KENYA COMMERCIAL TREE IMPROVEMENT STRATEGY (KCTIS)

KEFRI

July 2021

Jane Njuguna, Joseph Machua, Stephen Omondi, Jason Kariuki, James Kimondo, Bernard Kamondo, Angela Muthama, Leonida Cherotich, Miriam Gathogo, Rory Mack, Lilian Magak and *Steve Verryn*

FOREWORD

Kenya Forestry Research Institute (KEFRI) is a state corporation mandated to: Conduct research in forestry and allied natural resources; Disseminate research findings; Build capacity of stakeholders and Establish partnerships with relevant institutions and organizations. In accomplishing its mandate, KEFRI generates, collaborates, disseminates and shares information and technologies with a wide range of stakeholders including government ministries and state corporations, private sector, international organizations, institutions of higher learning, Community Based Organizations, Non-Governmental Organizations and farmers. KEFRI implements its research mandate under four research and development thematic areas. Among the four is the Forest Productivity and improvement theme under which tree improvement falls.

In 2019, Gatsby Africa supported KEFRI in carrying out a series of baseline studies whose objective was to undertake a strategic gap analysis in forest productivity for commercial tree species with emphasis on research in tree breeding, seed production and supply, and forest health. The involvement of Gatsby Africa was in line with their mission which is to accelerate inclusive, competitive, and resilient economic growth in East Africa by demonstrating how key sectors can be transformed. This is achieved by: Funding and implementing programmes that look to catalyze and influence large-scale and lasting change in priority sectors; building and supporting local organizations dedicated to sector transformation and; sharing lessons learnt with others such as governments and donors who are trying to transform various sectors.

In its country programs in Kenya, Gatsby Africa has partnered with Government of Kenya (GoK) to transform the commercial forestry into a competitive, inclusive and sustainable sector. This appreciates that market trends and demands by processors and consumers of wood and timber products must be supported by the country's efforts of increasing timber production through greater productivity and efficiencies. More importantly, it is this demand for improved planting material now and in the future, that will drive investments in tree growing through the development of planted forest sector and linked to creating higher income streams for investors in tree growing through the development of planted forest sector as envisaged in the Vision 2030, National Forest Conservation and Management Act (2016), Draft National Forest Policy, the National Forest Programme (NFP) 2016-2030. It is under

this understanding that Gatsby Africa supported KEFRI to undertake a review of the tree improvement program. Further support has been availed by Gatsby Africa for the development of this Kenya Commercial Tree Improvement Strategy (KCTIS).

The KCTIS also provides a road map to meet the short, medium and long-term investments needs by catalyzing production and distribution of improved tree germplasm and where necessary facilitate acquisition from other improvement programs. This is intended to increase the productivity of planted commercial forests to meet the demand for forest products. The KCTIS combines tree breeding, silvicultural considerations and integrated pest management which are the core elements of a tree improvement programme aiming to increase productivity of trees per unit area. This Strategy will contribute directly to implementation of national policies and initiatives, particularly the National Forest Programme (NFP) (2016-2030), which has set the agenda for the development and coordination of the forestry sector, to meet the needs of Kenyans, based on Kenya's Constitutional values and principles of Vision 2030. The KCTIS will be key in achieving the objectives of the Forest Productivity Cluster of the NFP and will enhance implementation of the Government's Big 4 Agenda on manufacturing, food security, universal health care and affordable housing, as well as Sustainable Development Goals (SDGs). Ultimately, a vibrant commercial forestry program will lead to increase in forest cover beyond the 10% stipulated in the NFP (2016-2030).

The KEFRI Board of Directors is committed to the full implementation of the Kenya Commercial Tree Improvement Strategy, and will work closely with the Ministry of Environment and Forestry, other state agencies, private sector and all relevant stakeholders to ensure its implementation. The KEFRI Board and Management will also ensure that this Strategy is implemented through timely provision of resources, preparation of annual work plans and regular monitoring and evaluation through Board of Directors meetings.

……

Joshua K. Cheboiwo (PhD)
DIRECTOR - KEFRI

Table of Contents

List of Tables

1.0 THE VISION

The vision of the Kenya Tree Improvement Strategy (KCTIS) here after called The Strategy is to foster availability of diverse and high quality planting materials of major commercial tree species that are adapted to the relevant agro-ecological zones in Kenya for enhanced commercial forestry productivity and superior wood properties. Our short-term vision (by 5 years) is to establish participatory tree improvement programs that develop, acquire and deploy high quality improved germplasm that responds to the ever-growing demand for various wood products. In the same period, the strategy will promote access to improved germplasm from both local and external sources**.** In the medium term (by 15 years) the strategy will make commercial forestry an attractive investment in Kenya through breeding for: productivity, tolerance to biotic and abiotic stresses with desired wood properties linked to markets. While in the long term (more than 15 years) the strategy will make Kenya a sustainable, resilient, dynamic, attractive, competitive and inclusive economic hub for commercial forestry through provision of quality germplasm and supportive information and services.

2.0 INTRODUCTIO

The forest sector plays a key role in the socio-economic development of Kenya and contributes 3.6% to the country's GDP excluding environmental services. Further, it is estimated that the formal forest sector employs 18,000–50,000 people directly and 300,000 – 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. Forestry sector contribution to GDP can be enhanced through promotion of commercial forestry and tree improvement programs that increase tree productivity per unit area of land.

Globally, tree improvement started in mid-twentieth century, and since then, the use of improved germplasm for forest regeneration has become an essential part of forestry in many countries. Nationally, the demand for forest tree seed and planting stock has increased rapidly, and frequently exceeds the supply. However, most nurseries do not stock material of high genetic quality and traceable to source.

Tree improvement is the cornerstone of commercial forestry, as it provides the means through which tree growers' access superior germplasm to optimize tree and forest productivity. It combines principles of tree breeding, silviculture, and pests and diseases control. The principles are best actualized through a strategy, which outlines the means of achieving the desired outputs.

Tree improvement programmes have been implemented in Kenya at varying levels of intensity since 1936, to address the deficit of wood supply, which is currently estimated at 15 million cubic meters. Challenges to tree improvement include; low levels of funding, climate change, forest excisions, poor forest management practices, and wanton clear felling of seed sources, experimental plots and other forest areas. Formulation of this Strategy arose out of the need to streamline tree improvement activities for maximum outputs. It is also envisaged that it will align with the need for revitalizing commercial forestry in the country. This Strategy will play a central role in promoting commercial forestry development in Kenya, and will be key in enabling the forestry sector to achieve profitability and meet the Government's Big 4 Agenda on manufacturing, food security, universal health care and affordable housing. The scope of this Strategy is national, covering all the agro-ecological regions.

From the outset, the tree improvement programmes in Kenya mainly focused on three highland fast growing exotic timber species namely: *Cupressus lusitanica*, *Pinus patula* and *Pinus radiata*. Subsequent expansion of the programme included lowland pines and later involved diversification of priority species such as *Eucalyptus grandis*, *E. saligna*, *E. urophylla*, *E. camaldulensis*, *Casuarina equisetifolia, Casuarina junghuhniana*, *Grevillea robusta*, *Markhamia lutea,* and *Gmelina arborea*. More recently, two indigenous species; *Melia volkensii* and *Acacia tortilis* have been incorporated under breeding for productivity and drought tolerance targeting commercial forestry in the drylands. Other indigenous species with high commercial potential include; *Vitex keniensis, Maesopsis eminii* and *Milicia excelsa.*

The key elements of the tree improvement programmes in Kenya have been species prioritization, identification and expansion of base populations; selection and testing of plus trees through progeny trials; and establishment of seed orchards. Although some achievements have been made in terms of volume increment and establishment of seed sources, there is need to upscale tree improvement activities in order to obtain higher outputs.

However, from results of benchmarking in South Africa and Thailand, and baseline studies carried out by KEFRI in 2019 to 2021 with the support of Gatsby Africa, it is apparent that there are a number of challenges constraining the supply of globally competitive improved tree germplasm in Kenya. There are also incomplete breeding strategies, for a number of major commercial tree species, limited market alignment, under resourcing/support of tree improvement research and minimal sector/stakeholder collaboration among others. These challenges have limited the comparative genetic gains and competitiveness of most commercial species germplasm currently produced in the country.

In the formulation of this Strategy stakeholder input was collected through structured interviews, E-questionnaires and public participation webinars. The major issues of concern raised included; access to high quality seed from local and international sources, opportunities for collaboration with various public and private stakeholders on tree improvement, and market driven breeding for targeted end products.

There is therefore a need to accelerate breeding for desired wood properties, quality germplasm to create resilient commercial forestry in the face of a changing climate, increase productivity, provide what the markets need and give a competitive advantage to local producers in terms of quality. The purpose of this Strategy is to provide an appropriate national, sustainable and well-resourced tree improvement programme for Kenya.

The strategy aims to;

a) Facilitate enhancement of production, and promotion of the use of high quality tree seed and planting material for commercial forestry;
b) Create awareness and provide supporting information on species-site matching;
c) Ensure preservation of genetic diversity of priority tree species for future breeding;
d) Promote public and private Stakeholder engagement, catalyze partnerships in the tree improvement process
e) Enhance institutional and human resource capacity for tree improvement

3.0 THE VALUE OF TREE IMPROVEMENT

Tree improvement, often referred to as genetic improvement is the process of improving the tree species for production of high quality germplasm to meet the demand of forest products and plays a pivotal role in forestry development globally. It combines tree breeding, silvicultural practices and integrated pest and disease management that are simultaneously applied to take advantage of the existing genetic variation in forest tree populations to increase productivity per unit area.

Tree breeding involves recurrent selection of superior trees, for traits such as fast growth rate, good stem form, wood properties, resistance to pests and diseases and other desirable characteristics. Selected or improved germplasm undergo silvicultural management practices such as species-site matching; and proper site preparation, quality seedlings, handling of planting material, planting procedures and management of plantations.

Tree improvement in Kenya is therefore an important strategy that can address the projected deficit of timber, poles, firewood and charcoal supply currently estimated at 10.3 million cubic meters and is expected to increase to 15 million cubic meters by 2030. The current wood deficit is being met by importation from neighbouring countries, and illegal exploitation of indigenous forests, which are unsustainable. The demand for wood can be met sustainably by increasing the size of forests and/or productivity per unit area. However, increasing forest area is constrained by population pressure, competing land use and environmental factors. It is therefore more feasible to invest in increasing the yield per unit area of forest land through development of tree improvement programmes. In addition, tree improvement provides the opportunity for meeting demands for high value wood products leading to increased incomes and access to global markets.

4.0 STRATEGIC CONSIDERATIONS FOR KCTIS

4.1 Research focus

4.1.1 Commercial Tree Improvement Centre

This strategy proposes the establishment of a Commercial Tree Improvement Centre at KEFRI hereafter called the Centre that will focus on tree breeding of commercial tree species, and integrate other disciplines of silvicultural management, integrated pest management, site species matching, seed production and seed quality, wood properties research and market analysis. The Centre will ensure collaboration among all KCTIS partners, and sustainable tree improvement towards a vibrant commercial forestry sector. The centre will also establish knowledge management and molecular breeding infrastructure.

4.1.2 Breeding programs

The Centre will establish well-structured and practical breeding programs focussing on growth, pest and disease tolerance, resilience to climate change, biomass energy, wood properties, with focus on market demands. The Strategy will advance the existing breeding programs for current commercial tree species. However, breeding programs for emerging species (indigenous and exotics) will be developed upon market demand.

4.1.3 Clonal forestry

The strategy will promote the use of clonal forestry as complementary to propagation through seed and to conserve genetic gains from breeding programs. However systems will be put in place to ensure adherence to clonal forestry principles.

4.1.4 Genetic gains and species site matching trials

The strategy will ensure that genetic gains and species site matching trials are established for all commercial tree species undergoing breeding program

4.1.5 Germplasm and wood products certification system

The Strategy will encourage the use of germplasm and wood certification systems that will ensure inherent genetic quality and wood grading based on physical properties. The certification system will also ensure proper information on sources of germplasm that is crucial for site-species matching.

4.1.6 Access to improved germplasm

This strategy will ensure an efficient production, marketing and distribution system for improved germplasm for commercial forestry through encouraging partners to venture into improved germplasm production and supply chain.

4.1.7 Capacity building

The strategy will enhance capacity of research staff and partners through trainings, workshops, exchange programs, benchmarking visits and extension services.

4.1.8 Research land

Research will be carried out on public land complemented by land from private partners in a mutually beneficial model.

4.2 Legal and policy framework

The strategy shall work within the existing forest sector legal and policy framework to ensure;

i. Access to improved germplasm either through locally improved sources or by importation of new varieties.
ii. Compliance with Intellectual Property Rights (IPR) however, work carried out under KCTIS will benefit all partners and IPR will be acknowledged but not proprietarily restricted
iii. Participation of partners in the development of enabling policies that are crucial in increasing investments in commercial forestry in the country.

4.3 Governance

This Strategy proposes the constitution of a Steering Committee to oversee the coordination and delivery of KCTIS on behalf of its partners. The membership of the steering committee may include representatives of; tree growers' associations, timber industry players, national and county government agencies, research and institutions of higher learning, international partners, among others. All partners will have equal say in the implementation of the Strategy. KEFRI will facilitate the formation of the Steering Committee, its composition, number of member and terms of reference for the inception phase (5 years).

The steering committee shall create a Commercial Tree Improvement Trust for resource mobilization and administration of the funds.

The strategy proposes aggregation of small-scale tree growers in a co-operative approach. The cooperative approach will be member focused to provide opportunity for financial support, access to improved germplasm, extension services and marketing of products.

4.4 Funding

The Strategy will seek financing through multiple funding streams that include partners' contributions, development partners, charitable trusts, tree grower's cooperatives, bonds, competitive grants, sale of genetic resources, National and County governments, sponsored projects, forest product levies, and crowd funding among other approaches.

4.5 Communication

Delivery of the objectives set in this strategy will be predicated on an effective and efficient communication system. Consequently, the strategy will ride on four key tenets.

1. It is envisaged that research developed under the support of KCTIS will be shared in accordance with the strategy's Intellectual Property Rights principles and centrally coordinated for easy access.
2. KCTIS will put in place an effective communication system to ensure a seamless flow of information among partners.
3. The KCTIS steering committee will provide periodic updates to the partners on progress made against an agreed action plan.
4. Information sharing with partners will be enhanced through a knowledge management system.

5.0 TIMELINES

Table 1. Timelines for the implementation of the strategy

Strategic considerations	**After launch (September 2021)**	**Short term (By 5 years)**	**Medium term (–By 15 years)**	**Long term (> 15 years)**
Research focus	Prioritize research areas for commercial tree species	Develop a blue print for Commercial Tree Improvement Centre, develop tree breeding programs, enhance access to improved germplasm, undertake capacity building and identify suitable research land	Establish a the Commercial Tree Improvement Centre, establish genetic gain, and species site matching trials	Establish certification systems for genetic, and seed quality, timber grades and other properties
Legal and policy framework	The Steering Committee to draft articles of agreements	Document and create awareness on sector legal and policy framework	Allocation of accrued benefits from Intellectual Property Rights (IPR)	Seamless flow of germplasm in adherence to legal and policy framework
Governance	Create the steering committee and agree on key principles of partnership	Aggregate tree growers	Create a Commercial tree improvement trust	Strengthen market chains
Funding	Develop budgets and work plans for KCTIS	Identify sources of funding and fundraise	Expand funding streams	Sustainable resource base
Communication	Promote the KCTIS among the stakeholders and develop communication plans	Create database for existing tree improvement work and share research results with stakeholders.	Develop and launch a commercial tree communication portal	Develop an integrated knowledge management hub for all

6.0 STAKEHOLDER ROLE ANALYSIS

The strategy was presented to various strategic partners (Table 2) for endorsement. The list will however be updated periodically to include new actors.

Table 2. Strategic Partners for KCTIS Implementation

Category	Stakeholder	Areas of interaction
Government agencies		
1.	Ministry of Environment and Forestry (MoEF)	Policy and institutional support
2.	Kenya Forest Services (KFS)	Germplasm development and research land
3.	Ministry of Industrialization	Products development
4.	Kenya Plant Health Inspectorate Services (KEPHIS)	Phytosanitary and certification
5.	Kenya Building Research Centre	Timber and wood standards
6.	Kenya Wildlife Services (KWS)	Protection of life and plantations from Wildlife
7.	National Environment Management Authority (NEMA)	Environmental impact assessments and audits
8.	National Lands Commission (NLC)	Land tenure
9.	National Treasury and Planning	Funding
10.	Kenya Bureau of Standards (KEBS)	Timber and wood standards
11.	Council of Governors (COG)	Policy and institutional support at County level
Development and Funding partners		
12.	Japan International cooperation Agency (JICA)	Financial and technical support
13.	World Resources Initiative	Financial and technical support
14.	Finish Embassy	Financial and technical support
15.	Food and Agriculture Organization (FAO)	Financial and technical support
16.	United Nations Development Programme (UNDP)	Financial and technical support
17.	Swedish Embassy	Financial and technical support
18.	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Financial and technical support
19.	Gatsby Africa (GA)	Financial and technical support
20.	Kenya Climate Change Innovation Centre (KCIC)	Financial and technical support
21.	Rainforest Alliance (RFA)	Financial and technical support
22.	European Union (EU)	Financial and technical support
23.	Kenya Private Sector Alliance (KEPSA)	Public policy for an enabling business environment
Commercial Banks		

Category	Stakeholder	Areas of interaction
24.	World Bank	Financial and technical support
25.	African Development Bank (ADB)	Financial and technical support
26.	National Commercial Banks	Financial and technical support
Research and institutions of higher learning		
27.	University of Eldoret	Research and development
28.	University of Nairobi	Research and development
29.	Egerton University	Research and development
30.	University of Kabianga	Research and development
31.	Karatina University	Research and development
32.	Kenya Agricultural and Livestock Research Organization (KALRO)	Research and development
33.	World Agroforestry Centre (ICRAF)	Research and development
Tree growers		
34.	Kenya Forest Services (KFS)	Seed and seedlings clients
35.	James Finley Limited	Seed and seedlings clients
36.	Kenya Tea Development Agency (KTDA)	Seed and Integrated Pest Management clients
37.	COMPLY/Timsales	Seed and seedlings clients
38.	Western Tree Planters Association (WETPA)	Seed and seedlings clients
39.	Sotik Tea Company	Seed and seedlings clients
40.	Kakuzi LTD	Seed importers
41.	Tree Growers Association of Nyandarua (TGAN)	Seed and seedlings clients
42.	Farm Forestry Small Holder Producers of Kenya (FFSPAK)	Seed and seedlings clients
43.	South Coast Forest Owners Association (SCOFOA)	Seed clients and seedlings
44.	Kenya Network of tree Growers Association	Seed and seedlings clients
45.	BETTER GLOBE Forestry	Seed clients
Nurseries		
46.	Aberdare Technologies	Seed clients
47.	KOMAZA	Seed clients
48.	Tree Biotechnology Trust (TBPT)	Clients for Integrated Pest Management
49.	Better globe	Seed clients
50.	Vi Agroforestry	Seed clients
Seed stockist		
51.	One Acre Fund	Seed distribution
52.	Kenya Seed Company	Seed stockist
Processors, manufacturers and end Users		
53.	Association of saw millers	Information on desired wood products

Category	Stakeholder	Areas of interaction
54.	Timber Manufacturers Association	Market information on category of products and trends
55.	Biashara Masters	Market information on category of products and trends
56.	Kenya Association of Manufacturers	Wood market
57.	COMPLY/Timsales	Wood market
58.	RAIPLY Limited	Wood market
59.	Timber Treatment International	Wood market
60.	Kenya Power and lighting Co. Ltd	Pole market
61.	PG BISON (K) Limited	Wood market for Construction and Furniture Industry
Forest Standards		
62.	Forest Stewardship Council	Quality assurance
63.	Forestry Society of Kenya	Quality assurance
64.	Association of wood science specialists	Quality assurance

7.0 ACKNOWLEDGEMENTS

First, we would like to acknowledge the support given by the KEFRI management led by the Director, Dr. Joshua Cheboiwo in committing staff time, resources and logistics for the development of this Strategy. We acknowledge that this Strategy and the four baseline studies under the Commercial Forestry Project would not have been realised without the technical guidance of the Project's Principal Investigator (PI) and Senior Deputy Director, Research and Development KEFRI, Dr. Jane Njuguna.

We further highly appreciate all the financial and technical support from Gatsby Africa (GA). The Kenya Commercial Forestry Programme (KCFP) of GA staff worked hand in hand with KEFRI Gatsby-Africa Commercial Forestry Project staff. In particular we acknowledge some key players: Lilian Magak for her exemplary coordination; Rory Mack of GA for playing the key visionary role of guiding this strategy and Dr. Steven Verryn (Creation Breeding Innovations) from South Africa for being instrumental in shaping this Strategy.

We would like to appreciate the KEFRI Gatsby-Africa Commercial Forestry Project core team members for devoting time and technical inputs into this Kenya Commercial Tree Improvement Strategy.

Lastly but not least, we thank all our stakeholders especially those who participated in the data collection surveys whose analysis helped to shape this Strategy and also all stakeholders

who participated in the two public participation Webinars which helped to fine tune the final document. Thank you and May God bless you all.