KENYA FORESTRY RESEARCH INSTITUTE

Annual Report and Record of Research

2022 - 2023

KEFRI is ISO 14001:2015 and 9001:2015 IMS Certified

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Published by:

Kenya Forestry Research Institute

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ACRONYMS

AHRC/IIED	Arts and Humanities Research Council / International Institute for Environment and Development
ASALs	Arid and Semi-Arid Lands
CABI	Centre for Agriculture and Bioscience International
CADEP	Capacity Development Project for Sustainable Forest Management in Kenya
CETRAD	Centre for Training and Integrated Research in ASAL Development
CFAs	Community Forest Associations
COVID-19	Corona virus disease caused by sars -2 virus
CPTs	Candidate Plus Trees
DBH	Diameter at Breast Height
FAO	Food and Agricultyure Organization
GATSBY Africa	Lord David Sainsbury Private foundation engaging in East Africa across government, business and society on commercial forestry
GTZ	Germany Technical Cooperation
IMS	Integrated Management Standards
INBAR	International Bamboo and Rattan Organization
ISO	International Organization for Standardization
ISTA	International Seed Testing Association
KALRO	Kenya Agriculture and Livestock Research Organization
KCSAP	Kenya Climate Smart Agriculture Project
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KWTA	Kenya Water Towers Agency
MAI	Mean Annual Increment
MDAs	Ministry, Departments & Agencies
NEMA	National Environment Management Authority
NETFUND	National Environment Trust Fund
PIP	Performance Improvement Plan
RCBD	Randomized Complete Block Design
SCAC	State Corporations Advisory Committee
TVET	Technical and Vocational Education and Training Institutions
TLUD	Top-Lit Updraft
TWENDE	Towards Ending Desertification Emergencies
UNDP	United Nations Development Programme

SERVICE DELIVERY CHARTER

No	Services/Goods	Requirements to obtain Services/ Goods	Cost	Timeline
1	Develop forest technologies	Research based on stakeholder needs	Depends on the technology	1-5 years depending on technology
2	Disseminate forest technologies	Formal Request	Free	Within 60 days
3	Production of quality tree seed	Demand for priority tree species	Depends on the tree species	Within 90 days
4	Production of high quality tree seedlings	Demand for priority tree species	Depends on the tree species	Within 90 days
5	Sale of high quality tree seed and seedlings	• Formal request • Filled seed order form	As per tree seed catalogue	Within 2 hours
6	Training on forest technologies	Formal request	Depends on the type of training	Within 90 days
7	Wood, plant and soil analysis	Formal request	As per analytical price catalogue	Within 10 working days
8	Advisory services	Formal request	Free	Within 5 working days
9	Contribute to policy formulation in the environment and forestry development	Formal request	Depending on the nature of the policy	1-5 years depending on the policy
10	Attachment of students	Acceptance letter from HR	Free	90 days
11	Consultancy in forestry and allied natural resources	Formal request	Free	1 week to 5 years
12	Establish linkages and partnerships	Formal request	Free	Within 90 days
13	Handling of customer complaints and compliments	Complaint / Compliment form	Free	Within 2 weeks after receiving the complaint

We value and welcome feedback and comments to enable use serve you better.
Complaints, compliments and suggestions should be sent to:

The Director Kenya Forestry Research Institute P.O. Box: 20412-00200, Nairobi Tel: +254 722 157 414, 724 259 781/2 Email: director@kefri.org contact@kefri.org Website: www.kefri.org	The Commission Secretary/Chief Executive Officer Commission on Administrative Justice P.O. Box 20414-00200, Nairobi Tel: +254 20 2270000/2303000/2603765/2409574/0777125818 Email: info@ombusman.go.ke/complain@ombudsman.go.ke

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HUDUMA BORA NI HAKI YAKO

STATEMENT BY CHAIRMAN KEFRI BOARD OF DIRECTORS

In the Fiscal Year 2022/2023, KEFRI Board of Directors continued to provide leadership in designing and control of credible strategic intentions and implementation of obligatory global and national agenda for research and development in forestry and allied natural resources in our country.

The Board provided support through approval of perquisite budgets as per the agreed performance targets under the research themes namely: Forest Productivity and Improvement; Forest Biodiversity and Environment Management; Socio-economics, Policy and Governance; Forest Products Development; and Technical Support Services. In addition, the Board provided for resources to support infrastructural development at the six Eco-regional programmes.

Similarly the Board also continued to oversee the adoption and implementatiuon of KEFRI 7th Strategic Plan (2022-2027). This Plan aligns KEFRI research and develpment activities to: Medium Term Plan IV of the Kenya Vision 2030; the Kenya Governments Bottom-Up Transformation Agenta (BETA); the MECCF Strategic Plan 2022-2027 and the Kenya Green Economy Strategy and Implementation Plan 2016 - 2030.

As the Institute continued implementation of key activities for provision of efficient and effective service delivery, the Board of Directors reviewed and analyzed progress made in key strategic activities consequently steering the Institute to realize various milestones:

In compliance with Mwongozo Code of Governance for State Corporations, I take this opportunity to most sincerely thank the Board Directors for ensuring leadership and good governance, financial stewardship, and discipline through prudent use of GoK funds as well as grants from Development Partners. The Board through its constituted committees examined any deviation from the targets and suggested corrective measures to mitigate the challenges encountered.

Special thanks to the National Government through the Ministry of Environment, Climate Change and Forestry, other ministries departments and agencies (MDAs), County Governments, Development Partners, my colleagues in the Board, entire KEFRI staff and all our stakeholders for the immense support which enabled successful achievement of the research and development targets set for the 2022/2023 fiscal year.

Prof. Erastus Gatebe (PhD)
Chairman - KEFRI Board of Directors

DIRECTOR REMARKS

We are pleased to share the 2022/2023 Annual Report and Record of Research. KEFRI continued to fulfil its mandate through conducting innovative research in forestry and allied natural resources for sustainable development, capacity building and technology transfer in line with the 7th Strategic Plan (2022-2027). The Institute developed quality forest and tree germplasm to support national agenda of achieving and maintaining a minimum of 30% tree cover by 2032; development of forest and tree-based technologies and innovations for sustainable forest management, blue economy and climate change mitigation and adaptation; and, improved forest based livelihoods through gender sensitive Nature Based Solutions (NBS) for sustainable socio-economic development and wealth creation.

The Institute collected 47,192kg of tree seed from 80 different species, an increase from about 17 tonnes (16,961.50 kg) in the year 2021 - 2022, and intensified distribution of seeds, seedlings and potting bags to specific users countrywide, through partnership with the communities and County governments. This initiative is part of the Government National Tree Growing and Rangeland Restoration Programme that aims to grow 15 Billion trees to achieve at least 30% tree cover by 2032. The Institute continued with monitoring and verifying tree growing and survival through Jazamiti App; dissemination of forestry technologies and information, engagement with diverse stakeholders to expand linkages and partnerships, enhance resource mobilization and technical capacity.

During the year under review, the Institute continued to facelift facilities in headquarters and regional centres as well as development of eleven seed infrastructure across the country as part of national strategic initiative, safeguarding research plots and probing new land for expansion. The Institute continued with policy formulation, implementation of four (4) Human Resource Management Instruments as well as business re-engineering through implementation of an Enterprise Resource Planning (ERP) and completion of data centre for automation - digitization and safeguarding forestry research.

In conclusion, the Institute faced challenges including staff resourcing, inadequate land for research, low funding, and COVID 19 pandemic thus straining operations and maintenance. However, I wish to appreciate the Board of Directors for continued strategic direction and oversight. Our clientele for relentless support, our service providers for their continued collaboration and loyalty, and finally, the dedicated and talented staff who have shown unwavering commitment to their duties.

I also extend our gratitude to the Government of Kenya, through The National Treasury and the Ministry of Environment and Forestry; Development Partners and all other stakeholders for their cooperation and support in accomplishing the Institute's mandate.

Joshua Cheboiwo (PhD)

DIRECTOR, KEFRI

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Corporation Secretary &
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Partnership and
Res. Mobilization

Ms. Mary Miingi
GM, Enterprises

Background

Kenya Forestry Research Institute (KEFRI) is a State Corporation established in 1986 under the Science and Technology Act (Cap 250) which has since been replaced by the Science, Technology and Innovation Act No. 28 of 2013 to undertake research in forestry and allied natural resources, generate, promote and improve technologies for sustainable developed.

Vision

A world class Centre of excellence in forestry and allied natural resources research for sustainable development.

Mission

To conduct research and provide information and technologies for sustainable development of forests and allied natural resources for socio-economic development

Mandate

- Conduct research in forestry and allied natural resources
- Disseminate research findings to stakeholders
- Building capacity of stakeholders and
- Establish partnerships and cooperate with other research organization and institutions of higher learning in joint research and training

Core Values

- Teamwork
- Healthy environment
- Professionalism
- Partnership
- Innovation
- Creativity
- Customer focus

CHAPTER ONE

1.0: TREE SEED DEVELOPMENT AND PRODUCTION

Forestry plays a key role in the socio-economic development of Kenya, contributing about 3% to Kenya's GDP and 10% of the non-monetary economy. It is estimated that the formal forest sector employs about 50,000 people directly and about 600,000 indirectly, making it an important source of employment particularly in the rural areas. Forests and trees supply over 90% of the rural and peri-urban energy needs. Forests are also are home to many organisms. In addition, forests and trees provide important ecosystem services that include; conservation of water catchment areas, soil protection, and carbon sequestration..

KEFRI plays a significant role in various climate change mitigation interventions by developing technologies for; restoration of the country's forest cover, rehabilitation and restoration of degraded forests and riverine vegetation, agroforestry, alternative energy sources. The Institute also supports continuous re-establishment of plantation forests as required.

The Kenya Government previously had a target of achieving and maintaining 10% tree cover by 2022. The seed KEFRI seed production and distribution activities made major contribution in enabling the Government to meet the target of achieving at least 10% tree and forest cover as well as requirements of numerous tree planting programmes within the country and outside. After surpassing this target, the Government launched an ambitious 10- year Programme to grow 15 billion trees by 2032. This Programme, anticipated to increase tree cover of the country from the current 12.13 percent to 30 percent by 2032 and, KEFRI still stands as the key players through provision of quality seed and seedlings.

Research and development in tree seed development, production, storage, and distribution plays a key role in enabling this increase. Provision of high quality germplasm is a key aspect necessary for this development in forestry to meet demands for forest products and services, and is therefore one of the key areas for forestry research and development. Development, production and conservation of tree germplasm in KEFRI is continuous and involves: establishment of seed stands and seed orchards of highly demanded tree species; seed collection; processing; sale or distribution and storage.

The bulk of this production is for planting outside forest reserves, and the balance will be for replanting forestland which has been cleared but not replanted, or whose stocking below capacity.

1.1 Establishment of tree seed sources

Demand for quality tree seed and seedlings for high value commercial species is high due to increased national effort towards reforestation by government, public and private organizations, and tree growers in general. There is however inadequate supply of seeds and seedlings of these species due to insufficient seed sources (seed orchards and seed stands) from which high-quality seeds can be obtained. KEFRI is mandated to produce high quality tree seed to meet demand by various tree planting programmes.. Establishment of seed stands and seed orchards guarantees provision of high quality tree seed in sufficient quantities. During the year 2022 – 2023, KEFRI continued to undertake establishment and management of tree seed sources ie seed orchards and seed stands.

1.1.1 Establishment of seed orchards

During the year 2022 -23, the various KEFRI Eco regions conducted different activities on the seed orchards. CHERP produced Cupresus lusitanica grafts in preparation for planting the orchard next season; RVERP planted a total of 3.6 ha ; whilst DERP and RVERP carried out maintenance of the existing seed orchards as shown in Table 1.1. Seed of improved Melia is currently under production in two seed orchards in Tiva -Kitui County and Kibwezi- Makueni County.

Table 1.1: Seed orchards established / maintained by KEFRI in different Centres / sites in 2022-23

SPECIES		**CENTRE / LOCATION**	**HECTARES**
Casuarina equisetiforlia	CERP		I ha
Cupressus lusitanica planted 1000 grafts raised for April - May rains	CHERP	Muguga seed orchard	12 ha
Improved *Melia volkensii*	DERP Under maintenance and under production	Kibwezi- Makueni County	
Cupressus lusitanica	RVERP	Makutano Lalakwen block	2.6 ha
Pinus patula		Compartment 6H	1 ha
Gmelina arborea	LVERP	ATC Maseno	1 ha
Grevillea robusta		Nyandiwa	1 ha
		Sangalo	1 ha
Maesopisis eminii		Kaimosi	1 ha
		Sangalo	1 ha
		Kaimosi	2 ha
Eucalyptus urophylla	LVERP (Ramogi)	Wambsa Primary School in Bondo sub County	1 ha
Eucalyptus maculata			
Eucalyptus citrodora		Nyagera Primary School in Usigu Division Bondo	
Eucalyptus camaldulensis			
TOTAL			**25.6ha**

1.1.2 Establishment of seed stands

During the fiscal year 2022-23, 25.6 ha of seed stands in the different eco-regions underwent maintenance. The maintenance operations involved; slashing between the rows, spot weeding, and pruning (brushing to remove large lower branches).

The seed stands were maintained in the different eco-regions as shown in Table 1.2.

Table 1.2: Tree seed stands established by KEFRI in different Centres in 2019 - 2020

SPECIES	CENTRE	LOCATION	HECTARES
	CERP	Gede	
		Gede	
Eucalyptus urophylla	CHERP	Muguga	2 ha
Brachylenia huillensis	CHERP	Nyeri	2 ha
Acacia tortilis seed stand	DERP (maintenance & assessment)	Tiva	3.6
Acacia tortilis seed stand		Kibwezi	2.5
M. oliefera		Kibwezi	1.0
Eucalyptus grandis seed stand ex. Zimbabwe	RVERP (maintenance & assessment	Turbo	2
Grevillea robusta seed stand (site 1) established in 2021		Soin Agricultural Training Centre	3
Grevillea robusta seed stand (site 2) established in 2019		Kipsinende Technical Training Institute in Fort Tenan	2 ha
Eucalyptus camaldulensis	LVERP Maintenance activities	Nyandiwa in Siaya County	2
Gmelina arborea		Nyandiwa Got Jope	1ha
Grevillea robusta		Sangalo	1ha
		Kaimosi	1 ha
Eucalyptus grandis		Kaimosi	1ha
		Sangalo	1 ha
Gmelina arborea		Vet Farm Maseno	1ha
TOTAL			**25.6ha**

1.2 Seed collection, processing and distribution

Production of high quality tree seed involves several steps including: identification of seed sources; seed survey to determine timing of collection in a particular seed source; actual seed collection; seed processing i.e. seed extraction, drying and cleaning; and quality testing before storage and distribution to the various consumers.

1.2.1 Seed collection

Kenya Forestry Seed Centre, a section within KEFRI, is the principle supplier of high quality tree seed both nationally and within the region. The Kenya Forestry Seed Centre collects tree seed from selected and established seed sources and seed orchards.

Activities of KFSC include; production, collection, testing, storage and distribution, These activities are undertaken under five KEFRI Eco-regional research programmes and various Sub-regional centres. KEFRI collects tree seed covering all ecological regions of Kenya. The Central Highlands Eco-Region Research Programme (CHERP) has two seed collection stations of Muguga and Nyeri, Drylands Eco-region Research Programme (DERP) has three stations of Kitui, Kibwezi and Garissa, Coast Eco-region Research Programme (CERP) has three stations of Gede, Lamu and Taita Taveta, Rift Valleys Eco-Region Research Programme (RVERP) has two stations of Londiani and Turbo, and Lake Victoria Eco-Region Research Programme with three stations of Maseno, Kakamega and Migori.

After collection, all the tree seed was processed and subjected to quality tests before any distribution was done to clients. The seed testing was done as per International Seed Testing Association (ISTA) rules. These rules that require various parameters are determined including; seed weight (number of seed per kg), purity, moisture content, and germination. These quality measures apply for every seedlot. Seed testing was done for fresh seed as well as re-trials for seed that had been under storage for more than 6 months.

Tree seed from KFSC plays a major role in development of forestry and allied natural resources in order to meet demand for forest products and services. The seed centres at KEFRI have capacity to supply adequate quantities of tree seeds to raise approximately 1 billion seedlings annually.

In year 2022 - 2023, KEFRI collected 47,192 kgs of tree seed (Table 1.3) an increase from 16,961.50 kg in the year 2021 - 2022. The seed was collected from a range of over 80 different tree species (Table 1.4).

Of this total, 21,132 kg were delivered to Muguga stores by 30th of June 2023 while 23,281 kg were held at the various seed collection centres at the under the Eco-region Programmes (Table 1.3).

Tree seed from KFSC was consumed by various stakeholders including; Kenya Forest Service, individual farmers, schools, NGOs, and private companies.

Table 1.3: Summary of tree seed collection and initial distribution in FY 2022-2023

NO	SEED COLLECTION CENTRE	SEED AT THE CENTRE	SEED DELIVERED TO MUGUGA (KG)	TOTAL SEED COLLECTED (KG)
1	Migori	925	912.56	1,867
2	Ramogi	655	631.45	1,320
3	Maseno	2140.99	2155.01	4296
4	Kakamega	4103	0	4103
5	Londiani	2007.5	3988.9	5996.4
6	Turbo	200	1813.3	1991.75
7	Marigat	1159.8	52.2	1212.5
8	Turkana	294	686.6	980.3
9	Muguga	150	3444.7	3873.9
10	Nyeri	600	4172.9	4865.9
11	Rumuruti	104	219.5	306
12	Kitui	1692.55	746.35	2439.9
13	Kibwezi	6039	46.2	6125
14	Garissa	1296	595.9	1896
15	Gede	1980.5	921.55	2904.18
16	Taita	930	0	1490
17	Lamu	584	745.8	1546
TOTAL		**23,281**	**21,132**	**47213.83**

Table 1.4: Amount of seed collected per tree species in the FY 2022 - 2023

NO	SPECIES	WEIGHT (KG)
1	*Acacia abyssinica*	**170**
2	*Acacia elliotar*	**105**
3	*Acacia gerrardii*	**1042.2**
4	*Acacia mearnsii*	**54.7**
5	*Acacia melanoxylon*	**98**
6	*Acacia mellifera*	**231.8**
7	*Acacia nilotica*	**642.9**
8	*Acacia nubica*	**393**
9	*Acacia polyacantha*	**617.5**
10	*Acacia senegal*	**82**
11	*Acacia seyal*	**185.5**
12	*Acacia sieberiana*	**151**
13	*Acacia tortilis*	**571.5**
14	*Acacia xanthophloea*	**267**
15	*Acacia spp (any other species)*	**221.4**
16	*Acrocarpus fraxinifolius*	**47**
17	*Adansonia digitata*	**764.91**
18	*Adenanthera pavonina*	**197.16**
19	*Afzelia quanzensis*	**1212.74**
20	*Azadirachta indica*	**891.26**
21	*Balanites aegyptiaca*	**1761.6**
22	*Berchemia discolour*	**37**
23	*Callitris robusta*	**96**
24	*Calodendrum capense*	**26**
25	*Casuarina equisetifolia*	**129.41**
26	*Casuarina jughuniana*	**27**
27	*Combretum schuminii*	**52.07**
28	*Cordia Africana*	**1732**
29	*Croton macrostachys*	**401**
30	*Croton megalocarpus*	**3201**
31	*Cupressus lusitanica**	**2015.1**

NO	SPECIES	WEIGHT (KG)
32	*Dalbergia melanoxylon*	**40**
33	*Delonix regia*	**199.23**
34	*Dovyalis caffra**	**165.4**
35	*Eucalyptus camaldulensis*	**500**
36	*Eucalyptus globulus*	**154.9**
37	*Eucalyptus grandis*	**776.15**
38	*Eucalyptus saligna*	**35**
39	*Faidherbia albida*	**223.7**
40	*Gmelina arborea*	**223.3**
41	*Grevillea robusta**	**124**
	Grilicidia sepium	**20**
42	*Harungana madagscarensis*	**450**
43	*Hyphaenea coriacea (palm spp)*	**649**
44	*Hyphaenea coriacea (palm spp)*	**488.33**
45	*Jacaranda mimosifolia*	**61.5**
46	*Juniperus procera*	**26.5**
47	*Leuceana lucocephala*	**617**
48	*Leucaena diversifolia*	**156**
49	*Maesopsis eminii*	**1712**
50	*Majidea zanguabarica*	**4.57**
51	*Markhamia lutea*	**399**
52	*Melia azedarach*	**660**
53	*Melia volkensii (nuts gen)*	**4055**
54	*Melia volkensii (nuts orch)*	**1016**
55	*Moringa oleifera*	**1841**
56	*Moringa stenopetala*	**17**
57	*Olea africana*	**654.1**
58	*Olea capense*	**302.5**
59	*Osyris lanceolata*	**6.3**
60	*Paramacrolobium coeruleum*	**75.08**
61	*Parkinsonia spp (any species)*	**131**
62	*Pinus patula*	**285.5**

NO	SPECIES	WEIGHT (KG)
63	*Podocarpus falcatus*	**2313.4**
64	*Podocarpus latifolia*	**50.5**
65	*Polyalthia longifolia*	**60.23**
66	*Schinus molle*	**203.5**
67	*Sclerocarya birrea*	**792.64**
68	*Senna siamea*	**731.52**
69	*Senna spectabilis*	**1183**
70	*Sesbania sesban*	**233.7**
71	*Spathodea campanulata*	**200**
72	*Tamarindus indica*	**1362.5**
73	*Tarchonanthus camphoratus*	**20**
74	*Tectona grandis*	**241.8**
75	*Terminalia brownii*	**1801.6**
76	*Terminalia cattapa*	**45.33**
77	*Terminalia mentalis*	**475**
78	*Terminalia prunoides*	**752**
79	*Terminalia spinosa*	**240.08**
80	*Tipuana tipu*	**101**
81	*Trichilia emetic*	**56**
82	*Vitex keniensis*	**1790**
83	*Vitex payos*	**130**
84	*Ximenia americana*	**35**
85	*Zizyphus spp*	**538.16**
TOTAL		**47,213**

1.2.2 Improvement of Seed Production Facilities and Activities

During the year under review, 2022 - 2023, the annual meeting to set targets took place during 3rd quarter and seed allocations for 2023/2024 were circulated to the concerned seed collecting staff. Construction of 11 new seed centres continued in different stages. Tree seed processing and storage facilities within various eco-region / centres would also be improved. These centres would facilitate collection of additional tree species and widen genetic base for species for some species already being collected at existing centres as well as provided easy access to quality seed by institutions and tree grower close to the new seed centres

Fig 1. 1 Demonstration of equipment for seed collection methods

Fig 1.2: Melia adaderach tree and seed

Fig1.3: *Dalbergia melanoxylon* tree and seed

CHAPTER TWO

2.0: PRODUCTION OF PLANTING MATERIALS

KEFRI support various afforestation programmes and conservation of tree genetic resources through production of planting materials for various categories of tree species. In the year 2022 – 2023, the Institute continued to raise seedlings for: species that are difficult to propagate (Table 2.1); superior genetic quality some of which KEFRI uses in raising high quality seed sources (Table 2.2); and assorted tree species to meet demand from various tree planting programmes and stakeholders (Table 2.3).

Table 2.0: Species difficulty to propagate

Species	**Site**	**Number of Seedlings Produced**
	CEERP	
Bamboo spp.	DERP	5,500
Osyris lanceolata		1100
Vitex payos		171
Ximenia americana		144
Dalbergia melanoxylon		152
Sclerocarya birrea		61
Dendrocalamus tulda	CHERP Muguga	140
Bambusa polymorpha		4,342
Bambusa bambos		800
Dendrocalamus asper		3,124
Bambusa longinternode		230
Bambusa vulgaris		112
Sub-total (various bamboo species)		**8,748**
Bambusa vulgaris	RVERP	8,054
Bambusa striatta		4,967
Giant bamboo		12
Bambusa Asper		6,733
Yunensis		200
Bambusa abyssinica		210
Bambusa bambus		450
Dendrocalamus giganteus		23
Yushania bamboo (indigenous bamboo)		1,232
Sub-total (various bamboo species)		**21,881**
Podocarpus falcatus & Juniperus procera were collected from Tenges Forest in Baringo	LVERP	project is ongoing and it is included in the 2023-24 FY
Olea europeae from Eburu Forest Nakuru		
Bamboo		7,262
Sclerocarya birrea		2,891
Albizia lebbeck		2,290
Balanites aegyptiaca		1,310
Sub total		**13,753**

2.1: Planting material raised in year 2020-21 for superior genetic quality

Species	Site	Number
Cupressus lusitanica	CHERP	1100 grafted seedlings
Grafted Grevillea		1000 (target 500)
P. patula propagules	RVERP (Turbo & Londiani)	1000
Gmelina arborea grafts	CERRP	Not provided
Improved melia grafts	DERP	1800

In addition, KEFRI raised more than 1,643,321 seedlings of asssorted species in its nurseries across its centres. Selection of species for seedlings in each centre was based on suitability of species for the specific ecological conditions (species-site matching). The seedlings were raised for; establishment of plantation within the Institute, sales, and in some cases free issues to the public and institutions such as schools. In the high rainfall areas both plantation species and indigenous species were raised comprising *Eucalyptus grandis, Cupressus lusitanica, Casuarina equiesetifolia, Grevillea robusta and Pinus patula. Indigenous species included:, Croton megarlocarpus, Makhamia lutea, Olea africana,* and *Vitex keniensis* among others.

In the drylands 65 species were raised as follows: *Acacia elatior, Acacia geradii, Acacia mellifera, Acacia polyacantha, Acacia Senegal, Acacia seyal, Acacia tortilis, Acacia xanthophloea, Adansonia digitate, Annona cherimoya, Azadirachta indica, Balanites aegyptiaca, Bambusa bambus, B. dendrocalamus, Bamboo polymorpha, Bambusa vulgaris, Carica papaya, Carissa edulis, Cashewnut, Citrus lemon, Commiphora myrrha, Croton megalocarpus, Dalbergia melanoxylon, Delonix regia, D. strictus, Desert rose, Dovyalis caffra, Eucalyptus camaldulensis. Faidherbia albida, Gmelina arborea, Grevillea robusta, J. mimosifolia, Kigelia Africana, Lawsonia inermis, L. leucocephala, L. eriocalyx, Mangifera indica, Markhamia lutea, M. volkensii (Improved), Moringa oleifera, Moringa stenopetala, Osyris lanceolate, O.abbysinica, Parkinsonia aculeate, Passiflora edulis, Persea americana, Phoenix reclanator, Psidium guajava, Saraca asoca, Sclerocarya birrea, Senna siamea, Senna spectabilis, Seraca asoca, S. campanulata, Syzygium cuminii, Tamarindas indica, Terminalia catappa, Terminalia brownii, Terminalia mentall, Terminalia spinose, Thevetia peruviana, Vetiver grass, Vitex payos, Ximenia Americana, Ziziphus macronata*

Table 2.2: Seedlings raised in the Eco-regions in FY 2022 – 23

Eco-region	Centres	No. of seedlings raised for 2022-23
CERP	To be updated on receipt of report	Pending
DERP	Production for Region which included: • Kitui Centre, • Tiva field station • Kibwezi Sub centre • Garissa sub-centre • Wajir field station • Hola field station	**189,284** One of the key species in the dry lands raised in Kibwezi, Tiva and Kitui Centre Tree nurseries was Melia seedlings.
CHERP	Total production for Region which included Muguga Nyeri and Rumuruti	**758,905**
RVERP	Production for Region which included: Londiani, Turbo, Marigat, Turkana	**379,430**
LVERP	Total production for Region which included Maseno, Kakamega, Ramogi, Migori and Kuja River	**315,702**

CHAPTER THREE

3.0: DEVELOPMENT OF FORESTRY TECHNOLOGIES

In the pursuit of fostering sustainable forestry practices, KEFRI has committed itself to a comprehensive set of strategic objectives designed to address the intricate challenges posed by the evolving environmental landscape These strategic objectives are: to generate technologies for establishment and management of forest plantations, trees on-farms and enhance production of superior germplasm for priority tree species for different agro-ecological zones, to generate rehabilitation technologies for adaptation to climate change, sustainable forest landscapes, woodlands, wetlands and riparian eco-systems, to develop technologies for efficient processing and utilization of wood and nonwood forest products, and to formulate forestry policies for sustainable forest management and improved livelihoods.. This chapter presents the progress made in KEFRI's unwavering dedication to the development of forestry, as the country strategically navigates the intricate interplay of ecological preservation, climate adaptation, and socio-economic upliftment.

3.1: Development of nursery standard potting media for tree seedlings production

The country has witnessed a growing demand for high-quality tree seedlings, driven by the need for tree establishment and greening activities. However, the lack of a standardized nursery soil mixture has led to variations in seedling quality, hindering successful agroforestry systems and plantation establishment. Forest soils are the main substrate used in preparing the potting mixtures used in raising of tree seedlings. Forest soils have a myriad of benefits ranging from nutrient composition to its structure stability. The main physical characteristics desired in potting mixtures are: optimal proportions of air and water in soil, adequate infiltration rate for water, high resistance to compaction, and low adhesion of soil to seedling roots. Dependence on forest soil is increasingly becoming a concern due to the negative environmental impacts associated with digging and transfer of forest soils to the nurseries. Moreover, forest soils in different parts of the country have unique challenges. For example, in the coastal region, the soils are highly saline with nutrients such as phosphorous being fixed and therefore unavailable for seedling growth. Such soils affect forest nursery production through growth losses, stunting, and sometimes seedling mortality. There is therefore need to provide a cost effective, viable and sustainable alternative to forest soils to farmers and nursery operators for production of vigorous tree seedling nursery stocks.

In the year under review, work at the coast region was initiated to compare the suitability of forest soil, farm soil and peat moss for use as tree nursery potting media when augmented with different ratios of livestock manure, Double Ammonia Phosphate inorganic fertilizer and foliar fertilizer using *Casuarina equisetifolia* and *Eucualptus camaldulensis* as the test trees. The effect of nutrient sources on the survival, number of leaves and height was statistically significant. Survival, height and foliage development was best when 5 parts of livestock manure was mixed with substrate media. Performance of the tree seedlings was much better in peat-moss than in the other two media and hold good promise for use as an alternative to forest soil subject to validation with a wider range of tree species.

Fig. 3.1: Experimental set up at the nursery at KEFRI Gede

Fig. 3.2: Assessment of seedling performance in the nursery

Fig. 3.3: Performance of seedlings at week 3

Fig. 3.4: Casuarina and Eucalyptus seedlings performance at week 8

Fig. 3.5: *Cupressus lusitanica* seedlings under different soil mixtures

CHAPTER FOUR

TECHNOLOGY INNOVATION

4.0 Development of bamboo timber laminates for furniture production

The development of bamboo timber laminate for furniture production is a response to the economic and environmental challenges faced by Kenya. With a drastic decline in forest cover and increasing demand for furniture, the project aims to introduce an environmentally friendly alternative to use of traditional wood sourced from hardwood and soft wood tree species . The global bamboo furniture market is on the rise, driven by the growing popularity of eco-friendly products. The primary objective is to develop furniture from bamboo timber laminate, promoting sustainable practices in the furniture industry.

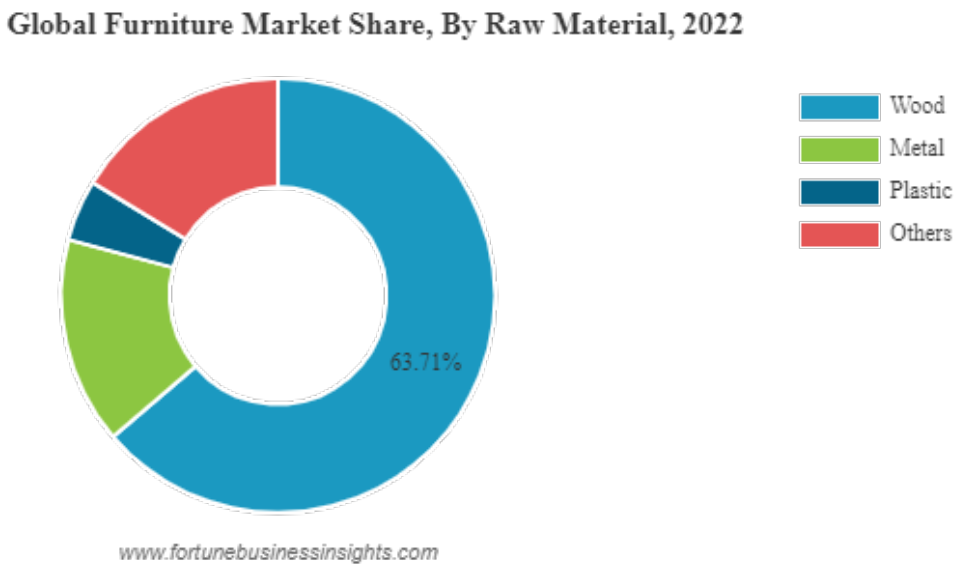


Fig. 4.1: Global furniture market share by raw materials, 2022

Bamboo culms were sourced from KEFRI Muguga, emphasizing mature culms to minimize insect and fungal attacks. Processing involved cutting culms into strips, smoothing nodes, and immersing them in a preservative solution for 10 days. The treated strips were air-dried, ensuring a moisture content of less than 10%. Lamination included categorizing slats as surface or substrate material, arranging them for increased strength, and gluing them together under hydraulic pressure. The finished bamboo boards underwent a finishing process, including cutting, sanding, and conditioning.

Fig. 4.2: Splitting bamboo culms

Fig. 4.3: Bamboo culms submerged in preservative

The laminated boards were successfully transformed into creative furniture pieces, including table tops and chair seats. The unique arrangement of bamboo slats allowed for diverse design possibilities, showcasing the versatility of bamboo timber laminate. The use of laminated bamboo presents an innovative approach to furniture production, offering a sustainable and durable alternative to traditional materials. The flexibility in design allows for creative and unique furniture pieces. KEFRI will consider scaling up production and exploring additional applications for laminated bamboo in the furniture industry. Emphasizing the environmental benefits of bamboo timber laminate could also contribute to increased market acceptance and demand.

Fig. 4.4: Finished Bamboo boards

Fig. 4.5: Laminated table top with a unique arrangement of bamboo slats glued together

4.1: Development of *Ximenia americana* seed oil body lotion

KEFRI undertook a groundbreaking project in the financial year 2022-2023, of developing a body lotion using Ximenia americana seed oil, a valuable resource found in dry and semi-dry regions of Kenya. Ximenia americana, commonly known as wild olive or sour plum, yielded a seed oil that demonstrated significant potential in the cosmetic industry. The oil, extracted from the kernels, exhibited stability to oxidation, making it an ideal ingredient for skincare products with natural ingredients. Recognizing its value in moisturizing and revitalizing the skin, the project aimed to develop a body lotion to capitalize on the species' potential economic and environmental benefits and to add onto skincare products.

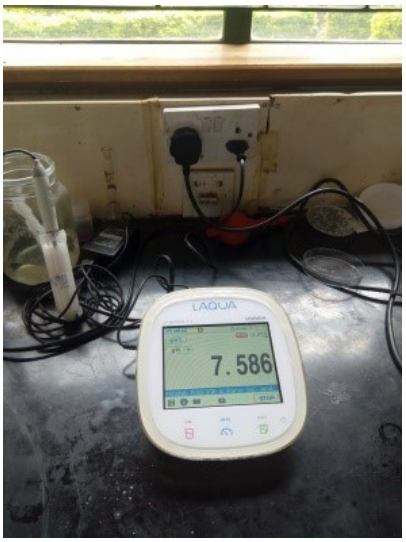
The formulation of the body lotion adhered to the Kenya standard for cosmetic specifications. Various tools and apparatus, including measuring cylinders, stainless steel sufuria, and filter papers, were employed in the meticulous process. The ingredients comprised water and oil phases, incorporating Ximenia oil along with other essential components such as glycerin, lanolin, and emulsifying agents.

The production process followed stringent guidelines, ensuring adherence to cosmetic specifications. Weighing and heating the water and oil phase ingredients separately, the contents were then mixed meticulously, achieving homogeneity. The lotion underwent rapid cooling, fragrance addition, pH monitoring, and subsequent dispensing into cream containers. To guarantee quality, a sample was sent to the Kenya Bureau of Standards (KEBs) for product verification.

Processing of lotion

Stirring after adding fragrance

Processed oil



pH monitoring

Packaging &labeling

Ready for use

The ratios of components used in the lotion, detailed in Table x, showcased the careful selection and balance of ingredients for optimal skincare benefits. Ximenia seed oil, at 4.0%, played a crucial role in skin softening and protection. The lotion, enriched with emollients, preservatives, and humectants, demonstrated the versatility of Ximenia oil in cosmetic formulations.

Table 4.1: Ratios of components used for lotion making, and their roles

Ingredient	Composition of ingredients (%)	Function
Ximenia seed oil	4.0	Skin softening ,protection and as emollient
Distilled Water	84.8	Solvent to disperse ingredients
Glycomonostearate (GMS)	0.5	Emulsifier (allows the phases to remain mixed)
Lanolin	1.0	Emollient
Ocptiphen	0.5	Preservative
Cetyl sterolalcohol (CSA)	1.0	Emulsifier, thickener and stabilizer
Triethanolamine(T.E.A)	0.1	Neutralizes fatty acids, thus raising the pH, and solubilizes oils to enhance their solubility in aqua phase
Petroleum jelly	1.0	Skin softening
Wax	1.0	Viscosity enhancement and emulsification properties
Glycerin	5.0	Humectants
Stearic acid	1.0	Thickening agent
Tea tree oil(Fragrance)	0.1	Antimicrobial agent/Customer satisfaction/ attraction

The successful development of Ximenia americana seed oil body lotion underscores the potential for further exploration of skincare products utilizing this valuable natural resource. The project's outcomes indicate the feasibility of expanding the product line to include soap, shampoo, body wash, facial creams, and lip balm. Importantly, the initiative extends beyond product development to community empowerment, as training local communities on the value chain ensures enhanced livelihoods and contributes to environmental conservation.

In the upcoming year, KEFRI will consider scaling up production and diversifying the range of skincare products derived from Ximenia oil. Additionally, efforts will be directed towards comprehensive training programs for local communities to maximize the socio-economic and environmental benefits of this valuable resource. This initiative aligns with KEFRI's commitment to sustainable practices and biodiversity conservation.

The successful development of the Ximenia americana seed oil body lotion exemplifies KEFRI's dedication to innovation, sustainability, and community engagement in the pursuit of a greener and economically viable future

4.2: Development of guava jam

In the fiscal year 2022-2023, KEFRI embarked value addition to guava fruits through development of jam. Guava, known for its versatile applications and high market potential, presented an opportunity for value addition, contributing to improved livelihoods and environmental conservation.

Guava, belonging to the Myrtaceae family, is a fast-growing tree known for its fleshy, aromatic fruits. While widely cultivated in Africa, the potential for its domestication and commercialization in Kenya remains largely untapped. Guava fruits, consumed raw or processed into various products, including jam, hold promise for both fresh consumption and industrial processing.

The primary objective of this initiative was to develop guava jam, addressing the limited research and development in structured guava value chains in Kenya. By harnessing the benefits of indigenous fruits like

guava, KEFRI aimed to create awareness, enhance community livelihoods, and contribute to environmental conservation, particularly in arid and semi-arid regions.

Fig.4.7: Ripe guava fruits

Mature guava fruits were harvested from Makuyu in Murang'a County, and processed into jam at KEFRI's Karura laboratories. The process involved preparation of fruits and ingredients included guava pulp, sugar, pectin, and other essential components to ensure flavor, set, and preservation. The process adhered to strict quality control measures, including pH monitoring and sterilization.

The guava jam met the required standards, with a °Brix score of 64.9%, surpassing the minimum 60% set by the Kenya Bureau of Standards (KEBS). Microbiological tests for E.coli, Salmonella, Yeast, and mould demonstrated compliance with safety standards, confirming the quality and safety of the guava jam. The absence of harmful elements like Arsenic and Lead further validated the product's safety.

Fig.4.8: Blending and sieving of mixture

The successful development of guava jam from the indigenous fruit showcased the feasibility of value addition to enhance the shelf life of seasonal fruits. The jam exhibited desirable characteristics in taste, color, aroma, and consistency, making it comparable to commercial brands. Notably, the guava jam production passed KEBS verification tests, emphasizing its quality and safety.

Fig.4.9: Monitoring to ensure the correct pH is maintained

Fig.4.10: Guava jam packaged for use

It is recommended that further testing on the shelf life of the guava jam be conducted to ensure prolonged product quality. Additionally, a comprehensive protocol for guava jam processing should be developed for standardized production. Community training initiatives on guava value addition can contribute to poverty alleviation and environmental conservation, aligning with KEFRI's vision and commitment to sustainable practices.

The development of guava jam stands as a testament to KEFRI's dedication to innovation, community empowerment, and environmental stewardship. The initiative aligns with national development goals, contributing to the sustainable utilization of forest resources and the economic well-being of local communities.

4.3: Assessment of the Distribution and Ecological Impacts of Opuntia ficus-indica and Opuntia stricta in Laikipia County

Opuntia species, introduced to Laikipia over 50 years ago for ornamental and live fencing purposes, have become aggressively invasive, covering vast areas of land. Particularly, *Opuntia stricta* has spread extensively in Laikipia North, posing significant challenges to conservation areas, rangelands, and cultivation zones. The invasion has led to negative impacts on community livelihoods, livestock production, and overall environmental health. KEFRI in FY 2022 = 2023 undertook the a study to systematically quantify these impacts and contribute to the development of effective management strategies. The specific objectives were to assess the ecological impacts of *Opuntia stricta* on communities and the environment, determine the field status of Opuntia species and factors facilitating their establishment and spread, and evaluate existing conservation plans and identify key stakeholders for the management of *Opuntia stricta.*

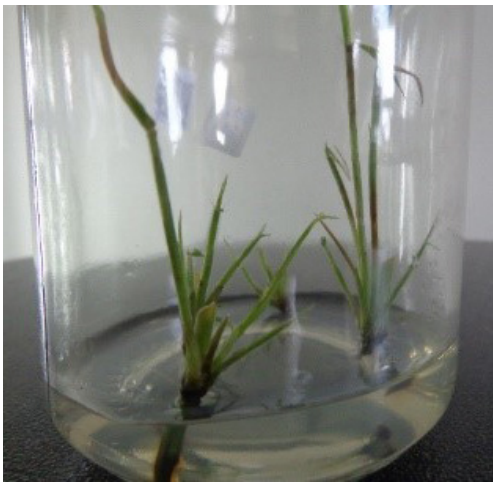
The study employed a cross-sectional design, utilizing survey research and questionnaires to collect data from 100 randomly selected respondents in low, moderate, and highly infested areas within Naibunga Conservancy. Field visits were conducted along transects to identify invaded hotspots, with observations, discussions, and GPS data collection. Experimental plots were established using a completely randomized block design to test control methods.

The study found that Optuntia spreads through various means, including elephants, livestock, and baboons. Its ecological impact includes competition with native species, leading to a categorization of low, moderate, and high infestation areas. Community perception emphasized the negative effects, with economic losses from livestock deaths and health issues such as blindness. Existing conservation measures involve biological control using Cochineal, and the community has shown interest in utilizing Opuntia products.

4.4: Development of Bamboo Tissue Culture Guideline

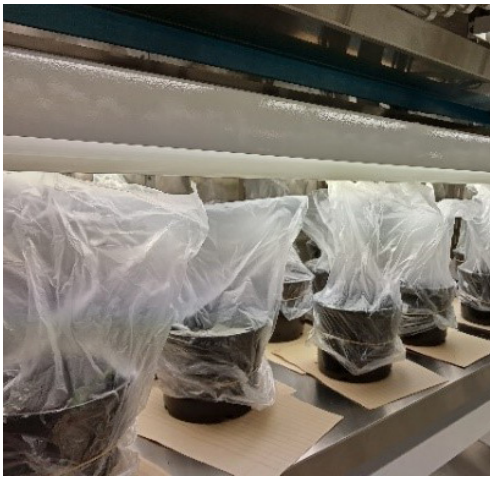
Bamboo, belonging to the family Poaceae, is a versatile plant with over 1600 species. In Kenya, bamboo is of significant economic and environmental value, grown in various counties. Recognizing its potential for poverty reduction and multiple applications, including wood production, charcoal, pulp, paper, and as a vegetable source, bamboo has emerged as a cash crop. The increasing demand for bamboo seedlings poses a challenge in seedling production, prompting the need for advanced propagation techniques such as tissue culture. In the year under review, KEFRI undertook to develop a propagation guideline for raising bamboo through tissue culture, raise tissue-cultured bamboo seedlings and evaluate their performance in different soil acclimatization and hardening media.

Explants of *Dendrocalamus spp.* and *Bambusa spp.* were harvested from well-established bamboo seedlings. Surface sterilization was done using ethanol and sodium hypochlorite, followed by cullus initiation on MS media with varying concentrations of BAP. Shoots were then multiplied and rooted in different media. Acclimatization was carried out in sterile pots with coco peat, followed by hardening in a growth room and later in a glasshouse. The acclimatized seedlings were transplanted to a demonstration site in the open field.



Shoot initiation of *D. membranaceus*

In-vitro rooting of *D. bigasper*



Seedling acclimatization in tissue culture growth room

Potted Bamboo seedlings hardening and acclimatization in growth room

Hardening tissue cultured Bamboo seedlings in root trainers in the glasshouse

Acclimatized tissue cultured Bamboo seedlings readying for planting

Fig.4.11: Tissue-cultured Bamboo propagation process

A draft protocol and a journal manuscript for bamboo tissue culture were prepared during the financial year, based on remarkable results achieved. Different bamboo species showed varied responses to shoot initiation, multiplication, and rooting. Optimal results were observed at specific concentrations of BAP and IBA. Twenty-five tissue-cultured seedlings of various bamboo species were successfully transplanted to a demonstration plot at St. Paul's University in Limuru. Ongoing monitoring includes site maintenance and growth performance assessment. This initiative marks a significant step in advancing bamboo cultivation techniques, ensuring sustainable and efficient seedling production. The successful field planting at the demonstration site demonstrates the practical applicability of tissue-cultured bamboo, contributing to Kenya's forestry and environmental goals.

CHAPTER FIVE

5.0: DISSEMINATION AND PUBLICITY ACTIVITIES

This Chapter is a summary of the implementation of three key strategic objectives namely:
to disseminate forestry research technologies and enhance institutional research and development capacity; to strengthen institutional capacity for research and development; to enhance corporate communication and publicity, within the reporting period 2022/2023.

5.1: Field Days and Open days:

The Institute in the Year under review, organized 41 field days as core mandate reaching out diverse stakeholders that benefited with forestry technologies and innovations on environmental conservation and economic transformation. The demonstration comprising: establishment of tree nursery, management and utilization of bamboo and propagation of valuable tree species namely: mangroves, Gmelina arborea, Casuarina, Grevillea robusta, Melia volkensii, Eucalypts, Osyris lanceolate, Terminalia brownii, Pinus species were also incorporated during the open days.

Technologies on restoration of degraded forests and landscapes, conservation of riverine and other watershed using bamboo and vetiver grass, agroforestry practices, participatory forest management (PFM), soil and water conservation; management of invasive species, specifically Dodder (Cuscuta), Cestrum, Lantana camara and Mathenge *(Prosopis juliflora)*.

5.2: Capacity building to partners and communities for adoption and upscaling of forestry technologies

In 2022/2023, KEFRI build capacity of stakeholders - youth, women groups and the underprivileged, impacting on skills, livelihood and environment. Majorly, initiatives contributing towards achievement of Vision 2030 objectives of increasing national tree cover to at least 30% by 2030, were prioritised. Others include tree seed production:-collection, processing and handling; tree nursery establishment, management and production of quality seedling; bamboo utilization and value addition, environmental conservation and livelihood improvement, greening Kenya initiative, sustainable forest management; restoration of degraded forest areas, endangered/threatened species, nature-based strategies on climate change resilience and mitigation, payment of eco-system services, forest health management, tree sawing on farm, value addition to wood and non-wood products e.g. value addition to Mondia and bamboo, bio-energy, efficient charcoal production, tree-crop integration to agriculture .

5.3: Dissemination of Forestry Technologies through Exhibitions, Print and Electronic Media

Under the Performance Contract Fiscal Year 2022/2023, KEFRI disseminated as well as demonstrated 43 forestry technologies/ innovations and related information to various stakeholders. Largely, three main approaches; i.e; personal level, group and mass contact were used to boost outreach and visibility.

5.4: Exhibition at the Agricultural Society of Kenya (ASK) Show

The institute participated at the Agricultural Society of Kenya (ASK) show across the country to disseminate forestry technologies /research findings under the show theme 'Promoting Climate Smart Agriculture and Trade Initiatives for Sustainable Economic Growth'.

The displays were miscellaneous of products and services, latest forestry technologies and innovations, best practices in tree seed production; tree nursery establishment and production of quality planting materials/ germplasm; tree improvement and management, rehabilitation and conservation of degraded environments; aerial seeding; utilization and value addition to wood and non-wood forest products (including charcoal

briquette modern drum kilns). Target publics were farmers, entrepreneurs, students, academician's policy makers amongst other stakeholders.

The ASK show were picking up from the post COVID-19 pandemic, gave farmers and other stakeholders an opportunity to interact with scientists and exchange information on challenges and opportunities facing tree growing and forestry development in the regions. KEFRI scoped trophies at the national, regional and international show levels for various categories including the best stand demonstrating the application of environmental quality standards, seed production and marketing, show theme interpretation- education and research, Non-Agricultural Statutory Board, and best Government stand.

1. Western Kenya Branch Show	June 14th - 17th 2023	Kakamega
2. S.E Kenya National Show	June 6th - 10th 2023	Machakos
3. Eldoret National Show	March 1st - 4th 2023	Eldoret
4. S.W Kenya Branch Show	Oct 5th - 7th 2022	Migori
5. Nairobi International Trade Fair	Sept 25th - 1st Oct 2022	J/Park
6. Baringo Branch Show	Sept 21st - 23rd 2022	Kabarnet
7. Central Kenya National Show	Sept 13th - 16th 2022	Nyeri
8. Mombasa International Show	Sept 6th - 10th 2022	Mombasa
9. Nakuru National Show	July 12th - 16th 2022	Nakuru

Fig.5.1: KEFRI staff in Eldoret show for best performance in various categories

5.5: Participation and exhibiting at the National and the International Events

In 2022/2023, KEFRI participated in eight of the below listed planned national and international events. These events entailed display of specific technologies and innovations, tree planting, donated seedlings to the public institutions in support of the national tree planting campaign to attain 30% tree cover by 2032:

1. The 6th Edition of the Kaptagat Annual Tree Planting event held on 15th July 2022 to restore Kaptagat forest ecosystem.
2. World Cleanup Day, 17th September 2022, Diani Kwale County
3. International Bamboo Day (IBD) 2022 on 19th September 2022 at Rapogi, West Songhor in Kisumu County.
4. World Wetlands Day Celebrations, theme: Wetlands Restoration at Enkung'u Enkare in Narok County, on 2nd February 2023
5. International Day of Forests (IDF) on 21st March 2023 at Kereita Forest, Kiambu County
6. The National Tree Planting Day at Shin Hyun Primary School, Mukothima Tharaka Nithi County, 21st April 2023
7. World Environment Day (WED) the 50th celebration, held in Nakuru National Park, Nakuru County under the theme "Solutions to Plastic Pollution", on 5th June 2023
8. World Day to Combat Desertification and Drought on 17th June 2022 at Waita, Mwingi Central, Kitui County.

5.6: Radio Talks and TV appearances

Considering that mass media as well as social media play an important role in educating and informing the public, the Institute predominantly used local radio stations FM to broadcast 9 talks. The discussions entailed topical issues on forestry technologies and innovations, climate change, tree growing and restoration of degraded forests and landscapes, policies as well as to mobilization of public to institutional events including field days and open days.

5.7: Capacity Building to Internal and External Stakeholders

In the FY 2022/2023, KEFRI build capacity for both internal and external stakeholders to adopt forestry technologies and economic transformation within the six eco-regions. Various platforms were applied to build capacity of scientists to develop and strengthen their skills through internship at KEFRI Graduate Research School (KGRS), and JICA supported Project entitled, Strengthening Forestry Sector Development and Community Resilience to Climate Change through Sustainable Forest Management and Landscape Restoration (SFS-CORECC), demonstration of technologies.

5.8: Scientific Colloquiums

In the year under review, the institute held six scientific colloquia (one public and five monthly institutional) to share research results. The forum were both physical /virtual and open to the public. The topics entailed current issues that contribute new knowledge to the field of forestry.

Table 5.1: Scientific presentation for the year

Date	Colloquium Topic/ Presenter FY 2022/2023
1st institutional public lecture 15th Sep 2022	Visibility and the Impact of Research Vis a vis Research Funding Prof. Walter Oyawa (http://km.kefri.org/Main/FirstInstitutionalPublicLecture)
4th Scientific Colloquium, 14th July 2022	'Increasing forest cover in Kenya for wealth creation: a need to re-evaluate the forest management systems. Dr. James M. Kimondo. (http://km.kefri.org/Main/FourthInstitutionalColloquium)
5th Scientific Colloquium, 6th October, 2022	Integration of trees in forest and land restoration initiatives: Lesson learnt and challenges from different landscapes in Kenya. Dr. James K. Ndufa (http://km.kefri.org/Main/FifthInstitutionalColloquium)
6th Scientific Colloquium, 30th November 2022	Integrating Forest Products in the Green Economy and Climate Change Space by Dr. George Mbeva Muthike (http://km.kefri.org/Main/SixthInstitutionalColloquium)
7th Scientific Colloquium, 29th March 2023	Creating Enabling Environment for Forest Conservation and Commercial Forestry in Kenya by Dr. Joram Kagombe (http://km.kefri.org/Main/SeventhInstitutionalColloquium)
8th Scientific Colloquium, 21st June 2023	Career Experiences, Research Achievements and Opportunities Mr. Linus Maina Mwangi. (http://km.kefri.org/Main/EighthInstitutionalColloquium)

5.9: CRACs

The annual Centre Research Advisory Committees (CRACs) and Pre-CRAC meeting was held at the six eco-regions. Scientists and other stakeholders - from both private and public sectors shared their experiences on current research activities and recommendation for the subsequent fiscal year research agendas and for inclusion in the 7th Strategic Plan.

5.10: Conferences, Workshop and seminars

At the reporting period, the Institute sponsored staff to attend several forums in and outside the country. KEFRI hosted the International Union Research Organization (IUFRO) site inspection delegate for proposed Nairobi 2029 Conference. Likewise in collaboration with MoECC&F hosted a national stakeholders' workshop to streamline Prosopis juliflora Management Strategy and Action Plan 2022-2030, at KEFRI Headquarters, Muguga, on 3rd March 2023. The workshop brought together environmental heads from eight Counties heavily invested with Prosopis weed to share experiences and opportunities toward management of Prosopis in Kenya.

5.11: Enterprise Resource Planning (ERP) System

During the FY2022/2023, the institute commenced implementation of Enterprise Resource Planning (ERP) system to streamline operational processes and increase organizational efficiency. AppKings, a contracted service provider, trained sixty departmental end users from Headquarters, CHERP and Karura on development and review of modules for Finance, Procurement, Human Resource and Enterprise. Data migration and development of prototype for the other modules was on-going.

5.12: Tree seed Dispatch

In support of the 15billion National Tree Growing and Rehabilitation Campaign, KEFRI dispatched 2.2 tonnes of tree seeds to Technical and Vocational Education and Training (TVET) Institutions across the Country to also enable the country produce enough seedlings to increase tree and national forest cover to 30% by 2032.

The Principal Secretary, State Department for Forestry, Mr. Ephantus Kimotho, presided over the dispatch of tree nursery materials including quality tree seeds and potting bags to six Regional Development Authorities, National Prisons, Kenya Defense Forces (KDF), Universities, Faith Based institutions, NGO, CBOs, CFA and community groups operating tree nurseries across the country.

5.13: Community Empowerment

KEFRI through donor and GOK funds empowered communities in various projects to enhance achievement of 30percent forests and tree cover countrywide. For instance in Kenya Central Highlands, KEFRI in collaboration with The University of Lancashire (UCLan) - United Kingdom through Quality Related Global Challenges Research Fund (QR-GCRF) on 17th February 2023 gave quality tree seeds, beehives and dairy goats to forest adjacent community groups in Kiambu County, as part of the intervention measures to conserve forest and mitigate climate change.

Fig.5.1: KEFRI staff in Eldoret show for best performance in various categories

5.14: Jazamiti App

During the launch of the 15billion National Trees Growing and Rehabilitation Campaign, one of KEFRI's technologies, JazaMiti App, a digital tool was adopted to enhance tree site matching and data collection on tree growing across the country.

5.15: Publications 2022-2023 Financial Year

Within the reporting period, the Institute recorded 43 different publications 21 journals; 9 technical notes/ research notes; 9 guidelines/ extension materials; 1 policy brief; 3 booklets/book chapters as indicated (see Appendix I).

KEFRI and Japan International Cooperation Agency (JICA) launched a booklet titled, 'Dryland Forestry Research and Development in Kenya: Achievement and Lessons of 37 years of Kenya/Japan Cooperation in Forestry', during an online side event for the final Tokyo International Conference on African Development (TICAD 8), hosted by the Republic of Tunisia. Likewise, KEFRI being amongst the leading partners contributed to Kenya position document that was presented in the UNFCCC-COP27 held in Egypt.

CHAPTER SIX

6.0: PARTNERSHIP AND RESOURCE MOBILIZATION

During the year under review 2022/2023, KEFRI continued to strengthen partnerships and linkages by pursuing relationship and cooperation with organizations from both public and private sectors with similar interest in joint forestry research and training.

Key accomplishments recorded within the period include increased MoUs to strengthen institutional capacity for research and development, updated database of partnership, and improved resource mobilization strategy.

6.1: Memorandum of Understanding (MoU's)

The Institute under the Performance Contract for the year under review, targeted to partner with Turkana County, JKUAT, Maasai Mara University, Agricultural Training College Chebororwa and COBEC, a CBO conserving mangrove in Coast region. However, the Institute signed 10 of total 22 (MoUs) with Dedan Kimathi University-engineering of Melia nut cracker, JKUAT, Centre For Restoration-Kenya (CER-K) Brackenhurst botanical gardens), Nyeri Water And Sanitation Company, Better Globe Forestry Ltd-MOU and MoA, Turkana County Government (TCG), Lukenya University, Presbytery Church of East Africa (PCEA), JIFPRO. The National Forestry Resources Research Institute, NaFORRI, Uganda, The Centre for Natural Resources Management (CENAREMA), and Coast Development Authority.

There was advanced progress on 12 partnership which were shared with the requesting partners for further development: West Pokot Office of The 1st Lady, Indian Council of Forestry Research and Education, JANS Bamboo Products Pvt. Ltd, Devolution and Climate Change Adaptation (DaCCA) programme, Cloud Line Airship, KALRO-MoU and MoA, Homa Hills Community Development Organization, Agricultural Development Corporation (ADC), Green Corporation Limited-GCG, St Paul University, Maasai Mara University, WINROCK, North Carolina University - USA, DEVTECH systems Inc USA on development and implementation of environmental payment ecosystem services (PES) in Kenya, E4 Impact Entrepreneurship Centres in Africa, Stockholm Environment Institute (SEI) Africa, and Colorado State University (CSU) USA.

The institute engaged with strategic partners at national, regional and international levels and pursued 17 activities involving Northlands Healthcare International collaborations on products development, 1MTN collaboration on bamboo, Lukenya University on improved furniture manufacturing and establishment and strengthening of training centers, Scotland Christian University of Machakos for joint fundraising, FAO - GEF 6- LOA and progress, UNDP on financing and implementing modalities for FLaRAK including procurement and teams, held 3 joint meetings and participatory community forums with NETFUND & MECCF Agencies in a joint venture to develop proposals, KEFRI and Cloud Line Airship to discuss joint collaboration on use of drones' technology for conservation and restoration of Forests, 4 multi-institutional forums, partner's liaison to write the bid to host IUFRO conference in 2029, University of Nairobi on Kibwezi Land, Kenya Offset National Emissions through Sustainable Landscapes (ONE-SL) Engagement Mission, ONE-SL aims to support countries in developing operational jurisdictional REDD+ programs.

6.2: KEFRI-KFS Research and Management Liaison activities

KEFRI and Kenya Forest Service (KFS) held joint 53rd TLC meeting that reviewed gaps and actions in research and forest development amongst other issues of national interest. The Institute also enhanced participation with Counties of Nyeri, Elgeyo Marakwet, West Pokot, Samburu and Laikipia to joint rehabilitation and enhancing livelihoods for communities, collaboration and partnerships in management of Ngare Ndare, Cherangany, Kirisia, Mkogodo forests as well as operationalize the Kenya Commercial Forestry Innovation Centre (KCFIC).

6.3: Increase in revenue

To increase revenue for research and development, the institute developed 19 proposals and concepts approximately KES.3.4 billion that were submitted to GoK, donors/ development partners seeking for national and international grants. Amongst the targeted funders were: JICA, Kenyatta University, GEF - 6 project, FARM Africa, IUFRO, Africa Forest Foundation -AFF, Italian Development Cooperation Agency (IDCA), National Commission for Science, Technology and Innovation (NACOSTI), Zimbabwe University of Science and Technology on Innovations for Food Security, NETFUND, KFS, KWTA, KVDA and Counties, AFDB, MoECC&F, UNEP, CREST, UNIDO, Lukenya University, Stellenbosch University, African Centre for Technology Studies (ACTS), CWTS, Leiden University, Tanzania Forestry Research Institute (TAFORI), ICIPE, YALE University, Jaramogi Oginga Odinga University of Science and Technology (JOOUST), LIRA University -Uganda, Addis Ababa University (AAU), UK-PACT: Kenya Climate Innovation Center (KCIC), ICRAF, UNDP, GBP, JKUAT, UON, University of Nottingham, AFSDA, Maasai Mau Conservation Trust, European Union, KCB Foundation, ICIPE, Stellenbosch University of South Africa, UNDP though FLaRAK project.

CHAPTER SEVEN

7.0: HUMAN RESOURCE, ADMINISTRATION

During the period under review, the Human Resource Department undertook both routine activities and those signed in the performance contract for 2022/23 FY. The activities include: Policy development and implementation, human resource planning, recruitment and selection of staff, training and development of staff, Performance management, reward management, employee relations, human resource administration, employee separations and provision of medical services at the KEFRI clinic.

The Institute has continued to motivate and retain competent human capital to ensure efficiency and effectiveness in its service delivery. KEFRI successfully developed, and implemented approval for 4 human resource management instruments from State Corporations Advisory Committee (SCAC) namely: Grading and Organization Structure, Staff Establishment, Career Progression Guidelines and Human Resource Management Policies and Procedures Manual. The Institute also made concerted efforts to fill staffing gaps in its staff establishment through the appointment of 83 new staff, staff rationalization, training and development, mentorship programmes. The Institute also engaged 25 graduates on internship program and 321 students on attachment. During the period, 3 Research Scientists graduated with Doctorate degree thus bringing the total number of PhD holders to 33 in the Institute. In compliance with the one-third (1/3) gender rule, the Institute staff gender representation stands at 38% (Female) and 62% (Male).

7.1: Human Resource Training and Development Policy

During this period the Human Resource Training and Development Committee met and reviewed the Training and Development Policy by incorporating the proposals by the Board of Directors. These included; Advisory from SRC to rework on the CBA without any financial implication, a virtual meeting held between the CBA taskforce and SRC to shed light on the reasons for their dissatisfaction of the CBA; and a meeting between the Management and UNRISK for renegotiation and a new CBA document was developed to cover the period 2018 to 2022.

To strengthen human resources capacity the Institute competitively recruited fifty one (51) employees, appointed 6 officers to higher positions and confirmed 10 staff to permanent and pensionable terms in line with staff replacement plan approved by the National Treasury for 2021/2022 FY

The Institute supported (6) staff pursuing PhD studies induction of one hundred and forty five (145) attachees, fourty one (41) interns and fifty one (51) newly recruited employees were inducted and mentored. Nine (9) members of staff also undertook professional management courses at the Kenya School of Government institutions and Data Protection Commission Training respectively. Other trainings and professional development conducted for PC compliance included; gender mainstreaming, disability mainstreaming, public complaints handling, defensive driving for drivers and integrity officer training. Fifteen (15) employees were achieved PhDs, Msc, Bsc, Diplomas and Certificates on a self-sponsorship basis.

During the period under review, the Institute exited Fifty Six (56) staff, Fifty One (51) retirement upon attaining the mandatory retirement age or early retirement; One (1) through termination/ Expiry of contract; and Four (4) through resignation

7.2: Gender Mainstreaming

In compliance with the government policy of gender mainstreaming in public institutions;

The annual work plan on Gender Mainstreaming was done in quarter 1 and sensitization of staff at Rumuruti and Garissa Sub-centres on 16th March 2023 and 22nd March 2023 respectively. Quarterly reports done and submitted to the State department for Gender and National Gender and Equality Commission.

7.3: Disability Mainstreaming

In compliance with the Government Policy on disability mainstreaming in public institutions;

The Institute developed the annual work plan on Disability Mainstreaming and submitted to NCPWD in quarter 1; and disaggregated data of employees with disabilities by 1st July 2022. A three year implementation plan for the accessibility audit conducted in Lamu Forestry Sub-Centre in 2021/2022 FY was set and forwarded to NCPWD in Q2.

In addition, KEFRI Clinic has provided appropriate adoptive technology for staff and clients who visit the clinic through provision of a wheel chair. KEFRI has availed information, Education and Communication (IEC) materials. Audio which can be accessed on https://www.kefri.org/components/video/video.html. Initiated the process of transcribing the KEFRI Environmental Policy into Braille, (a proforma invoice for payment of the Braille work is in process). Submitted a three year work plan for the implementation recommendations of the Accessibility and usability Audit. Undertook Disability Mainstreaming sensitization to staff of Rumuruti Sub-Centre on 30th March 2023.

7.4: Prevention of Alcohol and Drug Abuse

KEFRI supports government's effort to prevent infection and spread of HIV and AIDs. In 2022-2023, two hundred and eleven (211) members of staff and their families were sensitized about HIV/AIDS, NCDs and Lifestyle conditions, three thousand seven hundred and forty four (3,744) male condoms distributed, and substance abuse behavior, twenty two (22) employees were individually counseled on various mental illnesses, mental health wellness and quarter one reports was submitted to National AIDS Control Council.

Fig.7.1: Members of staff during a sensitization seminar at the headquarters

CHAPTER EIGHT

8.0: WORK ENVIRONMENT

KEFRI entrenched its commitment to provide a safe workplace - free from serious recognized hazards, comply with standards, rules and regulation issued under the Occupational and Safety Act, 2007 (OSHA). In this regard all KEFRI regional centers put preference in clean and healthy environment, safety protections, renewal of workplace permits and operation licences for employees including professional membership certificates and driving licences.

Currently, the Institute has put in place Occupational Safety and Health policy and an operationalized safety committee to ensures matters on Safety and Health are monitored, and management advised on the best practices and corrective actions.

KEFRI has also registered and attained workplace permit from Directorate of Occupational Safety Health and continued to conduct annual safety audits and inspections and OSHA procedure is incorporated in its Integrated Management System. The procedure puts in place all measures to address occupational safety and health principles including occupational accidents, incidents, first aid, fire safety, safety inspections, trainings among others and ensure safe working environment. All employees, contractors, sub-contractors, and other interested parties have to adhere to Occupational Safety and Health Act of 2007 and permit to work issued for non-routine activities where necessary to ensure adherence to safety standards.

8.1: ISO Certification

During the year under review, internal Audit for ISO and sensitization on Covid 19 pandemic were accomplished in Kibwezi, Kitui, Garissa Sub Centre. To improve its work environment for more effective service delivery, KEFRI continued to improve its facilities in various Regional Research Centres. In the reporting period, the following infrastructural developments were accomplished.

Maintenance of show stands in Mombasa, Machakos, Nairobi, Nakuru, Eldoret and Kakamega prior to official commencement of the exhibition. Maintenance of buildings and station at KEFRI HQs – carpeting of the boardroom, Chairman's office and SDD-RDs office, repaired furniture at chairman's and SDD-RD's offices. Secured title deeds for Taita Taveta and Lamu centres as well as followup ownership documents for Migori, Wajir, Baringo, Migori and Hola. Electrical safety audits were planned for Hqs, Muguga (CHERP), Karura, Lamu and Kitui and finalized audit for the Kitui on a priority basis, the rest were shelved due to austerity measures.

The following activities were completed. Fencing of 3 km - KEFRI Tiva 1.5 KM-KEFRI/UON Kibwezi land. Repair of Generator-Kakamega, Construction of Guard House at Turkan Sub-Centre - completed and handed over. Fencing of 1050 LMs - Completed and handed over. The following activities were halted due to austerity measures. Removal of asbestos and re-roofing, improvement of water well and piping work for Kakamega. The following contracts are ongoing: Fencing of 0.7 km -Contract awarded and the contractor on site, current completion rate is 20%. Construction of a generator house at Lamu Sub-Centre - Contract awarded, plans are underway for handing over. Construction of a generator house at Kibwezi - Contract awarded, plans are underway for handing over. Drilling of two boreholes - Tiva and Kitui Regional Centre- Put on hold to next FY due to delay in release of funding. Landscaping of Rongo Nursery - Purchase of Murram for landscaping purchased and stockpiled. The construction of the eleven (11) seed centres (phase 1) are ongoing.

Fig.8.1: Nairobi ASK Show Stand

Appendix 1. KEFRI Publications 2022 - 2023

JOURNAL PAPERS

1. Basiru, A.O., Oladoye, A.O., Adekoya, O.O.; Akomolede,L.A.; Oeba, V.O.; Awodutire, O.O., Charity, F.; Abodunrin, E.K. (2022). Livelihood Vulnerability Index:Gender Dimension to Climate Change and Variability in REDD + Piloted Sites, Cross River State, Nigeria. Land 2022, 11, 1240. Received: 12 June 2022. Accepted: 27 July 2022. Published: 4 August 2022. https://doi.org/10.3390/land11081240
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3. Kaudo, B. O., Mwenja, P., Epasit, D., Ekai, D., Isacko, D., and Owino, J. (2022), "Effect of Potting Tube Size on Growth and Development of Ziziphus mauritiana Seedlings., East African Journal of Forestry and Agroforestry, 5(1), pp. 118-129. Date Published: 17 August 2022. doi: 10.37284/eajfa.5.1.795.
4. Swiderska, K., Argumedo,A., Wekesa, C., Ndalilo, L., Song, Y., Rastogi, A.; Ryan, P. Indigenous Peoples' Food Systems and Biocultural Heritage: Addressing Indigenous Priorities Using Decolonial and Interdisciplinary Research Approaches. Sustainability 2022, 14, 11311. Received: 3 May 2022 Accepted: 12 July 2022 Published: 9 September 2022. https://doi.org/10.3390/su141811311. pp 1 - 23
5. Owino, J. O., Onyango, A. A., Angaine, P. M., & Inoti, S. K. (2022). Effect of Soil Mixtures on Early Growth Performance of Grevillea robusta and Cupressus lusitanica Seedlings in the Highlands of Kenya. International Journal of Plant & Soil Science, 34(22), 597-609. https://doi.org/10.9734/ijpss/2022/v34i2231413
6. Chebet D., Musila F.M., Kituyi S.N., Muthike G.M., Kaigongi M.M. (2022). Molecular Phylogeny of Selected Kenyan Eucalyptus Species Inferred from MatK, rbcL and TrnL-F Genes and Their Suitability for Power Transmission Poles. Diversity 2022, 14, 563. https://doi.org/10.3390/d14070563 Received: 6 April 2022. Accepted: 28 June 2022. Published: 14 July 2022.
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34. KEFRI. JICA. CADEP. (2023). Compost Manure as an Approach to Organic Farming in Homa Bay County, Kenya. A Guide for Farmers and Extension Agents. Compiled by: Josephine Wanjiku, Paul Tuwei, Rebeccah Nenkai and Michael Mukolwe. With contributions from: Sylvia Mwalewa, Dorothy Ochieng and Honjo Yuki

35. KEFRI. JICA. CADEP. (2022). Establishment of Casuarina equisetifolia Woodlots for Livelihood Improvement in Kwale County, Kenya: A Guide for Farmers and Extension Agents. Compiled by: Kevin Muema, Florence Mwanziu, and Nixon Kilimo. With Contributions from: Josephine Wanjiku, Sylvia Mwalewa, Paul Tuwei, Yuki Honjo and Dorothy Ochieng

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37. KEFRI. JICA. CADEP. (2022). Use of Organic Pesticide as an Approach to Organic Farming in Homa Bay County, Kenya Compiled by: Josephine Wanjiku, Paul Tuwei, Rebeccah Nenkai and Michael Mukolwe. With contributions from: Sylvia Mwalewa, Dorothy Ochieng and Honjo Yuki.

38. Technical Notes and Research Notes

39. Pinimidzai S., Susan B., Fiker A., Nellie O., Michael M., Theodros G., Selim R. and Durai J. (2023) INBAR Working Paper Technical Paper. Report number: INBAR Working Paper - under the Dutch-Sino East Africa Bamboo Development Programme – Phase II. Affiliation: Kenya Forest Research Institute. DOI: 10.13140/RG.2.2.33595.28966

40. Amwatta Mullah Jared, Ngonga Boaz and Ojunga Samson (2023). Management and Control of Cestrum aurantiacum in Kenya: A guide for forest managers, farmers and extension agents. KEFRI. Muguga, Kenya.

41. Chemuku Wekesa, James Ndufa and Paul Tuwei (2023). Mangrove Deaths in Kenya: Causes and Recommended Management Interventions. KEFRI. Muguga, Kenya.

42. Amwatta Mullah Jared, Boaz Otieno Ngonga and William Bii (2023). The impact of livestock grazing on forest structure, ground flora and regeneration of disturbed areas in Mau forest. KEFRI. Muguga, Kenya.

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44. Policy briefs

45. MoEF (2022) National Bamboo Policy 2022

46. Book chapters

47. Jingjing Liang 1 *et al,.* . (191 authors including John N. Kigomo134, and Musingo T. E. Mbuvi159,) (2022). Co-limitation towards lower latitudes shapes global forest diversity gradients. Nature Ecology & Evolution. ARTICLES. 27pp. https://doi.org/10.1038/s41559-022-01831-x

Appendix II: Statement of Financial Performance for the Year Ended 30th June 2023

	Notes	2022-2023	2021-2022
		Kshs.	Kshs.
REVENUE			
Revenue from non-exchange transactions:			
Government Grants	3	1,478,987,007	1,525,757,811
External Grant for Research	4	130,867,199	114,835,278
Deferred Income from Donated assets	5(b)	18,140,179	19,761,368
Revenue from exchange transactions:			
Sale of Goods and Services	6	112,316,746	117,633,923
TOTAL REVENUE		**1,740,311,131**	**1,777,988,380**
EXPENSES			
Employee Costs	7	(1,209,837,910)	(1,207,442,826)
Operating Expenses	8	(488,016,695)	(477,197,903)
Board of Directors Expenses	9	(7,596,942)	(16,459,429)
Establishment Cost(Sinking Fund)	10(a)	(5,000,000)	-
Depreciation charge	5(a)	(80,356,688)	(77,625,146)
Amortization on Intangible Asset	11	(1,935,502)	(2,419,377)
TOTAL EXPENSES		**(1,792,743,737)**	**(1,781,144,682)**
OTHER GAINS/(LOSSES)			
Exchange Gain/(Loss)	12	(5,163,270)	(1,668,565)
		(5,163,270)	**(1,668,565)**
Surplus/(Deficit) for the Year		**(57,595,876)**	**(4,824,867)**
.....	.....	.....	
Dr. Jane W. Njuguna	FCPA Rose Osoro	Gen (Rtd) Samson Mwathethe	
Ag. Director KEFRI	Deputy Director F & A	Chairman: KEFRI Board of Directors	
	ICPAK No.:4555		
Date	**Date .....**	Date	

Appendix III: Statement of Financial Position as at 30th June 2023

STATEMENT OF FINANCIAL POSITION AS AT 30TH JUNE 2023			
		2022-2023	2021-2022
		Kshs.	Kshs.
ASSETS	**Notes**		
CURRENT ASSETS			
Cash and cash equivalents	13(a)	509,906,910	598,185,826
Receivables from exchange transactions	14(a)	48,326,314	35,994,466
Receivables from non-exchange transactions	14(b)	704,903	1,271,339
Inventories	15	144,379,080	145,626,635
		703,317,207	**781,078,266**
NON-CURRENT ASSETS			
Property, Plant & Equipment	5(a)	5,844,888,912	5,765,320,360
Intangible Assets	11	7,742,008	9,677,510
		5,852,630,919	**5,774,997,870**
TOTAL ASSETS		**6,555,948,126**	**6,556,076,136**
LIABILITIES			
CURRENT LIABILITIES			
Payables from exchange transactions	16	4,494,276	9,343,416
Auditor General- accrued audit fee	16(c)	660,000	660,000
Unxpended External Donor Grants	4	53,633,430	155,800,578
Medical Scheme Funds	17	345,205	345,205
		59,132,910	**166,149,199**
NET ASSETS			
Government Grants for capital assets	18(a)	1,598,716,690	1,421,091,292
Deferred Income on Donated Assets	5(b)	476,359,998	494,500,177
Sinking Fund	10(b)	39,492,061	34,493,126
Revaluation Reserves	18(b)	4,467,199,488	4,467,199,488
Revenue Reserves	18(e)	(84,953,022)	(27,357,146)
		6,496,815,216	**6,389,926,937**
TOTAL NET ASSETS & LIABILITIES		**6,555,948,126**	**6,556,076,136**
.....	.....	.....	
Dr. Jane W. Njuguna	FCPA Rose Osoro	Gen (Rtd) Samson Mwathethe	
Ag. Director KEFRI	Deputy Director F & A	Chairman: KEFRI Board of Directors	
	ICPAK No.:4555		
Date	**Date .....**	Date	

Appendix IV: Statement of Changes in Net Assets for the Year Ended 30th June 2023

2022-2023						
	Government Grants for Capital Assets Kshs	Deferred Income on Donated Assets Kshs	Revenue Reserves Kshs.	Revaluation Reserves Kshs	Sinking Fund Kshs.	Total Kshs.
Balance as at 1st July 2021	**1,143,349,103**	**514,261,545**	**(22,532,279)**	**4,467,199,488**	**34,494,191**	**6,136,772,048**
Prior period adjustment						-
As restated	**1,143,349,103**	**514,261,545**	**(22,532,279)**	**4,467,199,488**	**34,494,191**	**6,136,772,048**
Surplus/(Deficit) for the year	-		(4,824,867)			**(4,824,867)**
Adjustments						-
Transfers from Sinking fund						-
Sinking Fund expenses					(1,065)	**(1,065)**
Additions during the year	362,500,000				-	**362,500,000**
To Income & Expenditure	(84,757,811)					**(84,757,811)**
Deferred Income for the year	-	(19,761,368)	-	-	-	**(19,761,368)**
Balance as at 30th June 2022	**1,421,091,292**	**494,500,177**	**(27,357,146)**	**4,467,199,488**	**34,493,126**	**6,389,926,938**
Balance as at 1st July 2022	**1,421,091,292**	**494,500,177**	**(27,357,146)**	**4,467,199,488**	**34,493,126**	**6,389,926,938**
Prior period adjustment						-
As restated	**1,421,091,292**	**494,500,177**	**(27,357,146)**	**4,467,199,488**	**34,493,126**	**6,389,926,938**
Surplus/(Deficit) for the year	-		(57,595,876)			**(57,595,876)**
Adjustments						-
Transfers from Sinking fund						-
Sinking Fund expenses					(1,065)	**(1,065)**
Additions during the year	215,612,405				5,000,000	**220,612,405**
To Income & Expenditure	(37,987,007)					**(37,987,007)**
Deferred Income for the year	-	(18,140,179)	-	-	-	**(18,140,179)**
Balance as at 30th June 2023	**1,598,716,691**	**476,359,998**	**(84,953,022)**	**4,467,199,488**	**39,492,061**	**6,496,815,216**

Appendix V: Statement of Cash Flows for the Year Ended 30th June 2023

STATEMENT OF CASH FLOWS FOR THE YEAR ENDED 30TH JUNE 2023			
		2022-2023	2021-2022
	NOTES	Ksh.	Ksh.
Cash Flows from Operating Activities			
Cash from Recurrent Grants	3	1,441,000,000	1,441,000,000
Cash from Development Grants	3	215,612,405	362,500,000
Cash from donor grants	4	121,397,425	129,136,819
Cash receipts from customers		186,964,471	113,174,548
Cash receipts from Insurance		4,495,013	12,451,710
Cash receipts from employees	14(b)	174,677	20,816
Cash paid to employees(Salaries)	8	(1,209,724,904)	(1,207,442,826)
Cash paid for operations		(547,015,182)	(473,836,431)
Cash paid to board members	9	(7,596,942)	(16,459,429)
Cash refund to donor		(95,912,024)	(3,361,804)
Cash paid to employees	14(b)	(13,372,825)	(1,271,339)
Cash paid for Insurance (prepaid)		(21,989,200)	(21,999,110)
Cash paid to suppliers		-	-
Cash paid to employees for personal accident		(3,620,088)	(9,584,502)
Net cash from operating activities		**70,412,825**	**324,328,453**
Cash Flows from Investing Acticities:			
Purchase of property, plant, and equipment	5(a)	(158,691,741)	(180,535,947)
Purchase of Intangible asset	11	-	-
Net Cash from Investing activities		**(158,691,741)**	**(180,535,947)**
Net increase in cash and cash equivalents		(88,278,916)	143,792,506
Cash and cash equivalents at beginning of pe	13(a)	598,185,826	454,393,320
Closing Cash and cash equivalents at end of period		**509,906,910**	**598,185,826**
.....	.....	.....	
Jane W. Njuguna (PhD)	FCPA Rose Osoro	Gen(Rtd) Samson Mwathethe	
Ag. Director KEFRI	Deputy Director Finance	Chairman: KEFRI Board of Directors	
	ICPAK Member Number:4555		
Date:	Date	Date	

Appendix VI: Statement of Comparison of Budget and Actual Amounts for the Year Ended 30th June 2023

STATEMENT OF COMPARISON OF BUDGET AND ACTUAL AMOUNTS FOR THE YEAR ENDED 30TH JUNE 2023							
	Notes	Original budget	Adjustments/Supplementary	Full budget	Actual on Comparable	Performance difference	Budget Vs Actual
		2022-2023	2022-2023	2022-2023	2022-2023	2022-2023	%
Revenue		Kshs	Kshs	Kshs	Kshs	Kshs	
Recurrent Grants	3	1,564,000,000	-	1,564,000,000	1,441,000,000	123,000,000	92.14
Development Grants	3	383,850,480	127,939,205	511,789,685	215,612,405	296,177,280	42.13
Research Grants	4	131,555,065	-	131,555,065	130,867,199	687,866	99.48
Deferred Income from donors	5b	18,140,179	-	18,140,179	18,140,179	(0)	100.00
Sale of Goods and Services	6	186,000,000		186,000,000	112,316,746	73,683,254	60.39
Total Income		**2,283,545,724**	**127,939,205**	**2,411,484,929**	**1,917,936,530**	**493,548,399**	79.53
Development Grants: Income Recognised		37,987,007	-	37,987,007	37,987,006.68	-	100.00
NET TOTAL INCOME		**2,321,532,731**	**127,939,205**	**2,449,471,936**	**1,955,923,536**	**493,548,399**	79.85
Expenses		Kshs	Kshs	Kshs	Kshs	Kshs	
Employees Costs	7	1,300,000,000		1,300,000,000	1,209,837,910	90,162,090	93.06
Operation Expenses	8	536,059,833		530,325,160	488,016,695	42,308,465	92.02
Board Expenses	9	13,000,000		13,000,000	7,596,942	5,403,058	58.44
Establishment Cost(Sinking Fund)	10	5,000,000		5,000,000	5,000,000.00		100.00
Depreciation	5a	76,850,878	-	80,356,688	80,356,688		100.00
Amortization Expenses	11	1,935,502	-	1,935,502	1,935,502	-	100.00
Total Expenditure		**1,854,059,833**	**-**	**1,930,617,350**	**1,792,743,737**	**137,873,613**	**92.86**
Other Gains/(Losses)							
Exchange Gain/(Loss)	12b	(5,163,270)	-	(5,163,270)	(5,163,270)	-	100.00
Suplus /(Deficit) for the period without capital assets		472,636,167	127,939,205	524,017,855	158,016,529	355,674,787	
Development Grants	3	383,850,480	127,939,205	511,789,685	215,612,405	296,177,280	
Suplus /(Deficit) for the period		88,785,687	-	12,228,170	(57,595,876)	59,497,507	
Capital Expenditure		345,863,473	127,939,205	473,802,678	177,625,398	296,177,280	
Notes.							
1. GoK : Development Grant						Kshs	
Budget Estimates						511,789,685	
Less Received from Exchequer						(215,612,405)	
Variance in Development budget is because we did not receive exchequer release for Q1,2 and 3						296,177,280	
The Increase in Suplementary is for (100M) under Article 223 of the constitution and (27.9M) JICA revenue for drilling of Boreholes in Tiva							
2.The low expense in Board Item is because we didn't have a fully constituted Board.							
3. Budget adjustment was done during internal reallocation of funds							
4. Operating and Maintenace Includes funds from opening balances and other donor funded projects recognized as income and expenditure							

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