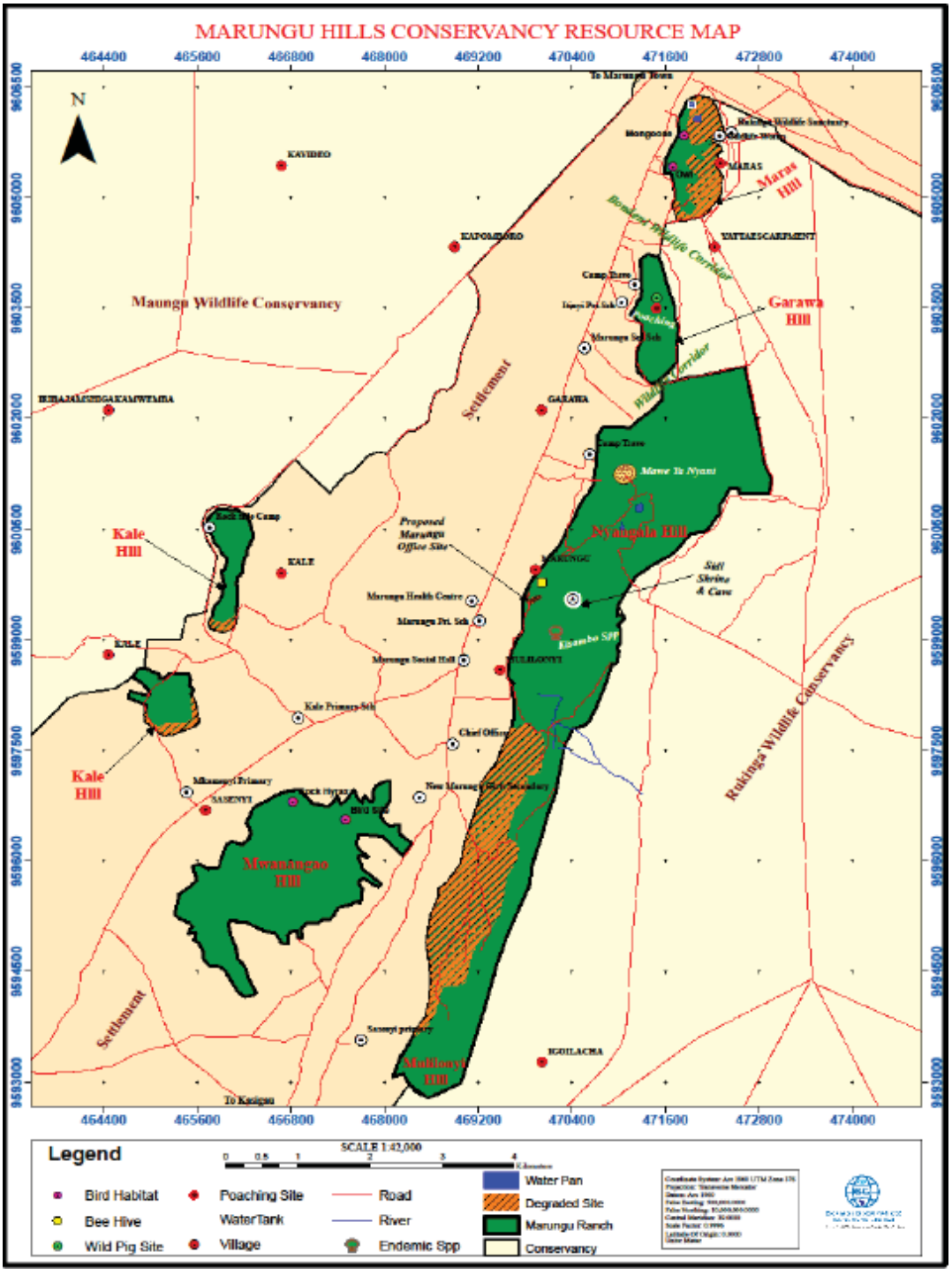
9.3 Birdlife Conservation

Birdlife conservation initiatives to include implementation and enhancement of conservation measures to protect and preserve the identified key habitats for bird species informed by their nesting and feeding characteristics.

- Long term bird monitoring program to track changes in bird populations, migratory patterns, and overall biodiversity in Taita Taveta Eco-region to be established.
- Communities' awareness and sustainable practices should be promoted to empower community to avoid degrading birdlife habitats.

- Encroachment, settlement andconversion of Marungu Hills Conservancy into other land usages should be stopped and areas already affected reclaimed to ensure resilience of the ecosystems especially during high utilization impacts during drought.

Chapter 10: Annexes



Annex 1: Marungu Hills Conservancy Resource Map

Group Name:			**Date of survey:**			**Form No:**	
Conservancy Area:			**Distance to the nearest Ranch boundary (km):**				
Location:			**Sub – Location:**				
Biodiversity Name of key/special interest in this site:							
GPS Readings of the site:	**Northings**		**Eastings**		**Elevation (Altitude)**		
Specific Name of the Site	**Status of the Conservancy area on the site**	**Main tree/plant spp (All)**	**Tree/Plant spp of special interest**	**Wildlife/Animal spp identified (All)**	**Animal spp of special interest**		
Threats identified on the site							
Causes of the threats							
Possible solution							
By who?							
Other Biodiversity's resource of interest on same site:							

Annex 1: Generic Data Collection Sheet

Annex 2: Workplan for Biodiversity Inventory

Activities/Tasks	Outputs/Milestones	Timeframe (Weeks)											
		1	2	3	4	5	6	7	8	9	10	11	12
Introduction and Inception meetings	BG (Contractor) introduced to the project. Biodiversity Inventory Inception Report produced	X											
Field orientation and reconnaissance visit between IFAW, TTWCA and BG.	IFAW introduce GB to TTWCA, GB benefits from; knowledge of TTWCA preparedness, Marungu Hill and Oza Ranches management readiness, Identification of Beneficiaries from communities		X										
Mobilization for Inventory	Formation of Management Evaluation Group and Field Survey Teams. Gathering of survey equipment.		X	X									
Baseline information gathering	Datasheets developed, Survey designs ready. Database formats ready, Survey methodologies agreed by parties			X	x								
Carrying out field inventory	Data collected, Field discussions, Review of methodology, Field data sheets filled, Data captured in the database				X	X							

Analysis, interpretation and information generation	Documentation of findings and production of information bulletins for targeted expert group discussions	**X**	**X**	**X**			**X**	**X**					
Gap filling and ground truthing surveys	Data, records and information generated verified and confirmed						**X**						
Consolidation of inventory information bulletins to produce Biodiversity Inventory Report (Draft) for management debriefing	Biodiversity Inventory Report (Draft) produced and presented to the Management Evaluation Group for discussion, editing and review.						**X**	**X**					
Stakeholders evaluation forum	Stakeholders discuss and evaluate the draft report leading to the production of Stakeholders evaluation report								X	X			
Final Biodiversity Inventories Report compilation, dissemination and submission	Validated Biodiversity Inventory Reports for Marungu Hill and Oza Ranches produced and submitted to IFAW										**X**	**x**	**x**

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