Ministry of Environment and Forestry

Proceedings of the 1st Kenya Commercial Forestry Investment Conference & Expo at KEFRI Headquarters, Muguga-Kenya 23rd - 26th November, 2021

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Proceedings of the 1st Kenya Commercial Forestry Investment Conference & Expo

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Cover Caption:
Photo of the Chief guest the Cabinet Secretary, Ministry of Environment and Forestry Mr. Keriako Tobiko, CBS, SC and participants who attended the 1st Kenya Commercial Forestry Investment Conference & Expo

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Kenya Commercial Forestry Investment Conference & Expo Organizing Partners

Executive summary

Globally, forests are estimated to cover about 4.06 billion hectares according to Global Forest Resources Assessment Report 2020, of which 131 million hectares are plantation forests representing 3% of the total global forests that is expected to supply wood for industrial and domestic use. It is projected that in order to meet the growing demand of wood, the plantation forests should supply at least 1.8 billion m3 of wood annually. This cannot be achieved if countries will rely on public plantations considering there is a significant loss of forest estimated at 420 million hectares since 1990. This calls for action by all stakeholders both from public and private to arrest the situation of wood deficit. This is because forestry sector provides goods and services that are very essential to environmental integrity and employment creation, thus playing a significant role on countries' Growth Domestic Product (GDP). Countries have made commitment on their Nationally Determined Contributions (NDCs) to reduce emissions through sustainable forest management practices including designing and implementing Reducing Emissions from Deforestation and forest Degradation (REDD+) programmes.

In Kenya, forest cover is estimated at 8.83% (5,226,191.79ha) of which 11% are forest plantations contributing to 3.6% of GDP excluding charcoal and direct subsistence uses, implying that with correct statistics, this should be higher than the stated percentage. However, with exponential population growth, wood deficit in Kenya stands at 10.3 million m^3 as the country is only able to meet 70% of the demand wood through sustainable supply. This implies that small and medium-sized enterprises are forced to operate below capacity resulting to unsustainable extraction of wood from natural forests and informal imports, leading to diminishing of the resource base. It is in this context that commercial forestry has the potential to bridge the wood deficit in Kenya and rest of the developing economies in Africa and rest of the world. The success of commercial forestry in Kenya lies in extending tree growing to private lands, community lands and arid and semi-arid lands that is constituting at least 80% of the total land. It is with this understanding that Kenya Forestry Research Institute (KEFRI) and partners organised the first Kenya Commercial Forestry Investment Conference and Expo from 23rd to 26th November 2021 at KEFRI headquarters Muguga with an objective of providing a platform to exchange knowledge and experiences on the potential of commercial forestry investment in Kenya. The conference also served as

an avenue for stakeholders and development partners who exhibited and showcased technologies, products as well as opportunities in commercial forestry in line with the conference theme "Commercial Forestry Investment for Wealth Creation, Enhancing Manufacturing, Food security, Health and Attainment of 10% Tree Cover in Kenya. The conference was structured into 11 sessions, namely: Opening session; Setting the pace for the commercial forestry in Kenya; Tree seed and forest plantation management; Forest product processing value addition and technologies; Regional Trade for key products and Bamboo value chain; Investment and financing models for forestry sector in Kenya; Commercial forestry investment forum dialogue; Education and skills development; Policy, legislation and governance; International perspectives on commercial forestry; Commercial forestry policy dialogue; Poster and expo; and Field excursion.

The Conference and Investment Expo was graced by Cabinet Secretary, Ministry of Environment and Forestry, Mr Keriako Tobiko, EBS who was a Chief Guest, Principal Secretary, Ministry of Environment and Forestry, Dr Chris Kiptoo, CBS, the Chief Executive Officers (CEOs) from KEFRI, Kenya Forest Service (KFS), National Environment Trust Fund (NETFUND), Ambassador from Sweden to Kenya H.E. Caroline Vicini, Ambassador from Costa Rica, H.E. Giovanna Valverde Stark, Deputy Ambasodor of Colombia Ms. Claudia Milena Vaca, and FAO resident representative of Kenya H.E Carla Mucavi. The key issues that emerged from the sessions of the conference and investment expo include the following:

SESSION I

Setting the pace for the commercial forestry in Kenya

In this session stakeholders were encouraged to develop innovative models of governing the sector such as public private partnerships that could be leveraged on to improve commercial forestry in Kenya. Leasehold and concessions could be adopted in the public sector while the private sector could supply the desired land, capital, and operational efficiency. There is also a need to address legal and policy barriers that discourage investment in the sector including the red tapes when seeking harvesting and movement permits for timber and charcoal products. It is also important to complete the development of the national sustainable forest management standards to improve the Chain of Custody and sustainability of the sector. Digital ICT based technologies can be used to support extension as well as provide information to stakeholders on

science based smart greening activities and initiatives including species site matching (KEFRI APP), silvicultural management, weather advisory, tree valuation, among others.

SESSION II

Tree seed and forest plantation management

Stakeholders called for increasing the quantities and accessibility of high-quality seedling nurseries to ensure affordability. Enhance production of high-quality seeds for improved production of high-quality seedlings and undertake more research on thinning regimes, topping (to ascertain its role in tree taper) and Mean Annual Increment (MAI). The research and academia should also consider providing information on species site matching to improve performance of superior germplasm and seed sources.

SESSION III

Forest product processing value addition and technologies

In this session stakeholders emphasized on the need to bridge the widening supply gap by working towards enhancing the supply of forest products through promoting farm forestry, investment in dryland forestry and diversification of species. The notable challenges facing the timber value chain sector were: shortage in raw material (partly due to moratoriums); high timber prices of timber products from imports; dilapidation of existing investment; loss of employment and slow growth of the sector. In this regard, sustainable commercialization of non timber forest products (NTFPs) has a great potential for the creation of employment, contributing to improved benefit-sharing, improved conservation of biodiversity, reduced land degradation, and increased households' incomes thus leading to reduced vulnerability of local communities.

SESSION IV

Regional Trade for key products and Bamboo value chain

This session called for the need to adopt innovative models to govern the sector and benchmarking with countries with developed bamboo value chains such as China. The stakeholders were also of the view to have fiscal and monetary incentives to the sector such as use of subsidies, tax reliefs and exemptions as well as sectoral allowances for the bamboo. There is also a need to improve financing in the sector through adoption of innovative financing models such as carbon financing. Stakeholders felt for the need to address land tenure systems and benefit sharing across the value chain to

ensure all the actors in the value chain and across genders are rewarded accordingly. Equally, conference noted for the need to identify and adopt innovative strategies to increase the participation of tree growers to Forest Stewardship Council membership to improve sustainability in the sector.

SESSION V

Investment and financing models for forestry sector in Kenya

Stakeholders noted that financing to forestry sector is currently improving due to the numerous environmental and restoration initiatives through global programmes such as the Global Environment Facility (GEF) and Green Climate Fund (GCF) that investors can tap into. There is a need for support in the development of tailor-made bankable business products jointly with the financial sector actors for improved finance in forestry. Equally,promoting and facilitating the growth of farmer groups into larger-scale groups (e.g., cooperatives) will reduce transaction costs, create economies of scale while improving bargaining power with potential financiers. In addition, there is a need to promote and facilitate business incubation services to improve farm forestry producer organizations credit worthiness.

The stakeholders also noted that capacity building and training on preparation of bankable business plans, bookkeeping, appraisal processes, collateral arrangements, guarantee funds, and insurance is key to the success of the sector. There is also a need to facilitate the creation of innovations/ways to de-risk commercial forestry investments by Forest and Farm Producer Organizations (FFPOs). Equally, promoting events that bring together investors/financiers and potential forestry value-chain clientele/actors to create awareness and open financing and business opportunities for either of the parties will remain valuable.

SESSION VI

Commercial forestry investment forum dialogue

In this session stakeholders encouraged increase of investment in remote sensing technologies to support monitoring of commercial forest plantations and inventory. They also recommended for the development of technologies for species site matching to optimize on the investments that can spur commercial forestry across various agro-ecological zones in Kenya. In this regard they called for: Establishment of Commercial Forestry Investment and Innovation Centre in Kenya to be hosted by Kenya Forestry Research Institute; identification and promotion of Public Private Partnership (PPPs)

land lease models that can result to realization of high-quality commercial plantation to meet the current demand and supply deficit in Kenya and across the region; and strengthen the role of private sector and international communities in the forestry industry to enhance co-financing for investment in commercial forestry to propel economic growth and environmental sustainability.

SESSION VII

Education and skills development

The conference and investment expo noted that university training in commercial forestry can be improved through linkages with industry. In this regard, investors were encouraged to provide opportunities for investment and expose students to practicality of forestry. This can be done through internship opportunities. It was also noted that the KEFRI Graduate Research School (KGRS) is envisaged to support students at all levels including undertaking joint research with post graduate students and supporting undergraduate students through provision of opportunities for research internships and attachments. The conference participants were also of the view that forestry private sector actors should employ persons with required skills in their businesses. It was noted for the need for inclusion of professionals and forestry private sector actors in curricula development for middle and tertiary colleges in forestry.

SESSION VIII

Policy, legislation and governance

In this session strengthening of linkages between science, policy, and practice by harmonizing conflicting policies and laws and streamlining of mandates between lead agencies in the forestry sector was viewed as important. The stakeholders proposed for the provision of forestry research extension services, education and training, inventories of forest and tree resources market information and analysis, forest valuation and monitoring and evaluation systems. It was noted that though forest extension is devolved most counties are yet to operationalize the Transitional Implementation Plans (TIPs). Stakeholders also encouraged for the adoption of forest management models that will support commercial forestry such as private and community land concessions, contract farming, forest certification, benefit sharing and community participation. Equally, it was recommended for the need to strengthen linkages between science, policy and practice by harmonizing conflicting policies and laws and streamlining of mandates between lead agencies in the forestry sector.

There is also need to secure land tenure, respect for private owners, have reliable economic governance structure and efficient resolution mechanism.

SESSION IX

International perspectives on commercial forestry

The stakeholders encouraged Kenya to embrace partnerships with other countries to improve investment and conservation in the forest sector. For instance the potential of wood in the construction sector is high calling for getting best practices and standards that can be used to unlock this potential that will boast the country's economy and influence sustainable utilization of forests. The formulation of enabling public policies and incentive mechanisms such as PES and REDD+ in forestry has an enormous potential in promoting sustainable forest management. Kenya should also tap in the opportunities offered by bamboo.

SESSION X

Commercial forestry policy dialogue

In this session stakeholders were of the view that financial institution need to join hands and come up with a tailor made product that will suit investment in commercial forestry through partnership approach with investors. The financial institutions should also seek for international support that will assist in working on the risks posed in funding investment in commercial forestry. The conference and investment expo noted that strengthening capacity of investors/stakeholders investing in commercial forestry to package the products like in the case of mortgage financing to enable financial institutions to fund the forestry sector in collaboration with insurance companies is of great significance. Equally, for the forestry investment to be sustainable there is need to link it with the Climate Change Act 2016 section on duties and incentives that compels the private sector to participate in climate change activities. If the government implement the Act the way it is, then it will be away of promoting sustainability in the forestry sector.

Way Forward

The conference and investment expo was closed by the Principal Secretary Ministry of Environment and Forestry, Dr. Chris Kiptoo, EBS who commended the KEFRI and partners for organizing the three day engagement with stakeholders on various technical sessions, expo and field excursion. In moving forward, the following were agreed:

i. There is need to hold the conference every two years to assess the status and progress of the sector;
ii. Establish and operationalize Kenya Commercial Forestry Innovation and Investment centre to continue the discussion on improving commercial forestry in Kenya and development of a strategy for the same;
iii. Create platform for continuous engagement with stakeholders from both public and private sectors including;
iv. Promote initiatives to support youth and women in commercial forestry;
v. Engage with stakeholders on better markets and prices of forest tree products and non timber forest products;
vi. Maintain the momentum of the commercial forestry engagement by holding quarterly meetings and webinars on key and emerging issues on sustainable commercial forestry;
vii. Design resource mobilization mechanisms among stakeholders for harnessing resources to support commercial forestry investment in Kenya, incentives, proposal; and
viii. Prepare commercial forestry conference proceedings and share widely by profiling and maintaining data base of the actors in commercial forestry, development of a policy and regulations to support commercial forestry in Kenya, and development of innovative incentive models to support commercial forestry (REDD+, and PES schemes.

Forward

Forestry is one of the key sectors of the economy due to the role it plays in supporting other productive sectors such as manufacturing, real estate, agriculture, and tourism. It also supports the provision of ecosystem services (supporting, provisioning, regulating and cultural), necessary for human well-being and improved quality of life in society. The country has in the past been heavily relying on public forests for its round-wood supply that in turn led to unsustainable exploitation of public forests. Commercial forestry presents an opportunity to reverse the situation by promoting tree farming in private and community farms including arid and semi-arid lands. Improved tree seed germplasm, species site matching, proper silvicultural management practices, efficiency in harvesting, processing, and utilization as well as a supporting policy framework are some of the strategies that can be used to improve commercial forestry in Kenya.

KEFRI's main mandate is to contribute to forestry development in the country through conducting research in forestry and allied natural resources, as well as development of forestry technologies, to improve efficiency in the sector. For this to be meaningful, robust extension and dissemination to all the stakeholders is critical. The institute adopted a multi-institutional and multi stakeholder approach in organizing the conference and expo. It provided a platform for stakeholders to take stock of the milestones achieved in the Kenyan forestry sector as well as chat the way forward. The conference came in the wake of increasing demand of forestry products in the country occasioned by economic growth . The supply of forestry products from public plantations, on the other hand, remains overstretched and cannot be expanded any more to meet the rising demand. The market and prices of timber have also been increasing , raising the potential for commercial forestry as a viable investment option. Key issues discussed in the conference included the need for improved tree seed germplasm for commercial forestry, adoption of proper species site matching in the sector, adoption of innovative plantation management models, fast tracking the completion of the forest standards and certification procedures for Kenya, adoption of high efficiency technologies along the value chains (Production and utilisation), capacity building of actors especially private producers on emerging financing models e.g. climate financing and REDD+ initiatives. These strategies require a multi-institution/ multi stakeholder approaches to achieve the targeted development agenda.

KEFRI maintains an open- door policy and is committed to support and capacity build all stakeholders interested in commercial forestry activities in the country. Through the proposed Kenya Commercial Forestry Investment Centre, key issues in commercial forestry including dissemination of research findings, provision of linkages to finance, insurance and markets, and the provision of commercial forestry related products and services will continue. The future of forestry products supply in the country lies in private and on farm forestry. All stakeholders are thus requested to support the sector to achieve sustainable economic development in the country

Dr. John Waithaka
Chairman, KEFRI Board of Directors

Preface

The forestry sector contributes approximately 3.6% to the GDP without accounting for the value of ecosystem services. It provides employment to actors in forest dependent value chains including tree growers, harvesters, sawmillers, traders, and processors. Forests supply raw materials such as timber, poles, and fuel wood to productive sectors of the economy such as real estate, manufacturing, and agricultural sectors. The demand for forest products in the country currently outweighs the supply potential, with an annual deficit of approximately 10.3 million m^3. This is attributed to high demand occasioned by increasing population, growing real estate, and manufacturing sectors in the country.

It is thus of necessity to improve the uptake of commercial forestry in the country to boost the supply of wood products in the country. The Kenya Commercial Forestry Investment Conference and Expo brought together forestry stakeholders including government agencies; producers; harvesters; saw-millers; traders; financial entities; academia; research institutions; machinery suppliers, among others, to deliberate and discuss on how best to upscale commercial forestry in the country. The theme of the conference was "Commercial forestry for wealth creation, boosting manufacturing and food security in the country. The conference provided a platform for national, regional, and international practitioners, researchers, professionals, and investors to share knowledge, experiences, innovations, and opportunities in the Kenyan and East Africa commercial forestry sector. It also provided an opportunity for stakeholders to showcase technologies, products, and services in commercial forestry.

Key recommendations from the conference were: The need for improved financial access in the sector. There exists minimal information on bankable financial products to support commercial forestry especially for smallholder farmers who make up over 70% of the Kenyan population. In the short run, Kenya could leverage on existing supply potential of wood products from East Africa such as the maturing pine plantations in Uganda to serve its market, as we improve our supply potential. There is need to improve on the efficiency along the forestry value chain including proper species site matching, harvesting, processing technologies and wood seasoning. The country could also leverage on innovative models of financing the sector such as the payment for ecosystem services experience from Costa Rica, potential wood substitutes for infrastructure development such as bamboo in Colombia as well as use

of wood technologies for sustainable cities in Sweden.

In future, there is need to continue the dialogue on up-scaling commercial forestry in the country through establishing and supporting a platform for linking stakeholders in commercial forestry where experiences and knowledge in commercial forestry can be shared. The Kenya Commercial Forestry Investment Centre will thus be key in linking industry players including producers, service and technology providers, government, and academia. It will also support linkages to markets, financial, and insurance services. Finally, even though the government has put in place various policies to promote commercial forestry in the country such as the FCMA (2016), there is need to look at innovative models of tapping into emerging financial opportunities such as carbon financing initiatives and mainstreaming payment for ecosystem services in smallholder farm forestry to improve returns for smallholder farm forestry in the country

Joshua K. Cheboiwo (PhD)
Director, Kenya Forestry Research Institute

Acknowledgement

First and foremost, the Conference Organizing Committee (COC) wish to express their heartfelt appreciation to the KEFRI Board of Directors for the approval and allocation of funds towards the commercial forestry investment conference and expo. Their guidance and support provided great insight and roadmap that led to the success of the conference. The COC also registers sincere recognition of the KEFRI Directorate and Executive Committee of the Senior Management for their strategic guidance in ensuring effective engagement with partners and staff in making the conference a successful event.

In a special way, the COC recognizes the critical role the Cabinet Secretary, Ministry of Environment and Forestry (MoEF), Mr. Keriako Tobiko EGH, played during the preparation, driving agencies of the MoEF and other international development partners to profile the investment conference and expo to the global community. The COC is really indebted for his vision and his availability to officially open the commercial forestry investment conference and expo. His presence was a clear testimony of the Ministry's commitment towards supporting green growth and commercial forestry in Kenya. The COC also acknowledges the valuable role and contributions from the Principal Secretary, Ministry of Environment and Forestry, Dr. Chris Kiptoo CBS who not only came to close the investment conference and expo, but who also ensured a success of the conference from the conception to the actual dates of stakeholders engagement. He was always available to the COC during the preparation and continuously guided and shared sharing invaluable insights that led to the successful holding of the first commercial forestry investment conference and expo.

The COC in a special way thanks partners who supported the conference and jointly participated in the planning and organization, namely; Food and Agriculture Organization of United Nations (FAO), United Nations Development Program (UNDP), Base Titanium Ltd, Kenya Forest Service (KFS), Japan International Cooperation Agency (JICA), National Research Fund (NRF), Kenya Climate Innovation Centre (KCIC), GATSBY Africa, We-Effect-Global, Family Bank, Kenya Commercial Bank (KCB), Ukulima Sacco, Asili Sacco, Better Globe Ltd, Komaza Ltd, Kakuzi Ltd, and the Forest Society of Kenya (FSK). It is out of your generosity and support that the conference was a success. Exceptional appreciation goes to the Ambassadors of Sweden, Costa Rica and Columbia for attending and

sharing useful experience from their respective Countries. The COC acknowledges those who participated in exhibition drawn from: KEFRI, KFS; Swedish Embassy; UNDP- (The Green War/ Chai Zambarau) Biashara Masters; Gatsby Africa (-Elifurni/ BUILD HER/KCFP/PLANTECH Techdirect Solutions; Base Titanium; FFSPAK/We Effect; FAO; KCIC- (HORN AFRIK- MUNDA APP/ AGAR-Gums and Resins/ ROI Farm); Forest Stewardship Council; Forest Society of Kenya; KFS; Family Bank; Cooperative Bank; Kenya Commercial Bank; Kingdom Bank; Kuhuru Tree Nursery-tree seedlings; Fruity Schools Africa; TARDA- bee products; and MERCFA Muguga-tree seedlings.

Last but not least, many stakeholders and partners provided the needed support and invested their time, energy and emotional intelligence towards making the investment conference and expo a success. Failure to mention their names does not in any way mean their deserved contribution is not appreciated, but to you the COC says thank you. It is in this context that the COC singles out extraordinary appreciation to the Director KEFRI, Dr. Joshua Cheboiwo and the conference Secretariat members namely; Dr. Joram Kagombe, Dr. Vincent Oeba, Mr. Paul Tuwei, Mr. Jonah Kiprop, Dr Anthony Macharia, Mr. Abdalla Kisiwa, Ms. Priscilla Kimani, Ms. Emily Njagi, Ms. Joyce Ojino, Ms. Gertrude Kimutai, Ms. Joyce Chege, Ms. Elizabeth Waiganjo and the Conference organizing sub committees (Technical, Resource Mobilization, Budget, Logistics and Publicity) who worked tirelessly to ensure all the technical papers, run-up webinars to the conference, resources and logistics as well as conference infrastructure were in place and efficiently running during the conference. The COC appreciate the good work from ICT team who ensured all systems were running well more so for those who attended virtually. In addition, the COC thanks the presenters who prepared and shared high quality presentations, those participated in the policy dialogues, investment forums, expo/exhibition sessions on the various aspects of commercial forestry and all participants who sacrificed their time and resources to attend the conference physically and virtually.

We Thank You All

Dr. Joram Kagombe
Chairman,
1st KEFRI Kenya Commercial Forestry Conference Organizing Committee

ACRONYMS

AFCC	Africa Forest Carbon Catalyst
ASALs	Arid and Semi-Arid lands
CEOs	Chief Executive Officers
COP 26	Conference of the Parties
DRC	Democratic Republic of Congo
EMCA	Environmental Management and Coordination Act
ERS	Economic Recovery Strategy
FAO	Food and Agriculture Organization of United Nations
FFF	Forest Farm Facility
FFPOs	Full Fee Paying Overseas Student
FMC	Forest Management and Conservation
FSC	Forest Stewardship Council
FSK	Forest Society of Kenya
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEAP	Green Employment in Agriculture Programme
GEF	Global Environmental Fund
GIS	Geographical Information System
GoK	Government of Kenya
GrEYAP	Green Economy Youth Activation Program
ICT	Information Management System
JICA	Japan International Cooperation Agency
KCB	Kenya Commercial Bank
KCIC	Kenya Climate Innovation Centre

KCV	Kenya Climate Ventures
KEFRI	Kenya Forestry Research Institute
KEPHIS	Kenya Plant Health Inspectorate Service
KEPSA	Kenya Private Sector Alliance
KFS	Kenya Forest Service
KGRS	Kenya Graduate Research School
MAI	Mean Annual Increment
MESPT	Micro Enterprises Support Programme Trust
MFIs	Micro Finance Institutions
MoEF	Ministry of Environment and Forestry
MOU	Memorandum of Understanding
NDCs	Nationally Determined Contributions
NGOs	Non Governmental Organisations
NRF	National Research Fund
NTFP	Non Timber Forest Products
OECD	Organisation for Economic Co-operation and development
PPP	Public- Private Partnership
R$D	Research and Development
REDD+	Reducing Emission from deforestation and Forest Degradation
RFF	Rapid Financing facility
RS	Remote Sensing
SDD	Senior Deputy Director
SDGs	Sustainable Development Goals
SMEs	Small and Medium enterprises
SPGS	Sawlog Production Grand System

STI	Science, Technology and Innovation
UNCBD	United Nations Convention on Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNCDF	United Nation Capital Development Fund
UNDP	United Nations Development Program
UNEP	United Nation Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UTG A	Uganda Timber Growers Association

CONTENTS

1.0

BACKGROUND TO THE CONFERENCE

1.0 BACKGROUND TO THE CONFERENCE

The Commercial forestry sector in Kenya has witnessed tremendous growth over the past few decades occasioned by the Country's rapid population growth, economic growth, and urbanization. This has in turn led to increased demand of forestry products and services. The growing demand has not been able to match the local supply of forestry products making Kenya a wood deficit country. Kenya had an annual wood deficit of approximately 10.3 million m^3 by 2013 where the country could only meet 70% of its timber demand sustainably. This deficit is covered through formal and informal imports of timber as well as unsustainable extraction from public natural forests in the country.

Forest products demand on the other hand has been on an upward trajectory occasioned by increasing population, economic growth and frequent timber harvesting moratoriums on public plantations. According to Kagombe *et al.* (2020), since the introduction of the current timber harvesting moratorium in 2018, farm forests have been the major suppliers of round-wood for both subsistence and commercial forest products in the country. This has led to increase in prices of forest products as well as over dependence on imports from East and Central African countries such as Tanzania, Uganda, and the Congo for supply of timber. The high demand of forest products in the country presents an opportunity for investors to tap into commercial forestry investments, this was key focus during the conference.

It is in this context that the Kenya Forestry Research Institute (KEFRI) and partners organised the first Kenya Commercial Forestry Investment Conference and Expo from 23rd to 26th November 2021 held at KEFRI headquarters Muguga. The theme of the conference was "Commercial Forestry Investment for Wealth Creation, Enhancing Manufacturing, Food security, Health and Attainment of 10% Tree Cover in Kenya" This conference and expo was organized by a multi- institutional team composed of public, private and development institutions such as the; Ministry of Environment and Forestry (MoEF), Kenya Forestry Research Institute (KEFRI), Kenya Forest Service (KFS), National Research Fund (NRF), Council of Governors (COG), Food and Agriculture Organization of United Nations (FAO), United Nations Development Program (UNDP), Japan International Cooperation Agency (JICA), Base Titanium Ltd, Kenya Climate Innovation Centre (KCIC), GATSBY Africa, We-Effect-Global, Family Bank, Kenya Commercial Bank (KCB), Ukulima Sacco, Asili Sacco, Better

Globe Ltd, Komaza Ltd, Kakuzi Ltd, One Acre Fund and the Forest Society of Kenya (FSK). The conference was officially opened by the Cabinet Secretary, Ministry of Environment and Forestry Mr. Keriako Tobiko, CBS, SC. It was graced by ambassadors from Sweden, Costa Rica, and Columbia and FAO resident representative of Kenya. A hybrid mode entailing both physical and virtual participation was adopted. This conference was structured into: Research paper presentations; Policy dialogues; Investment forum and Expo/ Exhibition session.

1.1 Conference objective

The overall objective of the conference was to provide a platform for exchange of knowledge and experiences on the potential of commercial forestry investment in Kenya.

1.2 Specific objectives

The Commercial Investment Conference and Expo specifically sought to:

1. To provide a platform to national and international investors, researchers, and professionals to share knowledge, experiences, and opportunities in the commercial forestry sector in Kenya and within the region;
2. To offer an avenue for stakeholders and development partners to exhibit and showcase opportunities and current technologies, products, and services in the commercial forestry sector in Kenya and within the region;
3. To facilitate discussions and exchange of ideas and innovative thinking among stakeholders on the future of commercial forestry sector;
4. To take stock of the status of the commercial forestry sector challenges and opportunities;
5. To provide an opportunity to create research, innovation, and enterprise linkages with potential industry players; and
6. To make strategic policy recommendations for promotion of commercial forestry in Kenya.

1.3 Conference Sub-themes and areas addressed

The Kenya Commercial Forestry Investment Conference and Expo had various sessions summarizes as follows.

Session	Topics
I	Plenary: Setting the Pace for Commercial Forestry in Kenya • Commercial Forestry Investment for Wealth Creation, Enhancing Manufacturing, • Food Security, Health, and Attainment of 10% Tree Cover in Kenya • Future of public forestry sector to meet the country timber needs and role of PPPs • The Role of KEFRI App in Commercial Forestry
II	Tree Seed and Forest Plantation Management
III	Forest Product Processing Value Addition and Technologies
IV	Investment and Financing Models for Forestry Sector
V	Commercial Forestry Investment Forum Dialogue Opportunities and Challenges in Commercial Forestry in Kenya
VI	Education and Skills Development
VII	Policy, Legislation and Governance
IX	International perspectives on Commercial Forestry
X	Policy Dialogue
XI	Commercial Forestry Tour and Expo

2.0

OPENING SESSION

2.0 Opening Session

This session consisted of welcome remarks from the: Director and Chief Executive Officer (CEO) of the Kenya Forestry Research Institute (KEFRI); CEOs from Government institutions- Kenya Forest Service (KFS) and the National Environment Trust Fund (NETFUND); representatives from development partners-the United Nations Food and Agriculture Organization of the United Nations (FAO), United Nations Development Programme (UNDP), and Japan International Cooperation Agency (JICA); and the representatives/CEOs from private sector and financial institutions-Family Bank, Kenya Climate Innovation Centre, Base Titanium and Gatsby Africa. It was then followed with official opening of the conference that consisted of remarks from KEFRI Chairman Board of Directors, Dr. Sammy Letema and speech from the Chief Guest Hon Keriako Tobiko, Cabinet Secretary Ministry of Environment and Forestry.

The following were the key remarks of speakers during the opening session after a word prayer from Dr George Muthike, the Deputy Director, Forest Product Development of the Kenya Forestry Research Institute:

2.1 Welcome remarks from the Director/CEO KEFRI

The Director/CEO KEFRI Dr. Joshua Cheboiwo welcomed participants to the conference after self-introduction. He was delighted that KEFRI was hosting the First Kenya Commercial Forestry Investment Conference and Expo together with various partners in the forestry sector. He informed the participants about the mandate of KEFRI and its relevance to the conference. He noted that Forestry research in Kenya started in 1934 and has grown tremendously since the formation of KEFRI in 1986, with 5 initial scientists which has increased to 120 currently. He reiterated on the need and importance of research in forestry to spur sustainable and socio-economic development. He emphasized that this first commercial forestry investment conference and expo will result to exchange of ideas and experiences among local and international stakeholders to advance forestry agenda now and in the future. He then highlighted the objectives of the conference as provided in the background part of this proceedings that were to be achieved through the presentations of technical papers, plenary discussions, poster displays, exhibitions and a field excursion that exposed delegates to activities related to commercial forestry.

Overall, he informed the participants that the conference was being attended by more than 500 delegated both physically and virtually drawn from public and private sectors in forestry and allied natural resources. He was delighted that as a result of this conference, KEFRI was able to invest on the infrastructure for Information Communication and Technology (ICT) to enable simultaneous attendance of the conference through virtual and physical. In addition, he informed that participants that KEFRI has upgraded its ICT and internet connectivity in all its centres to enhance information sharing with stakeholders to increase adoption of forestry technologies and support development of commercial forestry in the country.

Lastly the KEFRI Director/CEO notified the participants that the institute through its Eco-regional research programmes spread across the country offers other services such as: sale of tree seed and seedlings; soil analysis; plant analysis; diagnosis of tree pests and diseases; and capacity building of stakeholders. The Institute also works very closely with institutions of higher learning and other training institutions to recruit and build capacities of young scientists to ensure succession management in forest research. He appreciated the support from GoK through the Ministry of Environment and Forestry, Development partners, and private sector for making this conference and expo a reality.

2.2 Remarks from the CEO KFS and NETFUND

The Chief Ecosystem Conservator and CEO of NETFUND both noted the importance and timely arrival of the conference to support the forest sector. Essentially;

- NETFUND CEO Mr. Samson Toniok underscored the importance of commercial forestry to the support of socioeconomic development and alos the realization of the government drive towards 10% tree cover and restoration of natural ecosystems.
- The Chief Conservator of Forests Mr. Julius Kamau, EBS acknowledged the need for the collaborative engagement of stakeholders and communities in the forest sector for the success in forest development. He also noted that for KFS to achieve it's mandate of managing public forests in Kenya it will require support from various stakeholders, presence of enabling policies, resource base enhancement and stronger public private partnerships. He further restated the importance of commercial forestry which started in 1902 in the gazette forests.

2.3 Remarks from the private sector CEOs

The private sector was represented by Gatby Africa, Kenya Climate Innovation Centre, Family Bank and Base Titanium. The private sector acknowledged their vital role role to support the strategic direction being driven by the Ministry of Environment (MoEF) and Forestry. KEPSA through its members including Kenya Association of Manufacturers and Kenya Climate Innovation Centre (KCIC) have been able to rally the private sector to drive the Corporate Commitment to Climate Change and Sustainability in Kenya. This is because the sector drives most of the strategic decisions that are key in climate change adaptation such as matters in infrastructure, economic activities, and adaptive technologies, among others. Various private organisations are seeking collaborations and undertaking environmental initiatives, for instance:

- Gatsby Africa (GA) have already signed MOUs with the MoEF towards unlocking the potential of commercial forestry in Kenya. They have also established a commercial forestry programme to bring stakeholders in the sector to enhance investments in the forest value chains;
- The Kenya Climate Innovation Centre (KCIC) have an MoU with KEFRI and noted that Commercializing forestry is going to be a game changer in the forest sector. With financial support from UNDP, the organization is implementing a component of GrEYAP that aims to create private sector partnerships that will incubate and grow 40 start-ups/scale-ups engaged in forestry, agroforestry, and forest products;
- Family bank through its philanthropic arm, the Family Group Foundation has taken deliberate efforts so that we can build a healthier, more resilient and sustainable world and deliver real- world benefit to global challenges. The bank has set aside KES 5 million for a period of two years to support tree growing, conserve and enhance water availability; and develop and sustainably use natural resources for the benefit of local communities around the Ngong Hills forest while providing employment to thousands of youths within the area. This is being done through a partnership with with Green Blue Foundation Africa and made a commitment to support the restoration of 10 acres within the Ngong Hills Forest ecosystem. Only three other banks in Kenya have committed to to commit to building a sustainable businesses in Kenya. The Bank encouraged other players to join various environmental promotion programmes including Environmental Soldier

Program that encourages the corporate and private sectors to support rehabilitation and conservation of forest blocks within public and community forests; and

- The private sector envisage partnerships in commercial forestry ventures among the various organisations after the conference.

2.4 Remarks from the development partners CEOs/ representatives

The development partners from FAO and UNDP reiterated to the welcome remarks from the Director/ CEO KEFRI. Specifically, The FAO resident representative H.E Carla Mucavi appreciated KEFRI for hosting the conference and congratulated the Government of Kenya for initiating and organizing a commercial forestry conference and expo. He commended KEFRI for including FAO in the planning of the conference where the Organization committed and supported the conference with KES three (3) million. The representative informed the conference participants that FAO has been involved in development of several policies in support of forestry. Specifically, FAO has pledged the support to provide technical implementation of forest restoration in arid and semi arid lands (ASALs). Currently, FAO through national and county governments is implementing farm forestry in 7 countries to secure livelihoods and this year 2021, FAO is supporting of Nyandarua farmers in Kenya. FAO has also pledged to support the proposed innovation centre to provide technical advice to investors

H.E Carla Mucavi, underscored the importance of forestry in adaptation and mitigation of climate change. She informed the conference that FAO has supported sustainable forest management policies in Kenya through capacity building and implementation of Forestry Farm Facility (FFF) in the counties through small growers associations. She noted that FAO will continue to work with KEFRI to nature the forest investment innovation Centre and will support the Greening Kenya Initiative through provision of funds worth USD 75,000.

Mr. Walid Badawi, the UNDP Resident Representative in Kenya (represented by Julius Coredo), noted that the conference was important and timely coming on the heels of United Nations Framework Convention on Climate Change 26th Conference of Parties (COP26), a time to reflect on the foundations for future development and financing of commercial forestry in the country and the region at large. He informed the participants that UNDP supported the development of the country's Economic

Recovery Strategy (ERS, 2020-2022) that was pegged on Kenya's determination to Build-Forward-Better and Greener. The ERS is practical in its aspiration of growth opportunities that maintain a balance between people and planet, providing fit-for-purpose strategies and advocating for de-risking of nature-based solutions while responding to Kenya's pressing challenge of youth unemployment.

Mr. Walid pointed that through the Rapid Financing Facility (RFF), UNDP in Kenya is implementing a project titled 'Green Economy Youth Activation Programme (GrEYAP)' whose objective is to harness the engagement of the youth in the green economy in line with the National Youth Development Policy and mobilise and build the capacity of youth to establish and strengthen viable business and entrepreneurship models in the forestry and agroforestry value chains. In so doing, the project seeks to unlock sustainable green jobs and livelihood opportunities through innovative youth start-ups in the green economy.

He informed the participants that GrEYAP project is supporting KEFRI to establish the Commercial Forestry Innovation Centre which will link forestry research to investors (market) through suitable Public-Private Partnership (PPP) models. The centre will also include an ICT-based decision support system to support commercial forestry investors in Kenya by offering a repository of technical advisory services, market information/linkages, plantation management solutions, science laboratory services, forestry research dissemination, among others. UNDP has also supported 15 youth champions engaged in forestry activities whom they seek to link to practices, opportunities and innovations relating to commercial forestry, and thereby plant the seed of their future participation in the sector. Specifically, with financial support from UNDP, Kenya Climate Innovation Centre (KCIC) is implementing a component of GrEYAP that aims to create private sector partnerships that will incubate and grow 40 start-ups/scale-ups engaged in forestry, agroforestry, and forest products.

In addition, UNDP in Kenya has supported the development of market intelligence information called SDG Investor Maps. These maps have delineated potential opportunities areas that are amenable to private sector investment in Kenya and have the potential to impact on SDGs. Thus he noted that in the wake of COP26, Commercial Forestry becomes a clear potential Investment opportunity area and beginning to understand comprehensively the business and impact dimensions for Forestry is clearly in UNDP's interest. In view of this UNDP is also supporting the

development of the country's national REDD+ strategy.

Lastly, Mr. Walid informed conference participants that UNDP also recognizes the importance of unlocking climate finance flows to support Kenya's efforts in climate adaptation and mitigation and specifically, support towards the Ministry of Environment and Forestry's Tree Growing Fund, which aims at mobilizing over 2 billion good quality seedlings for Kenya's re-afforestation efforts.

2.5 Remarks by the Chairman, KEFRI Board of Directors - Dr. Sammy Latema

The Chairman in his remarks acknowledged the presence of the the Cabinet Secretary Ministry of Environment and Forestry, Hon. Keriako Tobiko Ambassadors present, Chief Administrative Secretary, Hon Mohammed Elmi, the Principal Secretary, Ministry of Environment and Forestry, Dr. Chris Kiptoo, the Board of Directors of various Government Parastatals, Directors of Public and Private Agencies, Representatives of Embassies, Representatives of various stakeholders from International and national institutions/organizations, key stakeholders from the region, all conference participants and invited guests whom he welcomed.

In his remarks, he re-iterated that Kenya Forestry Research Institute (KEFRI) is a state agency established in 1986, under the Science and Technology Act (Cap 250), which since been repealed by the Science, Technology and Innovation (STI) Act No. 28 of 2013. In the past 35 years, KEFRI has provided leadership in finding solutions to forestry and environmental challenges through: conducting research and generating technologies in forestry and allied natural resources. The Institute's research is guided through 5-cycle year strategic plans and is currently implementing the 6th Strategic Plan 2018-2022.

He informed the investment conference and expo that the Institute has well trained research capacity with 28 scientists holding PhDs, 55 trained to MSc level and 37 with BSc training. The Institute also has other technical staff specialized in diverse areas ranging from molecular genetics to forest pathology. To conform to international standards of both environmental management and quality standards, the Institute is ISO 14001:2015 and 9001:2015 IMS certified. In this regard, the Board of Directors through the support of the government has continued to provide modern infrastructure to ensure scientists undertake research in conducive environment to provide solution to support forestry development in the country.

The Chair also noted that KEFRI provides high quality tree seed to support commercial tree growing nationally and in the neighbouring countries. Annual seed production has grown from 24 tonnes in 2018/2019 to 47 tonnes in 2021/2022. For instance, in 2021, KEFRI was projected to provide 60 tonnes as contribution towards the Kenya National Strategy for Achieving and Maintaining 10% Tree Cover 10% Tree Cover by 2030 now accelerated to 2022. In order to continue providing high quality germplasm, the Chairman appreciated the Government for providing KES 690 million towards construction and equipping of modern seed centres to enhance seed production and distribution. He assured the CS MoEF, Mr Keriako Tobiko that the Board that the Institute shall continue to ensure utilization of resources in a prudent manner in order to maximize gains from research for the benefit of the Kenyan public even as the institute steers towards being 'A world class centre of excellence in forestry and allied natural resources research for sustainable development.

2.6 Chief Guest speech

SPEECH BY:

THE CABINET SECRETARY, MINISTRY OF ENVIRONMENT AND FORESTRY

THE 1ST KENYA COMMERCIAL FORESTRY INVESTMENT CONFERENCE AND EXPO 2021, 23-26 AT KEFRI HEADQUARTER, MUGUGA

The Principal Secretary Ministry of Environment and Forestry, Ambassadors present,
Chief Administrative Secretary, Hon Mohammed Elmi,
The Principal Secretary, Ministry of Environment and Forestry, Dr Chris Kiptoo The Chairman Board of Directors and Board of Directors, KEFRI,
The Board of Directors of various Government Parastatals, Directors of Public and Private agencies,
Representatives of Embassies,
Representatives of various stakeholders from International and National Institutions/ Organizations Key stakeholders South Africa, Tanzania, Uganda,

All conference participants and invited guests,

Ladies and Gentlemen;

1. I am delighted to be here today representing the Government of Kenya through my Ministry of Environment and Forestry on this important occasion of the First Kenya Commercial Forestry Investment Conference and Expo 2021 that is aimed at promoting commercial forestry initiatives in the country.
2. I am glad that Investment Conference and Expo identified a suitable theme "Commercial Forestry Investment for Wealth Creation, Enhancing Manufacturing, Food Security, Health and Attainment of 10% Tree Cover in Kenya" that is quite in line with call of His Excellency the President and Commander in Chief of the Armed Forces, Uhuru Muigai Kenyatta on Big Four Agenda, Housing, Manufacturing, Health and Food Security.

Ladies and Gentlemen,

3. I am very much encouraged that this conference and expo has come at the right time by bringing stakeholders from both public and private sector to discuss on investment opportunities, public private partnership interlinkages, innovations, skills, policies and legal frameworks in forestry sector; and how they should be harnessed in creating employment among the young people, women, vulnerable groups and accelerating forest and tree cover to over 10%.

4. I am aware that the forestry sector contributes to approximately 3.6% to the GDP and is prioritized in Kenya's Vision 2030 to spur sustainable development. It is therefore my understanding that this conference and expo is not targeting sharing of scientific knowledge like other technical conferences that KEFRI and partners have organized in the past, but downscale the scientific knowledge gained to address the sustainable development at all levels more so to the ordinary farmers and those interested to invest in the forestry sector.

Ladies and Gentlemen

5. For this to be viable, it requires involvement of various stakeholders at all levels with inclusion of the National government, international organizations, development partners, investors in private forestry sector, county governments and actors at grass root level interested in forestry activities. This will catalyse investment in primary, secondary and tertiary forest production that enhances opportunities in forest value chain including non-timber forest products.

6. For example, KEFRI and other partners in forestry, have developed technologies and generated knowledge and innovations that resulted to production of high quality germplasm and productivity of commercially viable tree species in highlands and dry lands and other agro- ecological zones. This need to translate to job creation and achievement of Government's Big 4 Agenda especially on access to affordable housing and manufacturing.

7. As we move towards a middle class economy, Commercial Forestry has huge potential to contribute livelihood improvement and more importantly bridge the wood deficit which currently stands at 10.3 m^3 per annum.

8. The current statistics show that the national per capita wood demand is estimated at 1m^3 per year. Considering the current population of about 50 million people, the wood demand is at 50 million cubic meters projected to 66 million m^3 by 2030 thus tripling the wood deficit in the country. The commercial forestry in the public forests will not meet this demand.

9. This calls for extending commercial forestry investment in the private, community lands and shifting the focus to arid and semi-arid lands (ASALs) that have demonstrated huge potential for commercial forestry. KEFRI and other partner institutions have enhanced research in ASALs and improved dry land species such as *Melia volkensii* for commercial forest plantations. This way, commercial forestry will no doubt contribute to socio-economic development in sustainably managed manner that rewards the environment.

Ladies and Gentlemen;

10. Reaching farmers with viable technologies and innovations that the organizers of the Expo aims to offer in this conference will go long way in promoting small and medium-scale enterprises in the forestry sector that will increase access of income to the farmers and more so create interest among the young people and women to venture into forest entrepreneurship, incubation and business startups.

11. This will be achieved by mobilizing required resources to support needed investment in the forestry sector. I am glad that in this conference and expo, there are varied stakeholders, ranging from research, academia, business investors, banks, innovation based institutions that have mobilized some resources that have gone to the organization of this conference and expo.

12. The same spirit need to be enhanced such that the outcomes of this conference and expo are translated into reality by creating new business models in the forestry sector. This will not only contribute to poverty reduction and enable the country realise Sustainable Development Goals.

Ladies and Gentlemen,

13. My ministry has put in place various policies and legislation as well as frameworks that will provide enabling environment for commercial forestry to thrive in Kenya and beyond. These instruments will continue to be improved to meet the realities on the ground as the development space is always dynamic that requires robustness in addressing new and emerging issues that will make commercial forestry sustainable venture.

14. Kenya is also a signatory to various global instruments such as United Nations Convention Framework on Climate Change (UNFCCC), United Nations Convention on Biodiversity (UNCBD), United Nations Convention to Combat Desertification (UNCCCD) among others that provides impetus to sustainable commercial forestry.

15. In this regard, Kenya has committed to restore 5.1million ha of degraded landscapes by 2030 through Forestry and Landscape Restoration Action Plan that commercial forestry can capitalize.

16. During the just concluded COP26 in Glasgow, Scotland in the United Kingdom that my Ministry participated and represented the Government on various decisions, Kenya put a strong case for trillion-dollar investment in forestry to enable developing countries invest in adaptation measures that forestry is expected to contribute directly and indirectly. This will assist Kenya address Nationally Determined Contributions through sustainable commercial forestry.

Ladies and Gentlemen,

17. As I conclude, it is my desire that this conference and expo in view of the programme shared to result to the following:
    a. Establish a platform among stakeholders in commercial forestry for sharing knowledge, innovations and best practices for up scaling locally and at the regional level;
    b. Provide a baseline data on where Kenya is in commercial forestry and how to move forward;

c. Establishment of Commercial Forestry Investment and Innovation Centre to be housed at KEFRI that will spur growth and development of sustainable commercial forestry more so attracting the youth and women in forestry development.

d. Profile how bamboo and other forest timber products will lead to acceleration of achieving housing and manufacturing agenda of the government considering our current national circumstances of the changing climate;

e. Mechanism for harnessing financial and human resources required for developing and implementing sustainable Commercial forestry;

f. Road map for strengthening the interlinkages between timber and non-timber forestry products as well as circular economy within the framework of sustainable commercial forestry; and

g. Empowering farmers and small and medium enterprise in forest value chain for creating employment and cash income to the rural poor.

Ladies and Gentlemen,

It is therefore my pleasure to declare the
THE 1ST KENYA COMMERCIAL FORESTRY INVESTMENT CONFERENCE AND EXPO 2021 OFFICIALLY OPENED.

THANK YOU

3.0

SETTING THE PACE FOR COMMERCIAL FORESTRY IN KENYA

3.0 SESSION 1

SETTING THE PACE FOR COMMERCIAL FORESTRY IN KENYA

Chairperson: Dr. Jane Njuguna; SDD-R&D KEFRI

Moderator: James Mwai - Gatsby Africa

Keynote address:

Overview of commercial forestry investment for wealth creation, boosting manufacturing, food security, health, and attainment of 10% tree cover in Kenya
Dr. Joshua Cheboiwo, Director, KEFRI

Keynote address:

Future of public forestry sector to meet the country timber needs and role of PPPs
Mr. Julius Kamau, EBS Chief Conservator of Forests, Kenya Forest Service

Keynote address:

The Role of KEFRI App in Commercial Forestry
Dr. Jane Njuguna; SDD-R&D KEFRI

Plenary Discussants:

Conservation Secretary, CEOs/Representatives
(KFS, FAO, Gatsby, KCIC, Commercial Banks (KCB & Family Bank),
Base Titanium, UNDP, KOMAZA ltd, Better Globe)

Link to presentations:

https://www.kefri.org/assets/documents/conference/Day%201%20Presentations.zip

3.1 Key highlights on Setting the Pace for Commercial Forestry in Kenya

The session addressed key issues on the potential of commercial forestry as an investment option and its contribution to the country's development agenda through supporting manufacturing, food security and attainment of the 10% tree cover in Kenya by 2022 as stipulated in the Kenyan constitution. The future of public forestry in supplying forestry as well as innovative models including public private partnerships (PPPs) were also discussed. Finally, the potential for ICT based technologies to support commercial forestry in the country, the case of KEFRI app was demonstrated. Overall key highlights from the session were as follows:

- In Kenya, the future of commercial forestry lies in the private sector. This is occasioned by the high demand for forestry products in the country coupled with a decrease in the sizes of public forest plantations over time. There has however been an increase on commercial forestry on private farms as an investment potential.

Commercial forestry on private lands can be supported through favorable policies, laws, technical support and improved pricing of the products;

- Increased population, urbanization that in term lead to increase in the demand for housing and infrastructure contributes to increased demand for wood-based products in the country such as timber, construction, transmission poles and furniture. There is also high potential for biomass energy (charcoal/ firewood) where per capita consumption stands at 742 Kgs with an annual equivalence of 34.3 million MT. This presents massive opportunity to invest in high value bioenergy woodlots in the country. Other potential sectors for investment in the sector includes wood carving sector, NTFPs;
- In terms of manufacturing/ processing, there is an upward trajectory in the number of firms doing reconstituted wood thus improving efficiency in the sector. Notable players include Raiply, Timsales and Comply dealing with plywood and board products and HDF/MDF laminated;
- Innovative models of governing the sector such as public private partnerships (PPPs) could be leveraged on to improve commercial forestry in Kenya. Leasehold and concessions could be adopted in the public sector while the private sector could supply the desired land, capital, and operational efficiency. There is need to benchmark with other East African Countries (Tanzania and Uganda where the leaseholds/ concessions have worked); and
- There is need to address legal and policy barriers that discourage investment in the sector including the red tapes when seeking harvesting and movement permits for timber and charcoal products. It is also important to complete the development of the national sustainable forest management standards to improve the chain of custody and sustainability of the sector.

3.2 Challenges to commercial forestry development in the country

- Limited information on appropriate silvicultural management practices;
- Limited supply of round-wood resources has led to idle sawmilling capacity in the country; and
- Shortage of high-grade quality seasoned timber in the market.

3.3 Opportunities to commercial forestry development in the country

- Innovative financing models such as social investment models (Komaza and Betterglobe forestry) could improve financing in the sector;
- Digital ICT based technologies can be used to support extension as well as provide information to stakeholders on science based smart greening activities and initiatives including species site matching (KEFRI APP), silvicultural management, weather advisory, tree valuation, among others; and
- The commercial forestry investment platforms will also support the collection and collating of real time data on tree planting in the country, the species and geographical distribution thus support the monitoring of forest development activities in the Country.

3.4 Key messages to the sector

- In the future, private and on farm forestry will play a major role in the supply of forestry products vis a vis the public plantations. Investors could thus leverage on the potential created by growing demand of forestry products in the country;
- Completion of forest standards are critical in the County to improve sustainability as well as control illegal activities in the sector. The policies should also be friendly to the actors to increase participation and investment in the sector, especially concerning harvesting, transportation, and trade in the sector; and
- There is a clear need to improve efficiency across the value chains including silvicultural management, wood seasoning, harvesting/ processing technologies, charcoal production as well as promotion of circular economy models in the sector.

4.0

TREE SEED AND FOREST PLANTATION MANAGEMENT

4.0 SESSION II

TREE SEED AND FOREST PLANTATION MANAGEMENT

Chairperson: Dr. Samwel Kareithi (CEO-Gatsby Africa)

Keynote paper:
Tree seed production, distribution and trade for commercial species William Omondi, Benard Kamondo, Jane Njuguna and James Kimondo

Forest plantation management of key commercial forest species in Kenya

James M. Kimondo and Jan Vandenabeele

Status and management of seed sources and other propagation materials for supply of quality germplasm for commercial forestry investment in Kenya

Stephen F. Omondi, Leonida Cherotich, Ebby Chagala, Jason Kariuki, Joram Mbinga, Priscilla Kimani, Florence Cherono and Phanuel Oballa

Breeding of *Melia volkensii* and Acacia tortilis for Commercial Plantation Forestry in Drylands of Kenya
Jason G. Kariuki, Hisaya Miyashita, Michinari Matsushita and Patrick Mwenje, Samuel Auka and Damaris Munyao

Promotion of industrial plantation forestry development: Key considerations
Thomas Kiprotich Kiptoo and Bekuta Kirongo Balozi

Insect pests and diseases of commercial tree species in Kenya
Eston Mutitu, Jane Njuguna, Beryn Otieno, Linus Mwangi, Mercy Gichora, Joseph Machua, Ely Mwanza, Miriam Gathogo and Angela Muthama

Significance, threats and management of invasive tree species in commercial forest plantation

Thomas Kiprotich Kiptoo and James Ole Kiyiapi

Plenary Discussants:

Conservation Secretary, CEOs/Representatives (KFS, FAO, Gatsby, KCIC, Commercial Banks (KCB & Family Bank), Base Titanium, UNDP, KOMAZA ltd, Better Globe)

Link to presentations:
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4.1 Key highlights

4.1.1 Commercial Forestry in the Semi-arid regions of Kenya

The distribution of drylands in Kenya (83%) is varied and covers both high and low potential areas with majority of African countries as greater than 50% ASAL.This distribution results in the considerable land use competition between forestry and agriculture in the high potential areas. Species such as *Melia volkensii* and *Acacia tortilis* are examples of multi-purpose drought tolerant trees. *Melia volkensii,* is fast growing, termite resistant, adaptable to arid areas, provides fodder and commercial timber, and holds a high afforestation potential. While, *Acacia tortilis* is also adoptable to ASAL regions, produces fuel wood with high calorific value (4,400 kcal/kg) and provides fodder. A good quality *Melia volkensii* tree can trade for between KSH 5,000-10,000. Processed *Melia volkensii* timber can be sourced at double the price of unprocessed timber and has the potential to supplement DRC mahogany timber due to similarity in quality.

Better Globe Forestry has continuously undertaken research on its silvicultural treatments requirements with the ultimate objective of obtaining clear pole. KEFRI has continuously undertaken breeding for both species with various breeding objectives that has led increase in genetic gain (14-15%) and expected to reach 30% in the second generation and developed guidelines for seeds and seedling production.

4.1.1.1 Challenges to commercial forestry in Semi Arid region

- Limited availability of raw materials (*Melia volkensii* plantations for timber harvesting to meet the requirements of a 7,000m^3 capacity);
- Inadequate financial investment for commercial tree growers;
- Inadequate capacity for seeds and seedling production;
- High cost of seeds and seedlings;
- A short-fall in KEFRI seed production to meet demands (1,560 kgs produced is 10% of the demand);
- Information on thinning practices for *Melia volkensii* plantations which require research for optimization; and
- Research gap on data for diameter to timber volume transformation.

4.1.1.2 Key messages to forestry development in Semi arid region

- Exploring carbon sequestration options (10$@tone/560ksh@tree) as an incentive for embracing the adoption of *Melia volkensii* as a commercial crop among farmer groups;
- Providing investment to farmer groups through capacity building and provision of high-quality seedlings;
- Increasing the quantities and accessibility of high-quality seedling nurseries to ensure
- Affordability;
- Enhanced production of high-quality seeds for improved production of high-quality seedlings;
- Enhanced genetic improvement to ensure high quality trees for commercialization; and
- More research needs to be undertaken on thinning regimes, topping (to ascertain its role in tree taper) and Mean Annual Increment (MAI).

4.1.2 Commercial Tree seed sources, production, distribution and trade in Kenya

KEFRI tree seed Productivity over the years has improved from an output of 40 kg (1950S') to the current target of 61t (6tonnes for commercial forestry species and 55tonnes for all other species). Production of high-quality seeds depend on the collection of seeds from registered seed sources, a practice that KEFRI holds under the OECD regulations for registration of seed sources which has resulted in selection and registration of 213.5 ha of seed sources for commercial seed production. The tree seed regulations are close to completion and for it to take effect, KEFRI will seek authority from KEPHIS to establish a seed certification unit. The unit will work to develop technologies geared towards tree seed certification, register tree seed sources, register tree seed merchants, license tree seed stockists, and ensure appropriate application of tree seed processing and storage protocols.

The long and slow breeding and selection process is essential for quality assurance in commercial forestry. The demand for tree seed from KEFRI has majorly been government (afforestation and reforestation) driven.

However, private and public demand for tree seeds also plays a role in determining tree seed demands. In this regard, the following were noted during the discussion:

Collaborative efforts have over the years been exploited to yield introduction of superior germplasm, which have been used in establishment of seed orchards. These have resulted in;

  - Documented genetic gains contained in family (F) generations; and
  - Establishment of clonal seed orchards, seedling orchards, and documentation of selected seed sources.

- Species based tree seed demand, *Cupressus lusitanica* and *Melia volkensii* seeds have had the highest demand-driven-production over the past five years, while *Casuarina equistefolia* accounted for the highest estimated seedling production. With regard to Eucalyptus species, demand driven production for E*ucalyptus grandis* was the highest. On the other hand, *Melia volkensii* seed demands, projected by the 773M seedling demands, also supersede the potential for production;
- Limited investments (financial resources, genetic resources, and time) in improvement of tree seed sources;
- Loss of identified registered seed sources;
- Phenological challenges, climate change and the interaction of the two that leads to poor seeding, dormancy changes, and endangering as well as extinction of some species;
- Forest fires, pests and diseases, animal and flood damage to seed sources;
- Illegal felling of trees in seed sources; and
- Unregulated tree seed vendors.

4.1.2.1 Key recommendations on tree seed production & distribution

- Intensify genetic improvement of indigenous and exotic tree species;
- Identification and registration of private seed sources to supplement KEFRI capacity for seed production that is at 40% of national demand;
- Identification and registration of wood lots that meet seed source requirements and training/capacity building for private seed source owners;
- Tree seed certification (through tree seed regulations for minimum quality standards);
- Establishment of larger seed sources as they are more economical to manage;
- Improving access to superior germplasm through linkages and partnerships;
- Species site matching to improve performance of superior germplasm and seed sources;

- Developing seed source management protocol for improved seed production; and
- Need for improved dissemination of research findings and achievements for capacity building of students, and stakeholder.

4.1.3 Insect Pests and Diseases for Commercial Species In Kenya: Status and Management

Large scale commercial forestry establishments are mainly government owned or privately owned by large companies individual farmers. The most common species exploited in commercial forestry are Eucalyptus, Pines, Cypress, Grevillea, Casuarina, and Melia. Various insect pests and diseases affect commercial tree species as they reduce their quality and quantity of the expected forest product. IPM is essential to ensure adequate management of important biological factors with potential to affect commercial forestry. Running a quarantine facility may be too expensive and private stakeholders may not be able to finance this, but can undertake identification, and import of bio-control agent. Private companies e.g. DuduTech produces pest and disease bio-control agents used in control of root and stem rots. They also work to train stakeholders in the use of these management agents. Insect species of commercial importance to these tree species are:

- **Eucalyptus snout beetle.** This damages leaves and shoots resulting in stunted growth. An upsurge of the beetle infestation has been reported and investigations on the cause of this upsurge are ongoing. Anaphes nitens have been identified as a biological control agent on beetle eggs. In addition, trials on augmentative biological control is underway and the introduction of a complementary bio-control agent from South Africa is being explored.
- **Red Gum Leper Psyllid.** This damages leaves through development of sooty mould, reducing photosynthetic area leading to a reduction in productivity. Bio control agent Psylleaphagus blietus was introduced in Uganda from South Africa to control the insects.
- **Blue gum chalcid**. This was identified as a major pest in 2004 with presence in all major Eucalyptus growing areas. It damages the tree canopy and stems leading to deformity and pest damage on plants less than10 years old. The main bio-control control for the pests is the Megastigmu spp.
- **Winter bronze bug:** A eucalyptus pest that results in stunted growth. Clerucoides noacke is the main parasitoid bio-control.

- **Cypress aphid:** Pest damage results in browning of tree canopy. *Pauesia juniperorum* is the main bio-control. Significant damage is on off-site establishment of cypress.
- **Pine woolly aphid:** Threatened the planting of *P. radiata* and is under biological control.
- **Pine black aphid:** Attacked pine seedlings in nurseries and is controlled by chemical control. Is prominent in the cooler rift valley areas.

Common diseases caused by the above named insects

- Damping off: This is caused by Fusarium, Pythium, Botrytis, Rhizoctonia, and Alternaria. Mostly caused by poor watering regimes.
- Armillaria root rot: Predominant in areas with susceptible Pinus or Cypress. Controlled by fungicides or rouging off.
- Botryospheria Canker: Controlled by rouging, tool sterilization, species site matching, and host plant resistance.
- Tetratospharia canker – transferred via infected seed.
- Crycopothe canker – controlled by use of tolerant species.
- Casuarina wilt (Bark blister disease)

Emerging issues

- There is limited capacity of causal agent identification and quantification of prevalence levels.
- Management options unknown or not implemented;
- Limited understanding of population dynamics relationships with economic impacts, to guide timing for management options;
- Limited host resistance; and
- Inefficiency in implementation of existing phytosanitary measures.

Key message for the sector

- There is a need for public- private partnership, management strategy awareness, and provision of resources towards the implementation of KEFRI 2018-2022 IPM strategy.

5.0

FOREST PRODUCT PROCESSING VALUE ADDITION AND TECHNOLOGIES

5.0 SESSION III

FOREST PRODUCT PROCESSING VALUE ADDITION AND TECHNOLOGIES

Chairperson: Mrs. Zipporah C. Toroitich Deputy Conservator of Forests, Kenya Forest Service

Keynote paper:
Status of forest products value chains and investment opportunities in Kenya
John Githiomi, George Muthike, Meshack Muga and Nelly Oduor

Technology in the wood industry in Kenya; drivers and inhibitors
George Muthike and Joseph Githiomi

Sustainable commercialization of non-timber forest products in Kenya: a situational analysis
Meshack Muga, Rose Chiteva, Violet Oriwo, Collins Obonyo, Emily Kitheka, Peter Ogutu, Shadrack Inoti, Elijah Mboko and Philip Kisoyan

Mass timber construction in Kenya: opportunities for manufacturing and affordable housing inno- vations to drive demand for sustainable forest products at scale.
James Mitchell

Status of wood pole treatment in Kenya
Godfrey Ali Odeny

Bioenergy analysis for 65 factories of the Kenya Tea Development Agency Holdings Company Ltd (KTDA)
Thomas Buchholz, Hilarious Kifalu, Geoffrey Ronoh, Dr. Izael DaSilva,Veronica Ngunzi

Status and commercialization of gums and resins in Kenya
Abdi A. Somo

The opportunity of high value processing linked to farm forestry in Kenya
Edward Onsongo, Charles Kimiti and Antony Ngugi

Plenary Discussants:
Presenters

Link to presentations:
https://www.kefri.org/assets/documents/conference/Day%201%20Presentations.zip

5.1 Key highlights

5.1.1 Status of Forest Products Value Chains and Investment Opportunities in Kenya

Status of forest products value chains and investment opportunities session dwelt on the status of the forest products value chains and the opportunities available for investment in the sector. The presenters shared their findings on the status of forest product value chains and investment opportunities; technologies in the wood industry drivers and inhibitors; latest technologies for manufacturing and housing innovations; bio-energy and status of non-timber products commercialization and opportunities for farm forestry in Kenya. The key highlights from the session were as follows:

- The key forest value chains in Kenya can be categorized in three groups: forest industries, biomass energy and non -wood forest products;
- The main wood products traded are timber, furniture, poles, posts, wood fuel, pulp, paper, wood composites, wood, and carvings;
- Kenya is a wood deficit country, an analysis by the Ministry of Environment and Forestry in 2013 indicates that the country has a wood supply deficit of 10,295,604 m^3 with a projected increase in demand by 20% by 2032;
- To bridge this widening supply gap there is need to work towards enhancing the supply of forest products through promoting farm forestry, investment in dryland forestry and diversification of species;
- An analysis of mills operations by KFS in 2016 indicated that majority of small millers were using outdated and low recovery equipment with between 20 to 35% recovery rates. This calls for investment in technologies to increase recovery, reduce emissions and to conserve forests;
- The main challenges facing the timber value chain sector are: shortage in raw material (partly due to moratoriums); high timber prices of timber products from imports; dilapidation of existing investment; loss of employment and slow growth of the sector. Hence, the need for incentives and increased investment to the sector including value addition; and
- A number of opportunities exist to scale up the sector including the development of forest products bio-enterprises; improved wood processing technologies integrated harvesting of forest plantations plantation development in ASALs; enhanced forest management practices; accessibility of forest certification standards; capacity

building opportunities; growing demand of forest products, large quantities of agricultural bio-residues for production of bioenergy; availability of fast growing resources such as bamboo; enhanced trade due to devolved system of government, existence of the Forest Conservation and Management Act 2016 among others.

5.1.2 Key highlights on forest products development

Efficiency in processing and utilization of forest products is still a challenge, there is need to increase recovery, reduce emissions to conserve the forests;

- There is need to create and enhance market linkages for forest producers;
- There is need to protect local manufacturers from cheap/sub-standard imports;
- Wood fuel from briquettes and agricultural wastes is an emerging industry with vast opportunities;
- To have sustainable commercialization of NFTPs, there is a need for a structured management strategy for NTFPs in Kenya;
- Sustainable commercialization of NTFPs has a great potential for the creation of employment, contributing to improved benefit-sharing, improved conservation of biodiversity, reduced land degradation, and increased households' incomes thus leading to reduced vulnerability of local communities;
- There is need to improve product quality assurance along the value chain; and
- There in need for continuous engagement by the actors, awareness creation, mentoring and market linkages to support value addition, branding, and certification of NTFPs for specialized markets.

5.2 Challenges within forest product & technology development

- There is a challenge with adherence to set standards which has compromised durability of products in the market;
- There is inadequate of business incubation facilities and mechanisms;
- Business licensing procedures which impede growth in the sector; and
- There is an influx of cedar poles in western Kenya affecting pole business.

5.3 Opportunities within forest product & technology development

- There are untapped opportunities in: Glulam and cross laminated timber, toothpicks from timber by-products (shorts + offcuts), from bamboo culms, matches, essential oils, eucalyptus oils and leleshwa oils

5.4 Key Messages to the sector

There is need for development of relevant policies and legal framework to support forest products sector and to to enhance value chains development;

- Enhancing sustainability of forest resource base is key through promotion of plantation development, integrated harvesting, and investment in efficient processing; and
- Need to build capacity of producers, processors, traders, and other stakeholders in the value chains on sustainable harvesting, post-harvest handling, value addition and marketing.

6.0

REGIONAL TRADE FOR KEY PRODUCTS AND BAMBOO VALUE CHAIN

6.0 SESSION IV

REGIONAL TRADE FOR KEY PRODUCTS AND BAMBOO VALUE CHAIN

Chairperson: Dr. Joseph Githiomi - KEFRI
Keynote paper 1 Status of intra Africa Forest products trade and the potential for positioning Kenya as a regional hub for forest products manufacturing Joshua K. Cheboiwo, Jonah Kiprop and Anthony Macharia Presenters Organization Affiliation: Kenya Forestry Research Institute
Keynote paper 2 Mapping of financial sources/initiatives and action-oriented strategies to catalyze investments in scaling up sustainable value chains in Kenya Charles Mutua Wambua
Keynote paper 3 Status of bamboo development in Kenya: challenges and opportunities Nelly Oduor, Paul Ongugo and Gordon Sigu
Interventions for unlocking the value of bamboo commercialization Caroline Kariuki
Bamboo as a solution to housing deficit and climate change Luis Felipe Lopez Munoz
Bamboo in construction Sylvia Essendi
Building a Bamboo business - a whole value chain approach-learning from success and planning for future India/Africa collaboration Krunal Negandhi
Enhancement of industrial production of Bamboo incense sticks through small, medium enterprises (S.M.E.'s) George Jenner, Thiru Selvan and Vipan Guleria
Unlocking the green economy by linking sustainable suppliers with responsible buyers Michael Brink
Win-Win wood trade linkages between Uganda and Kenya. Mike Howard
Opportunities and constraints of wood products markets in Western Kenya David Langat and Samson Okoth
Link to presentations: https://www.kefri.org/assets/documents/conference/Day%202%20Presentations.zip

6.1 Key highlights of Bamboo Value Chain

Regional trade for key products and bamboo value chain session addressed key issues affecting regional trade in forestry products and the potential for bamboo industry in Kenya. Presenters provided information on the economic potential of bamboo and how it can be used by various sectors of the economy. Some parts of bamboo are edible and can contribute to improving food and nutrition security. Bamboo can also be used in the construction industry to make low-cost housing. The crop is also used to make ornamental items such as key holders, earrings, house decorations among others, that contribute to employment creation and income generation among the industry actors. However, there is lack of knowledge on the multiple uses of bamboo. In order to increase bamboo use, there is need to capacity build stakeholders on; appropriate species for different uses, how to propagate and multiply the seeds, and how to grow, harvest and engineer bamboo for different products. Other key highlights from the session were as follows:

- The global economic potential of bamboo is estimated at approx. USD 75B. The sector has potential to create over 500,000 jobs in the future across the entire value chain while at the same time contribute to the achievement of the 10% tree cover strategy in the country;
- To improve the sector, it is critical to match raw material production to industrial needs through growing different bamboo species for different end products based on their characteristics. This could be achieved through capacity building farmers to grow the right species for the sector;
- There is need for synchrony between financial actors and industry players to address unfavorable policies especially towards SMEs;.
- Development of innovative win-win business models that assure returns throughout the value chain are essential in the sector, i.e., those that include all actors including communities to ensure sustainability;
- Potential for increased production of bamboo lies on the smallholder farming communities (agroforestry) and not in public plantations;
- Bamboo houses are durable and can last for many years with appropriate treatment and maintenance. Good architectural designs are key to longevity and durability of the structures. The cement- bamboo frame technology, which consists of a bamboo structure plastered with cement on the outside, has been

successfully used to construct affordable houses that can withstand typhoons, fires, destruction by insects, and earthquakes. Different bamboo construction standards have been developed, but none exist in Africa, thus, the need to develop such standards for Kenya. Cost of construction of bamboo houses in comparison to other methods varies by countries depending on the development of the value chain in the respective countries and the availability of inputs. In general, the cost of constructing bamboo houses is relatively lower than the contemporary stone construction. Improved quality of raw materials directly impacts on the quality of buildings. It is thus imperative to focus on a few species with the right attributes for improvement and value addition;

- Development of a complete bamboo value chain from production, value addition/ processing, treatment including associated support services is critical to the growth and sustainability of the sector; and
- Treatment, grading, and engineering architecture is very essential for preservation and utilization of bamboo products.

6.2 Challenges in the Bamboo value chain

Inadequate quality seeds of the various bamboo species in Kenya. Kenya heavily relies on China for the supply of quality bamboo seeds. Due to the seed inadequacy, growers are advised to preserve their seedlings for splitting to increase their stock when need be; and

- Lack of capacity in bamboo value addition.

6.3 Opportunities in the Bamboo value chain

- Bamboo is a potential commercial species due to its usability in various areas such as; food and nutrition security, conservation, ornamentals, infrastructure development among others; and
- Interested stakeholders who need to import bamboo seed can do so through the support of KEFRI to avoid unscrupulous dealers.

6.4 Key messages to the sector

- Bamboo producers are scattered all over the country and there is need to concentrate bamboo production in specific regions to reduce the cost of production and transportation;
- There is need for adoption of innovative models to govern the sector and benchmarking with countries with developed bamboo value chains such as China. China intentionally created demand for bamboo products and addressed supply constraints in the sector;
- Bamboo raw materials supply constraints should be addressed supply so that investors are assured of constant and stable supply throughout the year. These can be achieved through the adoption of cooperatives model for bamboo growing and pre-processing at community level;
- Fiscal and monetary incentives to the sector such as use of subsidies, tax reliefs and exemptions as well as sectoral allowances for the bamboo sector are some of the strategies that could be used to support the sector;
- Financing in the sector can be improved through adoption of innovative financing models such as carbon financing;
- There is need to address land tenure systems and benefit sharing across the value chain to ensure all the actors in the value chain and across genders are rewarded accordingly; and
- There is need to address incentive structure in the sector vis a vis other sectors where other sectors are heavily supported unlike the bamboo sector.

6.5 Key Highlights from Regional Trade for Key Products

- Kenya is a timber deficit country relying on imports from East and Central African countries presenting massive opportunity for commercial forestry for the Kenyan farmers;
- Other East African Countries are also tapping into the market where massive timber resources are already being grown in Uganda with the aim of selling to the Kenyan market;
- Value addition and primary processing of sawn timber products are key in increasing value of saw logs in Kenya;

- The sector is characterized by inefficiencies in production and processing leading to low recovery rates and wastage. Quality differentiation of wood products is also not assured;
- There is need to embrace chain of custody in the sector to prevent unsustainable harvested timber finding its way to the Kenyan market using forest certifications such as Forest Stewardship Council (FSC); and
- Factors contributing to deficits in timber, poles, firewood and charcoal include cumbersome licensing procedures, poor management of trees on farms, inadequate entrepreneurial skills among smallholder tree growers and pests and diseases.

6.6 Challenges in the trade of key products

Availability and accessibility of reliable data on supply and demand of forestry resources in Kenya;

- Low levels of Intra Africa trade caused by restrictive tax regimes, non-tariff barriers, language barrier, poor infrastructure limits the movements of forestry resources from resource abundant to resource scarce countries; and
- Low levels of value addition due to high cost of capital and technical capacity in the value chain.

6.7 Opportunities for trade

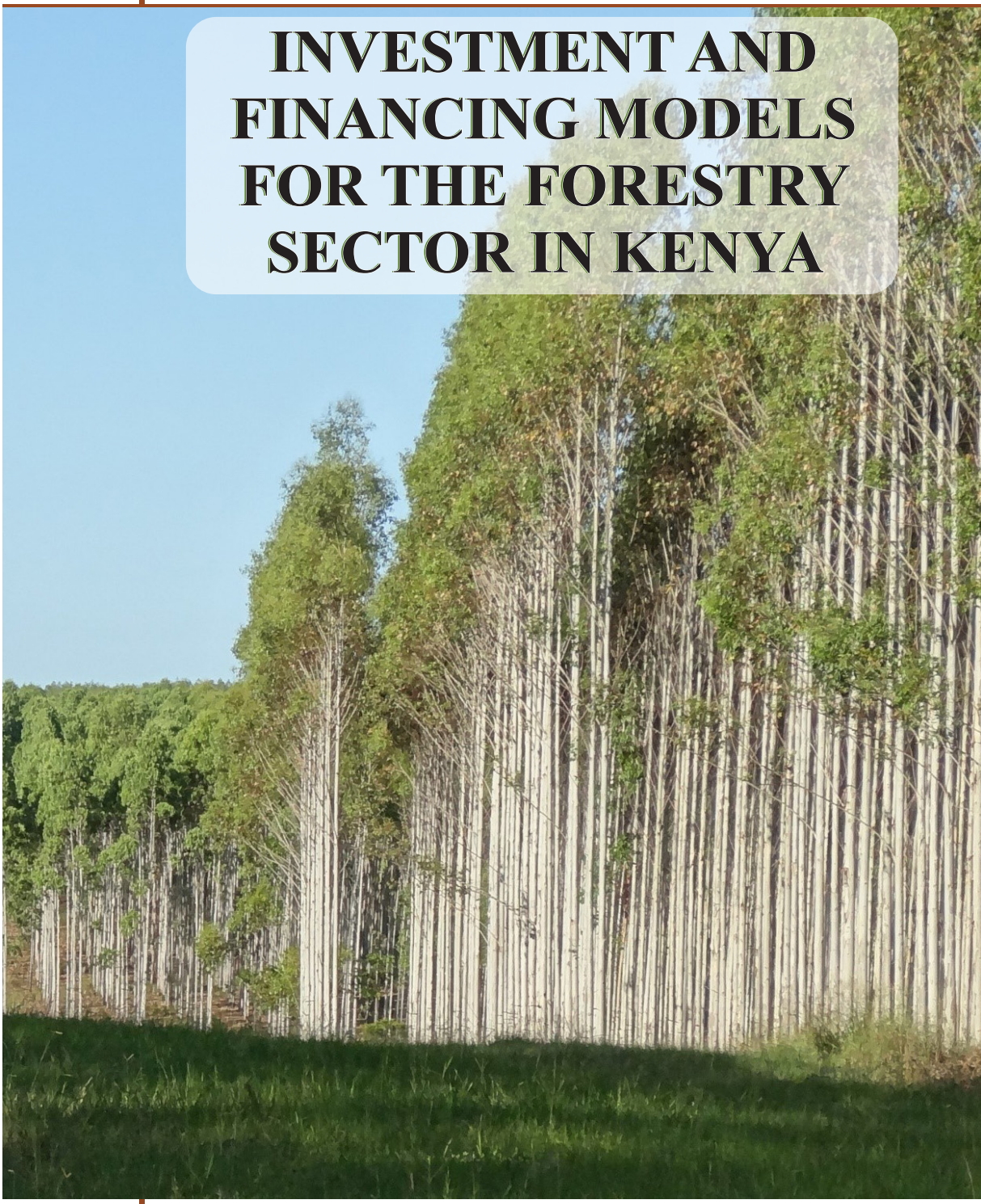
- Private commercial tree growers and smallholder farmers are venturing into commercial forestry due to the increased demand for tree products in Kenya. Tree species mostly planted on farm for commercial purposes are Eucalyptus, Cypress and Grevillea for poles, sawn timber, and fuel wood;
- Sawmillers in Kenya are now adopting efficient wood processing technologies such as wood- mizers to improve efficiency and recovery rates from saw logs; and
- There is an increase in the number of reconstituted and re-engineered wood products which have higher values in the market.

6.8 Key messages to the sector

- Need for adoption of innovative models of governance and plantation managements in the forestry sector;
- Inefficiencies and unsustainability in the extraction of forestry resources has led to the imposition of numerous timber harvesting moratoriums in the country. More often, the moratorium leads to supply shocks in the market. Innovative models such as leaseholds for plantation management should be explored. Inadequate supply of timber products provide opportunities for Kenyan farmers to venture in commercial forestry to fill the gap; and
- There is need to identify and adopt innovative strategies to increase the participation of tree growers to Forest Stewardship Council membership to improve sustainability in the sector.

7.0

INVESTMENT AND FINANCING MODELS FOR THE FORESTRY SECTOR IN KENYA



7.0 SESSION V

INVESTMENT AND FINANCING MODELS FOR THE FORESTRY SECTOR IN KENYA

Chairperson: Mr. Philip Kisoyan - FAO
Keynote paper Mapping of financial sources/ initiatives and action-oriented strategies to catalyze investments in scaling up sustainable value chains in Kenya by Charles Mutua Wambua
Paper 1: Investment and Financing Models for Forestry Development in Kenya J.K Cheboiwo, L. Wekesa, D. Langat, J. Kiprop, L. Ndalilo, G. Rutto and S. Nadir
Paper 2: Enhancing Climate Action in the Kenyan Forestry Sector - Overcoming Barriers to Enhance Investment Emily Le Cornu, AECOM
Paper 3: Remote Sensing and Spatial Forest Management Systems Michael Breetzke
Paper 4: Commercial forestry development in a Changing climate: Optimizing returns of investments on wood & carbon benefits Vincent O.Oeba & Zipporah Toroitich
Paper 5: The Africa Forest Carbon Catalyst (AFCC) harnessing the power of nature to battle climate change Kevin Juma
Paper 6: Application of Public Private Partnerships for increased forest cover, job creation and sustainable Development in Kenya Daniel M. Giti
Paper 7: Introduction of advanced seedlings propagation methods Plantech (K) Ltd
Paper 8: Trends and drivers of private financing in the forestry sector in sub-Saharan Africa (SSA) Benjamin Kinyili and Ezekiel Ndunda
Paper 9: Challenges in development of forest value chains in Kenya and opportunities to enhance their contribution to Sustainable Development Goals (SDGs) Michael Kiama Gachanja and Humprey Mwaniki Ngibuini
Link to presentations: https://www.kefri.org/assets/documents/conference/Day%202%20Presentations.zip

7.1 Key highlights on investment and financing models for the forestry sector in Kenya

Kenya is a timber deficit country and currently relies on farm forestry as well as imports from neighbouring countries to meet its timber requirements. This deficit creates an opportunity for private investors to venture into commercial forestry. Players in the banking sector indicated that low proportions of loans are disbursed to the forest sector. The banking sector requested for close collaboration between them and forestry actors to develop tailor made bankable products. The highlights from the session were:

- Main financial actors in Kenya include commercial banks, Micro Finance Institutions (MFIs), SACCOs and informal finance groups;
- There exist several projects/ programmes to support forestry activities in Kenya such as: Micro Enterprises Support Programme (MESPT), Green Employment in Agriculture Programme (GEAP); and Kenya Climate Innovation Centre (KCIC) among others;
- Investors in forestry can tap into green/ climate financing initiatives that target sustainable development projects and initiatives;
- Some of the innovative financial models for the forestry sector include; carbon financing (global concern for climate change), Social impact financing/ insurance, and cloud funding;
- Financial inclusion in the forestry sector is low due to the long-term nature of tree growing thus curtailing both public and private sector forestry development. Access to finance, however, improves as one moves higher the value chain (trading and processing), where the actors can access finance from the various institutions to support their businesses;
- Challenges limiting access to finance to forestry sector include; lack of awareness, literacy, gender limitations, lack of collateral, lack of tailor-made products for the sector/ guarantee mechanisms; and
- Public Private Partnerships as well as social investment models used by Komaza could be used to improve commercial forestry among smallholder farmers in Kenya through pooling them together, training and support with capital acquisition.

7.2 Challenges for investment & financing in forestry sector

- Low level of understanding by financial institutions on the forest sector;
- Inadequate bankable models in forestry; and
- Long term nature of some of the forestry programmes.

7.3 Opportunities for investment in forestry sector

- Financing to the sector is currently improving due to the numerous environmental and restoration initiatives through global programmes such as the GEF and GCF that investors can tap into;
- At the national level, the Kenyan government is implementing the national 10% tree cover strategy with annual budgetary allocations to fund the programme; and
- Financing by local banks, insurance and tap funding from pension funds.

7.4 Key messages to the sector

- There is need for support in the development of tailor-made bankable business products jointly with the financial sector actors for improved finance in forestry;
- Promoting and facilitating the growth of farmer groups into larger-scale groups (e.g., cooperatives) will reduce transaction costs, create economies of scale while improving bargaining power with potential financiers;
- There is need to promote and facilitate business incubation services to improve farm forestry producer organizations credit worthiness;
- Capacity building and training on preparation of bankable business plans, bookkeeping, appraisal processes, collateral arrangements, guarantee funds, and insurance is key to the success of the sector;
- Need to facilitate the creation of innovations/ways to de-risk commercial forestry investments by forest and farm producer organizations (FFPOs); and
- Promote events that bring together investors/financiers and potential forestry value-chain clientele/actors to create awareness and open financing and business opportunities for either of the parties.

8.0

COMMERCIAL FORESTRY INVESTMENT FORUM DIALOGUE

8.0 SESSION VI

COMMERCIAL FORESTRY INVESTMENT FORUM DIALOGUE

Session Chair and Moderator:
Alfred Gichu, Ag. Conservation Secretary, Ministry of Environment and Forestry

Presentations:

1. Opportunities and challenges in commercial forestry in Kenya.
   By Jack Steege, Gatsby Africa.
2. Use of solar drying panels in forestry for increased access of high-quality tree germplasm.
   By: Jane Njuguna, Kenya Forestry Research Institute, Harjt and Trevor Reese

Plenary discussants:

Jak Steege,Gatsby Africa; Esther Muthama, Komaza; Victor Ndiege, KCV; Joseph Kibugi, Investor in Forestry, Coastal Kenya; Jonathan Kituku, Farmer/Investor in commercial forestry; Abdulkardir Aden Hassan; Julius Coredo, UNDP; Ximena from Colombia;xxx Coasta Rica

8.1 Key highlights from session on Commercial Forestry Investment Forum Dialogue

The session focused on stakeholders' engagement in promoting investment in commercial forestry by identifying opportunities and challenges. Specifically, the session addressed issues on: how to position private sector in tapping opportunities of commercial forestry investment; strategic options to support public and private sector engagement in commercial forestry; role of forestry research in commercial forestry investment and partnership models of research institutions in promoting innovations and technologies for sustainable commercial forestry; and role of international institutions in advancing commercial forestry investment for job and wealth creation in Kenya and the African region.

During the dialogue, an emphasis was made on how to leverage on; nature-based solutions, resource mobilization, capacity development of entrepreneurs, changing policy/legal obstacles restricting commercial exploitation of bamboo for sustainable growth and development. It was evident from the discussion that bamboo can survive weather shocks, earthquakes, and tsunamis better than concrete houses if done well. This demands for better bamboo technologies appropriate for social housing projects and construction standards.

The dialogue attracted various key speakers from both public and private sectors including model farmers in tree planting. Some of the key institutions that participated in this investment forum included but not limited to; United Nations Development Programme (UNDP), Gatsby Africa, Biashara Masters, Kenya Climate Ventures (KCV), Kenya Forestry Research Institute (KEFRI), We Effect, Food and Agriculture Organization of the United Nations (FAO) and Tree Growers Cooperative Society, among others. During the session specific challenges, opportunities, and emerging issues were identified and discussed culminating into call for action as summarized below.

8.2 Challenges facing stakeholders to invest in commercial forestry

- Widening deficit of supply and demand of forest wood products undermining conservation and economic development targets of the country and rest of the African countries;
- Increasing shortage of forest wood products is contributing to unemployment in forest and tree-based manufacturing industries;
- Rise of deforestation and forest degradation due to illegal logging to meet the demand of high valued tree wood products;
- Failure of tree growers to access target market threatening future flow of private finance at the scale required to meet sustainable development in Kenya and the region;
- Limited access to high quality tree germplasm for commercial forestry; and
- Land tenure to support forestry investment.

8.3 Opportunities for investment in commercial forestry

- Kenya has set ambitious land restoration action plan that will attract agroforestry and tree growing activities that will stimulate commercial forestry venture;
- Increase investment in remote sensing technologies to support monitoring of commercial forest plantations and inventory;
- Development of technologies for species site matching to optimize on the investments that can spur commercial forestry across various agro-ecological zones in Kenya;
- Emerging silvi-cultural standards and group scheme arrangements that can promote plantation development and future market access; and

- Establishment of Commercial forestry Investment centre

8.4 Key messages to the sector

Investment in commercial forestry remains central in Kenya's national economic development and environmental agenda especially in meeting the country's ambitious targets on Nationally Determined Contributions (NDCs) and Land Neutrality. To achieve the economic development, Kenya needs to balance demand of industry with sustainable and cost-effective supply of tree products. There is a growing competition in the downstream industry that can significantly stimulate investments in private tree growing in Kenya.

8.5 Call for action for investment in commercial forestry

In order to halt challenges facing the stakeholders in commercial forestry investment and optimize on the opportunities that the forestry sector presents, the investment forum dialogue called for the action as follows:

1. Establish Commercial Forestry Investment and Innovation Centre in Kenya to be hosted by Kenya Forestry Research Institute (Box1);
2. Identify and promote public private partnership (PPPs) land lease models that can result to realization of high-quality commercial plantation to meet the current demand and supply deficit in Kenya and across the region;
3. Strengthen the role of private sector and international communities in the forestry industry to enhance co-financing for investment in commercial forestry to propel economic growth and environmental sustainability;
4. Create opportunities to incentivize youth's participation in commercial forestry investment which include; access to land, digital technologies, capacity development, access to market and enabling policies;
5. Target dry lands for scaling up commercial forestry investment with right species with consideration to climatic conditions and availability of funds as well as leveraging on climate finance options and carbon financing;
6. Facilitate and promote adoption of innovative models for commercial forestry to attract private sector capital, creation of market linkages and insurance schemes in entire value chain in the forest industry;
7. Reduce/minimize government red tapes which slows investment in commercial forestry;

8. Strengthen linkages between research and industry to increase access of technologies and innovations that will support development and investments in commercial forestry;
9. Develop and promote locally led forest certification schemes that will enhance equity, efficiency, environmental sustainability, and stewardship in commercial forestry; and
10. Increase recognition of bamboo in commercial forestry investment and balance the use and conservation needs

Establishment and operationalisation of National Commercial Forestry Investment and Innovation Centre

The establishment of National Commercial Forestry Investment and Innovation Centre will be crucial considering that the projected growth of commercial forestry in Kenya will be driven by private sector and engagement of small and medium-holder farmers with support from the research institutions, academia and international community. This Centre will be hosted by KEFRI and will provide Secretariat role in the implementation of programmes and activities aimed at addressing the key issues in advancing commercial forestry in Kenya. The centre will function as a hub for provision of information, products, and services to commercial forestry stakeholders in Kenya and the region. It will link commercial forestry stakeholders including; researchers, policy makers, tree growers, processors, manufacturers, input and service providers, financial institutions, insurance, among others where they can meet, share ideas, identify opportunities, and solve challenges in the commercial forestry value chain.

The Centre will have physical offices but also a dynamic digital platform where all the Centre activities will be hosted. The platform will be accessible to a wider audience within a larger geographical area. The digital platform will enable showcasing of latest technologies in commercial forestry, and dissemination of relevant information to stakeholders.

9.0

EDUCATION AND SKILLS DEVELOPMENT

9.0 SESSION VII

EDUCATION AND SKILLS DEVELOPMENT

Chairperson: Dr. George Muthike - KEFRI
Keynote paper: **Education and skills development in commercial forestry** Balozi K. Bekuta and James Ole Kiyiapi
Commercial forestry skills for sustainable development: The case of KFS Londiani Forestry College Johnstone Maloba
Blending forest education and research: case of KEFRI Graduate Research School Mukolwe M., Wanjiku J., Mwalewa S., Nenkai R., and Kemboi N.
Link to presentations: https://www.kefri.org/assets/documents/conference/Day%203%20Presentations.zip

9.1 Key highlights from session on Education and Skills Development

The stakeholders during the discussion noted that education should bridge the gap between theory and practice in forestry to ensure that students have the required professional skills in the job market. This can be through revision of the education curriculum together with professions in the field and private sector to ensure that it is able to respond to traditional needs and emerging issues especially those related to social, economic, environmental, biodiversity and climate change.

Training in commercial forestry should adopt a comprehensive approach which encompasses germplasm improvement, forest modelling and species site matching, silviculture and forest management planning, financing, marketing, and economic forecasting to maximize returns in the sector. This education should be provided at all levels by specialised institutions for instance, several universities provide undergraduate and postgraduate training, while the Kenya Forest College in Londiani provides training in forestry for middle level skills and competencies and short courses that include tree nursery management.

The government should improve funding for forestry training to ensure necessary training is acquired by students for a successful commercial forestry. Professional skills required to promote commercial forestry include; forest information systems (GIS, RS, ICT).forest products trade and marketing, hydrology, forests and climate change, disaster management and survival skills, biodiversity and conservation, biometry, mensuration and modelling, certification, and marketing issues. Also, there is need for promoting technology development and use in tertiary institutions that will support forestry investment such as the Miticalc App developed by University of Eldoret for forest establishment.

To create a link between the professional requirements and education, the KEFRI Graduate Research school (KGRS) is being established to enhance institutional forestry research outputs through building and linking practical experience and competency of stakeholders to industry. The KGRS addresses issues related to inadequate practical skills and provide shared space for scientists, scholars, and young graduates to translate ideas into actions and impact. The school enhances collaboration with recognized institutions of higher learning by offering support to both doctorate and master's student.

9.2 Challenges to forestry education & skills development

- Only a few students are attracted by general forestry courses. Therefore, the sector should ensure that forestry topics are included in specialized and diverse forestry related fields; and
- Limited employment opportunities for graduates trained in forestry.

9.3 Opportunities to improve forestry education & skills development

- Climate change and, carbon and forest certification should be incorporated in training institutions curricula;
- Tailored made training be made available to meet specific purposes, for instance development of better processing systems of forest products, cutting skills and improved logging technologies; and
- University training in commercial forestry can be improved through linkages with industry. Investors are encouraged to provide opportunities for investment and expose students to practicality of forestry, this can be done through internship opportunities. The KGRS is envisaged to support students at all levels, apart

from undertaking joint research with post graduate students, it is supporting undergraduate students through provision of opportunities for research internships and attachments

9.4 Key messages to the sector

- Education should bridge the between theory and practice in forestry;
- Training in commercial forestry should adopt an integrated approach to maximize returns in the sector;
- KEFRI Graduate School enhances forestry research outputs through building and linking practical experience and competency of stakeholders to industry;
- Forestry private sector actors should employ persons with required skills in their businesses; and
- Need for inclusion of professionals and forestry private sector actors in curricula development for middle and tertiary colleges in forestry.

10.0

POLICY, LEGISLATIONS AND GOVERNANCE

10.0 SESSION VIII

POLICY, LEGISLATIONS AND GOVERNANCE

Chairperson: Judy Ndichu - UNDP
Keynote paper: **Policy and legislative frameworks for commercial forestry Management in Kenya** Joram Kagombe and Joyce Ojino
Role of forest policy and legislation in enhancing commercial forestry in Kenya Benjamin Mutuku Kinyili, Ezekiel Ndunda
Potential and challenges of small-holder tree plantations in supplementing the wood market: The case of Kenya's timber moratorium D.K. Langat, A.K Kisiwa, N.C Leley, J.K. Kagombe and J.K. Cheboiwo
Tanzanian experience with public private partnership and concession models in forestry Busuyi Okeowo
Catalysing growth of inclusive, commercial-quality, plantations - Lessons from Uganda Dennis Kavuma
Link to presentations: https://www.kefri.org/assets/documents/conference/Day%203%20Presentations.zip

10.1 Key Highlights on Policy, Legislation and Governance

During this session it was noted that the government has the role of setting up a policy and regulatory framework to guide commercial forestry in Kenya. Currently, the main law governing Forestry sector in Kenya is the; Forest Conservation and Management Act (FMCA) 2016 which supports commercial forestry through its various pronouncements, including;

- Granting of concessions;
- Providing for regulation on benefit sharing;
- Community participation in forestry through development of management plans and agreements;
- Fiscal and financial incentives as provided in Section 54;

- National forest standards and chain of custody; and
- Grading and valuation of timber and other products.

However, most of the provisions in the Act have not been implemented to date, because requisite regulations have not been developed. It is in this context that:

- Laws and Policies for commercial forestry should adopt a long-term perspective and be supported by reliable facts based on science and proven experience.
- Forest sector players need to be aware of forestry related laws and policies and contribute to their review/amendment so that they do not affect the sector negatively.

Laws related to forestry should be innovative by adopting incentive-based schemes targeting vulnerable and minority groups as well as address issues of land tenure, transparent governance, financing, advanced forest products processing technologies and effective conflict resolution mechanisms;

- Various initiatives that should be taken up by the Government to support commercial forestry include;
- Strengthening of linkages between science, policy, and practice by harmonizing conflicting
- Policies and laws and streamlining of mandates between lead agencies in the forestry sector need to be in place;
- Provision of forestry research extension services, education and training, inventories of forest and tree resources market information and analysis, forest valuation and monitoring and evaluation systems need to be strengthened.
- Encouraging the adoption of forest management models that will support commercial forestry such as private and community land concessions, contract farming, forest certification, benefit sharing and community participation be prioritised;
- Involving private sector players and extend tree growing to community lands, farmlands, and drylands need to be strengthened in order to reduce pressure on natural forests;
- Promoting planning tools such as management plans need to be considered;
- Improving access to information on commercial forestry investment and management need to be supported ; and

- Promoting commercial forestry beyond wood-based enterprises to include Non wood forest products and support value addition through forest-based enterprises.

10.2 Concession Models lessons from Tanzania and Uganda

Tanzania has adopted innovative models in commercial forestry, through engaging small and medium growers in commercial forestry who own about 70% of the forest plantations, while the large private companies own about 10% with the rest owned by the Tanzania Forest Service (TFS). The high proportion of private players led to investment through Public. Private, Partnerships (PPPs) to complement the government's efforts. Tanzania practices three types of PPPs in forestry, which are: concession, forest land lease, and joint forest management. Key challenges in PPP implementation include: conflicting regulations, lack of realistic and comprehensive technical and socio-economic support, commercial forest feasibility leading to poor design, inadequate enabling environment, inefficiency capacity on negotiations among others.

Uganda also has several initiatives to support commercial forestry including:

- Uganda Timber Growers Association (UTGA), which is a cooperative that brings together commercial tree growers: It lobbies and advocates for support from the government; mobilizes for incentives and bulk purchases of inputs and market access for members; and provides outreach and training services through workshops and practical sessions;
- Sawlog Production Grant System (SPGS), which gives conditional grants (on the farmer adhering to set rules), sound technical advice, defines compliance standards - on nursery certification, provides silviculture practices and benefit sharing advise and offers local trained extension services; and
- Land concessions are offered to private sector in Central Forest Reserves to promote PPP and benefit sharing mechanisms and financial incentives.

10.3 Emerging issues within policy, legislation & governance

- Promotion of enabling policies for conservation and support commercial forests for instance in Uganda landowners must leave at least 10% of their land to natural regeneration/conservation;
- Gums and resins provide potential for commercialization of NTFPs in the ASALs. Various stakeholders are working towards sustainable utilization of the resources

for improved livelihoods and environmental resources. Moreover, rules and regulations on the sector are in development;

- Tree planting in ASALs is minimal and faces the challenge of animal browsing. Security can be enhanced through social fencing;
- Charcoal rules 2009 regulate the production and marketing of charcoal in Kenya, the challenge is on certification of products to ascertain the source; and
- Need for certification of planting material, addressing conflicting rules and investing in the entire value chain (planting material, awareness, and lobby for governance support), forest sector working group, and invest in capacity building of the farmers.

10.4 Key messages to the sector

- Strengthening of linkages between science, policy and practice by harmonizing conflicting
- Policies and laws and streamlining of mandates between lead agencies in the forestry sector;
- There is a need for secure land tenure, respect for private owners, ensure reliable economic governance structure and efficient resolution mechanism;
- Involve private sector players and extend tree growing to community lands, farmlands and the ASALs, which have immense potential to increased forest cover; and
- Need to strengthen PPP in forestry.

11.0

INTERNATIONAL PERSPECTIVES ON COMMERCIAL FORESTRY

11.0 SESSION IX

INTERNATIONAL PERSPECTIVES ON COMMERCIAL FORESTRY

Chairperson: Dr. Jackson Mulatya - KEFRI
The experience of Sweden: A nation of forestry H.E. Caroline Vicini, Ambassador of Sweden
Experiences from Costa Rica on forestry for sustainable development H.E. Giovanna Valverde Stark, Ambassador of Costa Rica
Experiences from Colombia on Foresty Ms. Claudia Milena Vaca, Deputy Embassy of Colombia
Link to presentations: https://www.kefri.org/assets/documents/conference/Day%203%20Presentations.zip

11.1 Session IX Highlights

11.1.1 The experience of Sweden: A nation of forestry

Sweden has made great advancement over the years in the use of wood for housing construction, buildings up to twenty-four storeys high constructions solely of wood. This was demonstrated during the conference and Expo through "the Woodlife Sweden" that showed the technologies and practices in use of wood in construction in Sweden. Even as wood continues to form the backbone of development in the country, Sweden's forest cover has doubled to almost 70%.

Sweden acknowledges that Kenya's population and economy are rapidly growing, increasing demand for housing construction. The country urges Kenya to transition from current reliance on concrete and steel for construction, to wood which has similar structural strength to steel and is also lighter and environmentally sustainable. To make a similar shift as Sweden, there is need to recognize wooden housing as suitable structures and promote industries for cross laminated timber. Currently, only South Africa has such industries in Africa.

Kenya has a tremendous potential in developing wooden construction industry because tree maturity period is much shorter (15-20years) as compared to Sweden's 70 years. Also, Kenya can take advantage of neighbouring Uganda's immense forest resources which have less demand in the country. The Ambassador affirmed the support of Sweden to help Kenya replace concrete storey houses with wooden.

11.1.2 Experiences from Costa Rica on forestry for sustainable development

Climate and vegetation in Costa Rica are like Kenya. Also, drivers to forest degradation and deforestation are more less the same. Costa Rica is one of the countries that experienced one of the highest deforestation, degradation, and soil erosion of up to 70% of the land by the early 1980s, with major drivers being unsustainable livestock production. However, they were able to reverse the trend and currently, the country has achieved 52% forest cover through policies such as National Forestry Financing Fund (FONAFIFO) which enforces fossil fuels and water resources taxes and levies and plough them back as Payment for Ecosystem services, and the REDD+ programmes which have enabled the country to protect and restore its forest resources. Since the 1940s the country has promoted the use of renewable energy including hydro, wind, geothermal and solar which now comprises of 99% of energy sources. Accordingly, Costa Rica recognizes the importance of public policies in promoting sustainable forestry and wishes Kenya to emulate.

In the Paris agreement, Costa Rica aims at achieving 60% forest cover, through the following strategies;

a. Working with agricultural sector. This is the first country to launch national appropriate mitigation action for both livestock and coffee cooperatives since 2011;
b. Adopting the plant more wood and plant more live fences programmes;
c. Planting more pastures (more carbon in the soils);
d. Launched long term public policy to become a decarbonized country through agriculture, forestry, transportation, and industry sectors;
e. Payment of ecosystem services Scheme; and
f. Focusing more on gender equality on issues of land tittles and property rights (only 15% of PES are received by women).

Costa Rica has set aside a new PES scheme to support conservation. This scheme will have a more integral view of territory and rural populations. The country boasts to be a major ecotourism destination because of nature conservation, 85% of the tourists visiting the country go to its national and park reserves. The Ambassador encouraged Kenya to take advantage of the global Forest finance pledge (Glasgow Pledge) which has committed 12 billion dollars towards financing the protection, restoration, and sustainable management of forests in the year 2021-2025.

11.1.3 Experiences from Colombia on Forestry

Columbia is the third largest country in Latin America and is extraordinarily rich in biodiversity, second only to Brazil. The country is commitment to global agreement on environmental conservation, this is following environmentalist projections on the loss of the Amazon by 2030. Columbian forests ecosystem very much resembles the Kenyan green forest scenery. Like Kenya these ecosystems are threatened by deforestation. In Columbia, the root causes of the deforestation include; encroachment brought about by conflict within the forest boundaries, such as illegal mining and fishing activities. Two major initiatives have been put to control the threats, namely:

- The use of army to protect the forest, considering forest are important national resources together with energy and water installations; and
- The commercialisation of bamboo and promotion as a construction material has ensured reduced pressure to the forest. Columbia being among first country to commercialise bamboo has promoted and disseminated the technologies to other Latin American countries and even to China. Columbia appreciates the need for the two countries to learn from each other. Accordingly, the Ambassador is open for a MoU with Kenya to be able to share the technologies of use of Bamboo and on protection of the forest ecosystem.

11.2 Emerging issues from international perspective on commercial forestry

- Kenya has several protected forests because of their importance for biodiversity. These forests should be protected from pressure by people by providing alternatives through establishment of forests for commercial purposes to avoid poaching of wood from the natural forests. This requires the establishment of mixed forest stands as opposed to monocultures. The government should then invest in the protection of indigenous forests which requires adequate funding;
- Sweden is willing to share ideas and knowledge on wood construction with Kenya through collaborations owing to successful investment as in the case of Woodlife Sweden;
- Returns on investments for carbon credits are still low. It is expensive to buy carbon per ha of trees. Currently the price is 5 USD per tonne but this should be at least 10 USD per tonne;

- There is new financing in Sweden for planting of forests as carbon sinks. Many incentives for green banking provide low interest rates on agricultural and coffee investments in Costa Rica; and
- Kenya should take advantage on postgraduate scholarships and capacity building programmes abroad for instance, Sweden provides general master's programmes and capacity building programmes in sawing of timber for efficient products, thus need to encourage students to apply for funding in these programmmes. Costa Rica offers experts and bachelor's degrees which they support students from Africa (90% students on scholarship). Columbia provides education in value chain processes.

11.3 Key Messages to sector

- Kenya should embrace partnerships with other countries to improve investment and conservation in the forest sector;
- Potential of wood in the construction sector is high that need to be unlocked in order to boast Kenya's economy and influence sustainable utilization of forests;
- Formulation of enabling public policies and incentive mechanisms such as PES and REDD+ in
- forestry has an enormous potential in promoting sustainable forest management; and Kenya should tap in the opportunities offered by bamboo.

12.0

COMMERCIAL FORESTRY POLICY DIALOGUE

12.0 SESSION X
COMMERCIAL FORESTRY POLICY DIALOGUE

Session Chair and Moderator: James Mwai, Gatsby Africa

Presentations:

Plenary discussants:

Judy Ndichu, United Nations Development Programme, Zipporah Toroitich-KFS, Bilhah Inyan- ya- Family Bank, Alfred Gichu-MoEF, Joram Kagombe KEFRI, Joshua Cheboiwo KEFRI, Joseph Kibugi, Philip Kisoyan, Esther Mutuma Representative from industry, representative from financial institutions.

12.1 Session XI Highlights

Commercial forestry policy dialogue centered on improving the enabling environment for forest and farm business from sustainably managed landscapes. The session addressed issues on good governance in commercial forestry, policy frameworks to support sustainable commercial forestry, forest concession, forest certification, incentives for private sector to promote commercial forestry, land tenure, befit sharing and access rights in forestry. The discussants also reflected on REDD+ implementation and its linkages to commercial forestry to reduce illegal logging and pressure on reliance of natural forests to meet wood demand-supply deficit in Kenya. The mechanisms for stakeholders' participation and inclusion across the value chain were also discussed. The following are therefore the highlights on what emerged from the policy dialogue:

12.1.1 Policy perspectives for commercial forestry investment

There are several policies that focus on forestry in Kenya that are mostly in draft form that are still guiding forest issues including commercial forestry in the country. Stakeholders are encouraged to implement the policies at the level they are in order to achieve the desirable sustainable development in Kenya. There exist also forest and tree-based Acts in Kenya that provides required legal framework to stimulate commercial forestry investment in Kenya. Some of these Acts include but not limited to: Forest and Conservation Management Act 2016; EMCA, 2015. Public Private Partnership Act, 2013; Community Land Management Act, Farm Agriculture Forest Rules, 2009. It was also noted there are issues that are outside policy and legislation such as land tenure systems and competition of land for agriculture.

Key highlights:

- Engaging stakeholders in the policy formulation and implementation process;
- Generate policies that are evidence based for easy implementation;
- Develop policies to support incentives that would attract stakeholders, especially the private sector to invest in sustainable commercial forestry; and
- Promote bench marking on best policy practices to spur investment in commercial forestry.

12.1.2 Forest certification

Forest Certification that is done by registered independent bodies such as Forest Steward Council promotes sustainable use of forest and tree resources for social, economic and environmental sustainability. Countries such as Uganda and Tanzania have embraced forest products certification and they are reaping benefits from these efforts. Tanzania has been able to certify Dalbergia melanoxylon (Mpingo) mostly used for carving. Uganda also has certified the Tree Growers Association.

However, in Kenya the uptake of forest certification is slow, calling for the need to have in place strategies to enhance certification of forest wood and non-wood products. There is a growing demand for certified timber for use in the construction industry. The forest stewardship council have developed interim standard for forest certification in Kenya and they promised to support stakeholders in finalizing the standards and promoting the certification.

12.1.3 REDD+ and sustainable commercial forestry

Reducing emissions from deforestation and forest degradation (REDD+) is phased in three levels, namely; readiness phase, implementation phase and investment/results based payment phase. Kenya is at the final stage of phase I and has developed REDD+ Strategy to address drivers of deforestation and forest degradation in different forest types. In the REDD+ Strategy, afforestation, reforestation, and commercial forestry are among of the interventions identified to halt the deforestation and forest degradation. The results-based payment phase is expected to catalyse various investments in the forestry sector. In view of this, the following were recommended for consideration:

1. Promote public private partnership models in forestry to spur afforestation, reforestation and commercial forestry investment in Kenya;
2. Strengthen financing mechanisms both from private and public to incentivize stakeholders especially small and medium-scale entrepreneurs in building up viable commercial forestry enterprises;
3. Encourage the private sector (banks, insurance companies) to move from the corporate social responsibilities on tree growing campaign but push towards sustainable social investments where these companies and groups can in future reap from these efforts;
4. Promote investments in public plantations and private land considering that the implementation of Community Land Act will have an effect on forest cover as some forests are community land held in trust by the county governments;
5. Promote alternative sources of energy to reduce pressure on forest resources;
6. Design investment Tree Growing Fund with support from private sector to support commercial forestry investment; and
7. Supporting forest investment to increase forest cover in ASALS.

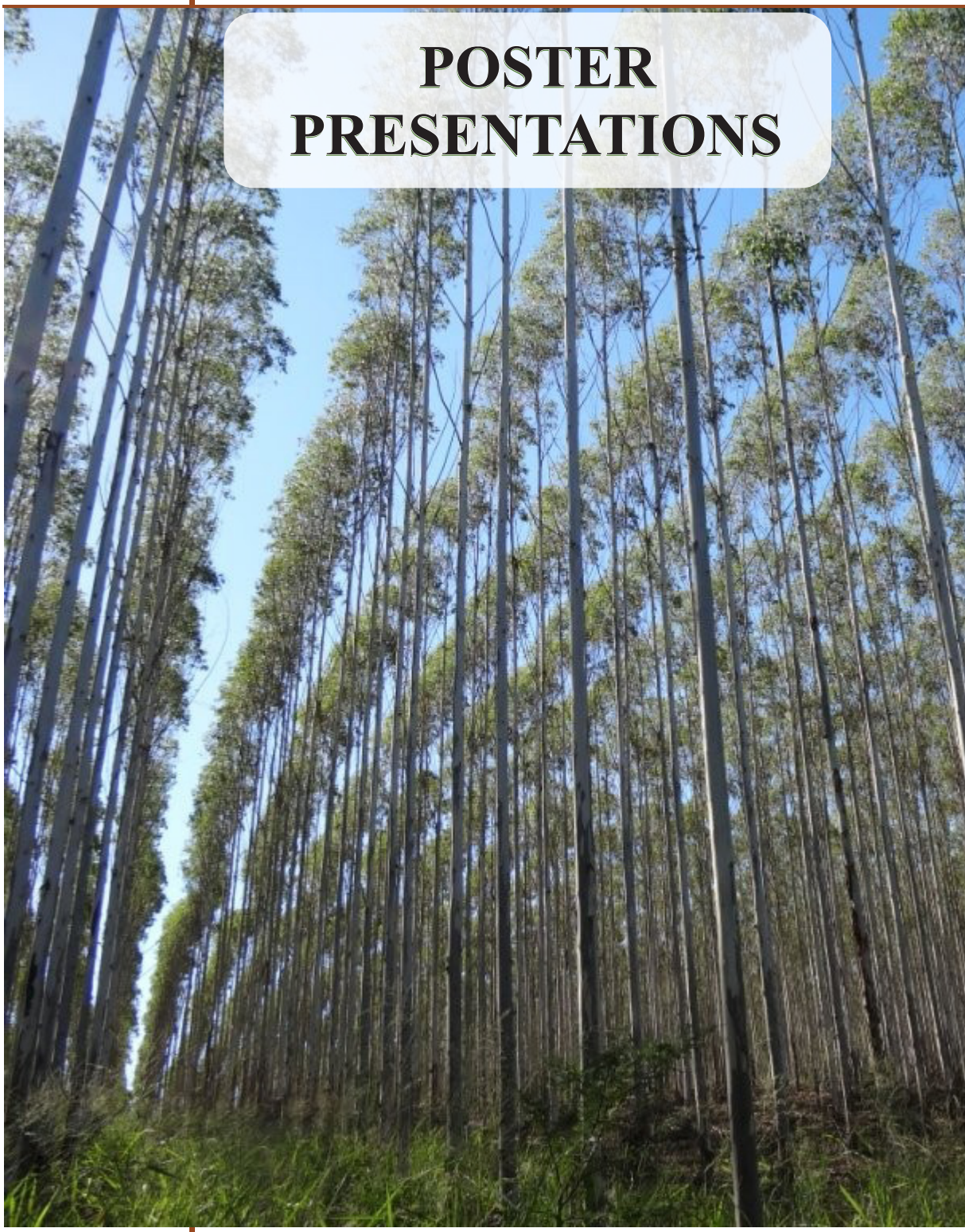
12.1.4 Strengthening financial institutions to support investment in commercial forestry

Commercial forestry is key to financial institutions more so the banking sector. In Kenya, the financial institutions have not thought of financing the forestry sector because of the risks involved. It has been a learning process for these institutions on how forestry sector can be included in their funding schemes. In view of this, the following called for action:

1. Financial institution need to join hands and come up with a tailor made product that will suit investment in commercial forestry through partnership approach with investors;
2. Financial institutions to seek for international support that will assist in working on the risks posed in funding investment in commercial forestry;
3. Strengthen capacity of investors/stakeholders investing in commercial forestry to package the products like in the case of mortgage financing to enable financial institutions to fund the forestry sector in collaboration with insurance companies;

4. Commercial forestry is a long-term investment so it requires incentives to attract the financial institutions for them to fund the commercial forestry venture. For instance the bank can partner with an investor to invest some money to finance farmers on commercial forestry;
5. For the forestry investment to be sustainable there is need to link it with the Climate Change Act 2016 with a section on duties and incentives that compels the private sector to participate in climate change activities. If the government implement the Act the way it is then it will be away of promoting sustainability in the forestry sector;
6. The financial institutions require really products. There is need to move forward as a sector, create products that create employment to the youth and the products should be tangible; and
7. Consider designing financing packages to support investing commercial forestry activities in Arid and Semi-Arid lands (ASALs).

13.0



POSTER PRESENTATIONS

13.0 POSTER PRESENTATIONS

Pinus patula seed collection and processing for improved yield

Peter M. Angaine , Alice A. Onyango and Jesse O. Owino

Kenya Forestry Research Institute, Rift Valley Eco-region Research Programme

Introduction

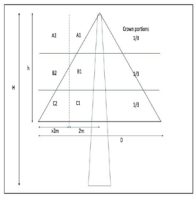
- *Pinus patula* represents 27% of commercial plantation species in Kenya, grown for pulpwood and sawn wood, exerting a high demand for seed.
- Seed stands and seed orchards are the main sources of seed. Studies have shown challenges in management of seed sources:

i. Lack of assessment on the effectiveness of management practices in seed sources,
ii. Poor seed collection practices in terms of where to collect from the crown and yield from the different parts of the crown
iii. Prolonged extraction periods delaying the availability of seed.

- The specific objectives were:

i. To show the best crown compartment for seed collection
ii. To improve the extraction efficiency for increased seed yield.

Approach



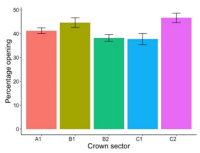
i. Sampled trees measurements were taken for dbh (cm), H-tree height (m), h-crown height (m), and crown radius (m).
ii. The crown height was subdivided into 3 equal portions; top (A), middle (B), and bottom (C).
iii. A further subdivision was done for each of the portions into two sections based on distance from the stem. Sections comprised A1, A2, B1, B2, C1 and C2.
iv. Sampled cones were measured for length (cm).
v. Cones were then soaked in hot (100°C) and room temperature (25°C) water for two durations: 10 min and 24 hrs, and control (not soaked to simulate current practice).
vi. The cones were subjected to artificial heating for seed extraction at eight temperature conditions: 30°C, 40°C, 50°C, 65°C, 70°C, 75°C and 85°C and DB (drying bed conditions to simulate the current practice for seed extraction; 44.8±6.00°C) at three exposure times (4, 24, and 48 hrs) together with the control (no soaking).
vii. Seeds were then extracted from cones by tapping gently on a flat wooden bench and counted.
viii. Length (cm) of the part of the cone that had opened was measured.

Key findings and discussions

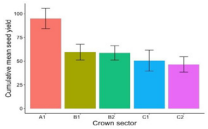
Photograph showing straight and curved cones.

- Continuation of key finding and discussions

Photograph showing stages of cone opening



Percent opening of cone by crown compartment.



Cumulative seed yield by crown compartment

Lessons learnt and Key Recommendations

- The upper crown compartments (A and B) was observed to outperform the bottom compartment (C) in seed yield
- Soaking (50.2±1.69) or not soaking (48.5±2.36) of cones does not influence their opening .
- This study recommends cone collection from upper part of the crown and artificial heating of cones at 65°C from 4 to 24 hours for improved seed yield.

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A new shoot and stem disease of *Eucalyptus* species caused by *Erwinia* sp.

Beryn Otieno and Emanuel Makatiani

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Introduction

- Eucalypts are the most preferred plantation species in Africa. Their growth has faced challenges of insect pest invasions mostly emanating from their home in the Australiopacific region (Paine et al., 2011). Important diseases such as canker (*Chrysoporthe cubensis*), rust (*Puccinia psidii*) and Ceratocystis wilt (*Ceratocystis fimbriata*) (Alfenas et al., 2009). The occurrence of bacterial pathogens started in the early 1980s, with minor incidence (Sudo et al., 1983), becoming more expressive from the mid-2000s with outbreaks of *Rasltonia solanacearum* and *Xanthomonas* spp. (Alfenas et al., 2006; Gonçalves et al., 2008).
- A diseases that is not originally associated with the genus in their areas of origin has also been observed threatening the productivity of the species. The bacterial disease, of unknown aetiology, is fast spreading in Eucalyptus spp. around the Lake Victoria region (Kenya). The symptoms were first sighted in nurseries in Migori in 2019.
- The objective of the study was to isolate and identify the causal pathogen causing dieback symptoms on *E. grandis* and *E. camaldulensis* growing in Migori.

Approach

Visual observation of the symptoms on eucalypt seedlings were described before bacterial isolation. Symptomatic characterization of the disease was based on nursery and field observations of naturally infected plants at Migori. Infected plant samples were then collected and sent to KEFRI laboratories at Muguga for bacterial isolation.

In the laboratory, parts of infected plants were disinfected then samples were collected round stem lesions or parts with die-back symptoms using a sterile scalpel blade. The samples were aseptically rinsed, dried then macerated in normal saline (0.85 % NaCl). The suspension was plated in freshly prepared SMS solid media (Kado and Heskett, 1970) then incubated at 28 °C in the dark for 24–48 hours. Pure cultures were transferred to Petri dishes containing the same medium and stored in 20 % glycerol at -70 °C.

Bacterial colony morphology was observed after growth for 48 h at 28 °C in the dark. The observed characteristics included shape, elevation, colour and diameter. Hanging drop technique was used to determine size shape, arrangement and motility of live bacteria in fluid media (Bisen, 2014).

All the purified strains were subjected to Gram staining then slide was blot-dried and observed under light microscope according to Bisen (2014).

Key findings and discussions

Disease symptoms

The earliest symptoms of the disease on young *Eucalyptus* trees seedlings and saplings are necrotic lesions along the midribs of newly formed leaves. The lesions progress to the tender stems. The most obvious symptom of the disease is shoot and branch die-back (Fig. 1).

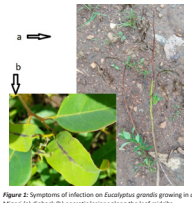

Figure 1: *Symptoms of infection on Eucalyptus grandis* growing in a tree nursery in Migori (a) dieback (b) necrotic lesions along the leaf midribs

Colony morphology

Colony morphology was cream and smooth. The colonies were dome shaped, shiny, mucoid-type with smooth and entire edges (Fig. 2).

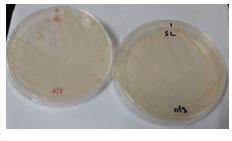

Fig 2. Bacterial isolates from *Eucalyptus grandis* (Left) and *E. camaldulensis* (Right)

Microscopic examination

- Microscopic examination revealed two shapes, the cocci and bacilli. *Eucalyptus grandis* contained both cellular shapes while *E. camaldulensis* was infected by bacilli.
- All the isolates were Gram negative, non-spore forming and no capsules. One isolate from *E. grandis* was motile while the three isolates from *E. camaldulensis* were all motile (Table 1).

Table 1. Results of microscopic examination on cultures from infected plant samples from Migori

Isolate code	Eucalyptus sp.	Shape	Gram stain	Motility	Spores	Capsules
1	*E. grandis*	Cocci	Gram -ve	-	None	None
2	*E. grandis*	Cocci	Gram -ve	-	None	None
3a*	*E. grandis*	Bacilli	Gram -ve	+	None	None
3b	*E. grandis*	Cocci	Gram -ve	-	None	None
4	*E. grandis*	Cocci	Gram -ve	-	None	None
5	*E. grandis*	Cocci	Gram -ve	-	None	None
6	*E. grandis*	Cocci	Gram -ve	-	None	None
A*	*E. camaldulensis*	Bacilli	Gram -ve	+	None	None
B*	*E. camaldulensis*	Bacilli	Gram -ve	+	None	None
C*	*E. camaldulensis*	Bacilli	Gram -ve	+	None	None

*suspected Erwinia species

Lessons learnt

- Based on observed disease symptoms, results of colony morphology and the microscopic examination of the isolates, the causal agent is possibly from the genus *Erwinia*
- This is the first report revealing Erwinia related bacterial species as the causal agent of die-back in *Eucalyptus* spp. in Kenya. Similar symptoms have been observed on *Psidium guajava* and *Syzygium* species in the region
- Mortality of 70 % was recently observed in a 6 month plantation of *E. grandis* in Migori
- The visually wilting symptoms observed in aerial part of the tree seedlings are indistinguishable from those caused by the bacterium *R. solanacearum* and the fungus *Certocysitis fimbriata* in eucalyptus

Key messages/ Recommendation

- This disease is fast spreading and could reach epidemic levels
- The disease should be considered a major threat to nursery and newly established trees
- We recommend research on identity of the bacteria, host range and management options
- The precise identification of the pathogen is possible by molecular and/or biochemical tests of the bacteria isolated from infected host tissue.

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Casuarina Equisetifolia: A Potential Alternative species for Industrial Fuel Wood in Kenya

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Introduction

Casuarina equisetifolia, is a tree 6- 35m tall.
In Kenya it is common along the coral beaches and nearby hinterland.

Optimum growth conditions

- **Altitude ranges:** 0 to 1,400 m. a.s.l
- **Mean annual temperatures:** 10 – 35^{0}C
- **Mean annual rainfall**: 200 - 3500 mm
- **Soil type**: Requires invariably well-drained and rather coarse textured soils mainly sands and sandy loams.
- It tolerates salinity
- **Agro ecological zones**: It can do well in zones 1-IV

Gap in industrial demand and supply

- Wood fuel (charcoal and firewood) forms the highest energy use yet the supply is inadequate.
- Some industries such as tea, tobacco processing and brick making rely on wood fuel energy
- Eucalyptus is one of the main species cultivated extensively in Kenya for industrial fuelwood, yet, it has raised negative concerns on its water use efficiency and its effects on soil fertility.

Key findings and discussions

Casuarina equisetifolia holds potential as an alternative tree species for industrial fuelwood because of the following:

- **Best firewood :** High wood calorific value (Figure 1)

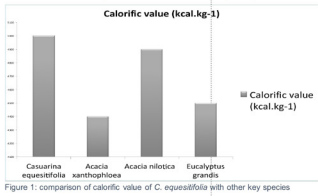

Figure 1: comparison of calorific value of *C. equesitifolia* with other key species

- Its wood ignites readily even when green and ashes retain heat for long periods
- **Charcoal:** best charcoal (about 7000 kcal/kg)

Lessons learnt

Casuarina equesitifolia has other attributes that makes it even better alternative:

- **Nitrogen fixing**: good for Intercropping in year 1 and 2 in agroforestry systems
- **Growth rate**: early growth rates of about 2 m/year in height, with good form
- **Yield:** The best yield of about 125 to 150 tons/ha is possible within 3 years at an espacement of between 1.2 x 1.2m and 1.5 x 1.5 m yields could increase through fertigation
- **Export market and Construction industry**
- **Rehabilitation of mined sites**

Key messages/ Recommendation

Casuarina equesitifolia holds potential as an alternative species for industrial fuelwood in Kenya

Oduor, N. M., Ngugi, W. & wa Gathui, T. (2012). Sustainable tree management for charcoal production Acacia species in Kenya. Ndegwa, G., Breuer, T., & Hamhaber, J. (2011). Woodfuels in Kenya and Rwanda: powering and driving the economy of the rural areas. *Rural*, *45*(2), 26-30.

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ENHANCING TECHNOLOGY TRANSFER THROUGH KNOWLEDGE SHARING AND NETWORKING: LESSONS FROM CADEP-SFM/AI-CD PROJECT

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Kenya Forestry Research Institute (KEFRI)

Introduction

Background

- AI-CD was developed against the background that the Sahel and Horn of Africa (HoA) have similar environmental challenges, with much of the region being dry and highly degraded.

AI-CD Outputs

- Build robust networks between Horn of Africa countries, Sahel and development partners
- Enhance knowledge sharing, facilitate technology transfer and promote adoption of natural Resource management (NRM) practices among African countries
- Improve access to finance to promote measures for combating desertification

Degraded lands in Horn of Africa suffering desertification

Approach

- Terms of Reference (TORs) were developed as a base for AI-CD participating countries to work together
- Held a series of workshops and meetings for Horn of Africa AI-CD participating countries for policy makers and technical officers
- Collected good practice information from the field
- Accumulated the collected information on KEFRI website (**https://www.kefri.org/cadep**)
- Shared the collected knowledge and information through internet and non-internet methods

CADEP-SFM web portal

Regional Forums and Capacity Building Events

- 1st Regional Forum for Horn of Africa held in 2017
  - Delegates familiarized with the Initiative
  - Agreed on ToR
- Ministerial Forum for Horn of Africa held in 2017
  - Promotion of Initiative at political level
- 3rd Regional Forum for Horn of Africa held in 2019
  - Objective: Resource mobilization through concept notes discussion with Development Partners
- 4th Regional Forum for Horn of Africa participants, a virtual meeting held in 2020
  - Objective: To appraise progress of AI-CD in HoA
- Final Conference for Horn of Africa, held in August 2021
  Objective: To appraise gains of the Initiative from 2016 to 2021.

1st Regional Forum for Horn of Africa field visit

3rd Regional Forum for Horn of Africa in-house session

Ministerial Forum for Horn of Africa.

4th Regional Forum for Horn of Africa screen shot

South Sudan delegates visiting KEFRI – case of enhanced network in HoA

Participants to final Conference in 2021

Regional Technical Workshops for Horn of Africa

- 1st Regional Technical Training Workshop held in 2017
  - Capacity building and introduction to AI-CD and CADEP-SFM tools to technical officers
- 2nd Regional Technical Training Workshop held in 2018
  - Capacity buildings on data collection and repackaging of dissemination information

1st Regional Technical Training Workshop

2nd Regional Technical Training Workshop.

Major Achievements

- Developed tools for identifying, collecting and documenting good practices
- Build networks among Horn of Africa countries
- Shared knowledge through internet and non-internet based methods
- Produced various knowledge materials
- Built capacity of partners in HoA
- shared lessons from HoA on combating desertification

Publications: Books and brochures

Clockwise - degraded sites
Anti-clockwise and middle region - rehabilitated sites

Lessons Learnt/Opportunities/Challenges

Lessons

- Need to have a common understanding for ownership of the Initiative (e.g. through ToR)
- Involvement of policy makers to mainstream Initiative is paramount
- Be creative and innovative in case of emerging challenges, e.g. COVID-19 containment measures

Opportunities

- Created Networks and Knowledge platforms
- Trained personnel within HoA
  - The pool of persons will successfully engage in further activities
- Leverage on prospects created by development partners

Challenges

- How to promote adoption of good practices in HoA
- Access to finance to promote envisaged activities

Key messages/ Recommendation

- Need to promote knowledge and good practices at ground/community level in order to collectively combat desertification in Africa
- There is need to continue working together within and among HoA countries to address current and emerging environmental challenges

Melia growing on-farm

Re-seeded pastureland in drylands of Kenya

Acronyms

- CADEP-SFM: Capacity Development Project for Sustainable Forest Management in the Republic of Kenya
- AI-CD: African Initiative for Combating Desertification to Strengthen Resilience to Climate Change in the Sahel and Horn of Africa

Acknowledgement

- Authors acknowledge JICA and Government of Kenya for financial, logistical and technical support,

Growth and Yield of Selected High Quality Genetic Stock of *Eucalyptus grandis*

Joram Mbinga *, Alice Adonga, and Richard Sika

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Introduction

- The development of commercial forestry sector is dependent on availability of fast growing and high yielding species and varieties of trees. Eucalyptus are among the popular fast growing species that have been grown since their introduction in Kenya in 1902. Among the many Eucalyptus species, research has shown that *E. grandis* species is the most suitable for planting in high potential area at altitude between 1400 and 2300 m a.s.l. and rainfall above 900 mm per annum (KEFRI 2010). The common planting density is 1100 stems per ha for supply of power transmission poles, pulpwood for paper, domestic and industrial fuelwood, and timber. Its also good in carbon sequestration which mitigates against climate change. There is about 100,000 ha of *E. grandis* in Kenya which is increasing due to the uptake of the species at commercial level by investors (KFS 2009). The early varieties of *E. grandis* were low yielding and it was the objective of this study to develop varieties of *E. grandis* that are higher yielding so as to give higher returns on investment

Approach

- **Plant Material and Site**
- Seeds from 23 genetic stocks (Mother Trees) selected on the basis if outstanding growth, from *E. grandis* plantations in Kericho, Sotik. Londiani, Turbo, and Kiambu, and one control seedlot were used to establish an experiment at Kamara site in Londiani
- **Experimental Design**
- The design of the experiment was Randomised Block Design with four block replications for each genetic stock.. Plots contained 90 trees (3 x 30) of the same genetic stock in a block at a spacing of 3.0 m x 3.0 m (1100 stems/ha). Normal plantation management practices were applied.
- **Data collection**
- Assessment was periodically done on 15 randomly pre-selected trees in each of the 24 plots in each block. Parameters assessed were survival, tree height, diameter at breast height, stem and branch qualities and pests and disease resistance. Growth data collected when the trees were 16 years was used to determine the wood volume and yield reported in this presentation.
- **Analysis**
- Plot means for the assessed parameters were subjected to analyses of variance (ANOVA)
- Tree yield in volume V (m^3) was calculated using Smalian equation, V= (π d^2hf)/4, where, d= tree Dbh (m), h= tree height (m), and f=form factor which for *E. grandis* is 0.6

Key findings and discussions

The performance of the selected genetic stocks in terms of growth parameters, volume, and yield are as shown in table 1 below.

Table 1; Growth parameters of 16 year *E. grandis* trial at Londiani

Parameter	Mean value of all genetic stocks	Mean of best genetic stock
Tree height (m)	28.6	32.0
Tree Dbh (cm)	24.5	26.6
Volume annual increment (m^3 /ha/yr)	55.0	66.4
Yield (total volume of wood per ha)	880.0	1062.4

Photo 1: A 4yr old E grandis experiment at Londiani

- As highlighted in table 1, the best performing genetic stock achieved a mean height growth of 32m and a mean diameter at breast height of 26.6 cm. at age 16 years. The mean performance for all the mother trees was 28.6m height and 24.5cm diameter at breast height
- The highest mean annual increment (MAI) of the best genetic stock in this experiment was 66.4 m^3 /ha/yr which is a significant improvement from the existing MAI of 45-50 m^3 /ha/year in the country (Oballa 2013)
- If harvested to-date, 1 ha of these trees would yield 880 m^3 of wood, but if only the best were selected, planted and given the best silvicultural management, 1 ha would yield 1062 m^3 of wood at age 16 years, which is a significantly higher output compared to the yield of 750-800 m^3 from the general sources at the same age. (Oballa 2013)
- Growth of *E. grandis* in terms of MAI elsewhere in the world is as follows;
  - Ethiopia; 25-41 m^3/ha/yr (Tesfaye H. *et al* 2003)
  - South Africa ; 35 55 m^3/ha/yr (Du Toit *et al*. 1998)
  - Brazil, general material; 25.5-36.4 m^3 /ha/yr (Ataídes M. F. *et al*. 2015),
  - Brazil, with intensive management and breeding, rises productivity to 70 m^3 /ha/yr (Turnbull 1999)
- The results from this study was therefore better than the productivity achieved in Ethiopia and was comparable to the productivity in South Africa and Brazil.

Lessons learnt

- Research on *E. grandis* in Kenya which started with introduction of the right material from other countries followed by testing for adaptation and growth has provided a high quality material which when subjected to right management can give large quantities of wood to help meet the wood demand in the country
- The increased productivity in volume of wood over a shorter time using the high yielding genetic stock will translate into higher earnings to investors who choose to grow *E. grandis*.
- Since genetic diversity in plantations helps to counter severe outbreaks of pests and diseases, it is therefore wise to keep all the selected genotypes of the species to maintain the diversity of the gene pool.
- Finally, this trial has shown that high yielding *E. grandis* varieties are now available for commercial tree growers in Kenya

Recommendation

The main recommendation is that;

- More seed sources should be established using the high yielding genetic stock developed from this research
- Clonal propagation material of high yielding stocks should be raised for commercial planting
- Investors in *E. grandis* planting should use seeds from the improved stock, or seek to use clonal planting material from the upcoming clonal development program in KEFRI which will be seeking to do clonal multiplication of the high yielding varieties

Ataídes M.F. et al., 2015. Growth and yield of Eucalyptus In tropical region of Brazil. Australian Journal of Basic & App. Sc. 9(33)
Oballa *et al.* 2013. High Yielding Eucalptus grandis as a Commercial crop in Kenya. KEFRI Information Bulletin
Tesfaye H., 2003. Growth and form of Eucalyptus grandis provenances at Wondo Genet, southern Ethiopia. Australian Forestry
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KFS 2009. A Guide to On-Farm Eucalyptus Growing in Kenya. KFS Nairobi
Du Toit *et al.* 1998. Eucalypt and Pine Plantations in South Africa. *Workshop Proceedings 16-20 Feb. 1998, South Africa*, CIFOR.
Turnbull, J.W. 1999. Eucalypt plantations. *New Forests* 17: 37-52.

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14.0

EXPO AND EXHIBITIONS

14.0 EXPO AND EXHIBITIONS

The commercial forestry expo and exhibitions, jointly sponsored by KEFRI and FAO, ran concurrently throughout the conference period. Various actors in commercial forestry including small- and large- scale tree farmers, tree nursery operators, tree seeds and seedling suppliers, wood processors, builders, service providers, machinery suppliers, bamboo processors among others, showcased various products, services, technologies, and innovations in commercial forestry, their cost, as well as how to access them. The expo also provided a marketing platform to the actors where various products and services were traded. The actors were also able to network and meet potential clientele and partners for their ventures.

Exhibitions were broadly categorized into 6 categories as follows (Table 1):

14.1 Tree seeds and seedlings

Tree seed and seedling production, distribution and planting technologies and innovations were exhibited under this category. Plantech, a commercial seedling nursery based in Naivasha showcased their innovative seedling raising techniques and capacity in specialized trays and pots. Other tree seedling nurseries were Central Highlands Tree Growers Association, Kuhuru Tree Nursery and MERCFA Muguga who exhibited and sold assorted tree seedlings. Fruity Schools Africa demonstrated the potential of greening Kenya through planting fruit trees in available public spaces while Seed Balls Technology exhibited innovative seed coating technology to preserve tree seeds in the open field until the conditions were right for germination, hence increasing their survival potential.

14.2 Timber products processing and value addition

This category involved exhibitions of high-quality furniture by Elifurni, Elegance and Alex Njenje. Ecogreen showcased their furniture and handicrafts while Warazi had innovative wood-based handicrafts. Mianzi exhibited wooden floor parquets, Biashara Masters wood-working machinery while Build Her demonstrated emerging technologies in the furniture industry. A key highlight in this category was the exhibition by Woodlife Sweden which focussed on the use of wood primarily in the built environment as is done in Sweden. This is usually accomplished using cross-laminated timber (CLT) to construct even highly complex multi-storey structures with unique designs and strength. Participants were taken through a compelling story of the potential of wood construction and application in all built environment, be it in small-scale or large-scale projects.

14.3 Bamboo and non-timber forest products (NTFPs)

Exhibitions in this category showcased the use of Bamboo lamination and its use in furniture making by KEFRI's National Forest Products Research Centre (NFPRC) at Karura and by Bamboosa. Charcoal briquetting from Bamboo and other NTFPs such as aloes, health products from different tree powders and value-added juices and fruit jams were also exhibited by NFPRC while Horn Afrik and Agar Limited showed gums and resins. Tarda exhibited bee products and Chai Zambarau showcased purple tea.

14.4 Plantations management

Japan International Cooperation Agency (JICA) gave information on its long-standing development projects with KEFRI, and particularly the development of improved drought-tolerant Melia volkensii and high-biomass Acacia tortilis in the drylands, with examples of seed orchards and progeny plantations established in Kitui. Kenya Forest Service (KFS) showed forest inventory tools and log production while Forest Stewardship Council (FSC) provided more knowledge on forest certification.

14.5 Forestry technologies

Kenya Climate Innovation Centre (KCIC) exhibited their MUNDA App and Gatsby Africa's Kenya Commercial Forestry Programme (KCFP) showcased their digital technology packages for commercial forestry. Base Titanium showed restoration technologies on mined areas, while TechDirect solutions had water retention soil products for plantations.

14.6 Linkages, partnerships and financing

Development partners FAO and UNDP gave exhibitions of their institutions and commercial-forestry affiliated programmes, especially those encouraging the youth to venture into commercial forestry activities. UNDP particularly is supporting the Great Green Wall that seeks to green an African Belt in the Sahel. Commercial banks such as Family Bank, Cooperative Bank, Kenya Commercial Bank (KCB) and Kingdom Bank showcased their products and offered information on different financing options and opportunities in forestry investment. Nyandarua Tree Growers Marketing Cooperative demonstrated finance access tools for commercial forestry and Forestry Society of Kenya (FSK) of- fered information on professional practice in forestry.

1. KEFRI's Central Highlands Ecoregional Research Programme (CHERP) also exhibited the region's forestry technologies in collaboration with its partners.
2. Its different sections all pointed to their contribution to research relating to commercial forestry from suitable soils and seeds, commercial tree nurseries and glasshouses, site-species match- ing, tree breeding, germplasm production through enhanced technologies such as tissue culture, sandalwood and Bamboo propagation, forest estate and plantations management, integrated pest management and cost-benefit analyses of commercial forestry ventures.

Table 1: List and category of exhibitors in the KCFIC

	ORGANIZATION	EXHIBITION
1.	Tree seeds and seedlings	
1.1	PLANTECH	Technology for high quality seedlings
1.2	Central Highlands Tree Growers Association	Tree nursery products
1.3	Kuhuru Tree Nursery	Tree seedlings
1.4	MERCFA Muguga	Tree seedlings
1.5	Seed Balls Technology	Innovative tree seeds technology
1.6	Roi Farm	
1.7	Fruity Schools Africa	Fruits trees
2.	Timber products processing and value addition	
2.1	Biashara Masters	Machinery
2.2	Elifurni Furniture Ltd	Furniture
2.3	Buildher	Technology in the furniture industry
2.4	Build x-CLT	Sustainable building technologies
2.5	Ecogreen	Furniture, handicrafts
2.6	Elegance	Furniture
2.7	Alex Njenje	Furniture
2.8	Warazi	Handicrafts
2.9	Mianzi	Floor parquets
2.10	Wood Life Sweden	Cross-laminated timber
3.	Bamboo and NTFPs	
3.1	Karura	Bamboo/lamination/furniture
3.2	Karura	NTFPs, charcoal briquettes
3.3	Bamboosa	Bamboo household furniture
3.4	Horn Afrik	NTFPs, Gums
3.5	Agar Limited	Gums and resins
3.6	TARDA	Bee products
3.7	Chai Zambarau	Purple tea
3.8	ENNDA	Gums and resins

4.	Plantations management	
4.1	JICA	*Melia volkensii*
4.2	KFS	Inventory tools, logs
4.3	Forest Stewardship Centre	Forest certification
5.	Forestry technologies	
5.1	Gastby-KCFP	Digital technology packages
5.2	KCIC	MUNDA APP
5.3	Base Titanium	Ores and sands
5.4	Techdirect Solutions	Water retention soil products
		Digital Technology packages
6.	Linkages, partnerships, and financing	
6.1	Nyandarua Tree Growers Marketing Cooperative	Finance access tools/beehives
6.2	Central Highlands Tree Growers Association	Tree nursery products
6.3	Family Bank	Finance options and bank products
6.4	Cooperative Bank	Finance options and bank products
6.5	Kenya Commercial Bank	Finance options and bank products
6.6	Kingdom Bank	Finance options and bank products
6.7	FAO	
6.8	UNDP	The Great Green Wall
6.9	Forest Society Kenya	
7.	CHERP EXPO & OPEN DAY	
7.1	CHERP EXPO & OPEN DAY	Integrated Pest Management (Pathology & Entomology) in forestry, Tree seeds, Tree breeding, Osyris Propagation, Commercial Tree Nursery, Bamboo Propagation, Quarantine Section, Glass house, Cost-Benefit analysis and Estate Management, Tree nursery set up and management

14.7 Selected exhibition photos

15.0

FIELD EXCURSION

15.0 FIELD EXCURSION

A Two-day post conference field tour was undertaken by the participants from 26th - 27th November 2021. The tour was fully sponsored by JICA, Better Globe Forestry and the Kenya Forestry Research Institute (KEFRI) to ensure that participants could relate some of the theoretical concepts discussed during the conference to practice in the field. A total of ninety participants including representatives from key organization in the forestry sector, financial institutions, investors, individual farmers and youths from all over the country participated in the excursion. The tour was a great opportunity to discover;

1. The potential for dryland commercial forestry using native tree species: The participants visited demonstration sites in Kiambere Better Globe forestry (BGF) within TARDA field station established with *Melia volkensii.* This is one of the priority trees species promoted, because it is a fast growing species in the dry areas and is classified as a hardwood and fully comparable to mahogany trees, and has the potential to enhance economic perspectives for the community and stakeholders while also contributing to conservation initiatives and reducing erosion problems.

2. Participants visited the TIVA woodlands, which is KEFRI's Dryland Research Centre of Excellence as part of further demonstration on the potential of native species in commercial forestry. Key lessons to farmers was on the tree improvement programme for Melia Volensii and Acacia tortilis which have been chosen as priority species for the dry areas. Opportunities on how local farmers can be involved in the process was shared through great inspiration of one of the pioneer farmers from Kibwezi (Mr. Jonathan Kituku) who had taken up the challenge and had used it to improve his livelihoods and social wellbeing. He also got a presidential award (Order of Golden Warrior–OGW) from the process for being a model tree farmer in the drylands.

3. Operation of successful village banks serving about 5,000 tree farmers in Kamuwongo village, Mwingi sub-county. The microfinance bank was established by the support of Better Globe Forestry using crowd-funding financing model. The village bank provides small loans without any collateral requirements with the goal to improve livelihoods and welfare of people living close to the established tree plantations. The priority to loans is given to

women, upon repayment of the loan, one qualifies to borrow larger amounts with a longer repayment period.

4. Adoption of on-farm tree planting initiatives in the drylands of Kiambere by partner community farmers with the support of Better Globe Forestry through a 20 year buy-back agreement on trees which is expected to benefit the customers economically.
5. Round wood processing and preservation technologies in Kakuzi. This includes the demonstration of efficient processing machinery and the industrial wood treatment process for posts and poles.
6. Management of high productivity privately managed Eucalyptus plantation with a production of upto 400M^3/ Ha, in Makuyu, Muranga County.
7. The tour was a success as participants were able to learn and appreciate the feasibly of commercial forestry through the demonstrations in the field and provided the opportunity for continued networking among the conference participants.

16.0

CONFERENCE CLOSING CEREMONY

16.0 CONFERENCE CLOSING CEREMONY

16.1 Key conference highlights

- There is need to leverage on technology by provision of ICT support tools and user friendly innovative digital solutions for tree growers such as the KEFRI App that can monitor survival and track growth to support commercial forestry
- Scaling up of commercial forestry in Kenya will require multi stakeholder efforts and involvement of all the players including development partners, private sector, community and financial institutions to provide technical information, capacity building and access to resources and tailor make financial products to support commercial forestry. Strengthen the interlinkages between timber and non-timber forestry products as well as circular economy within the framework of sustainable commercial forestry
- Provision of quality tree germplasm is key to viable commercial forestry
- Financial mechanisms to support commercial forestry including developing bankable products for the commercial forestry industry
- Forest standards and certification to promote sustainability in the sector through proper chain of custody
- Benchmark innovative public plantation management models such as Leasehold as used in Uganda
- Need for adoption of innovative and efficient production, harvesting and processing technologies across the value chains
- Kenya needs to upscale value addition and processing technologies to act as a regional hub for forest products
- Capacity building of youth, women, and other affirmative action groups in the forestry sector across the forestry value chain including seeds and seedling production

16.2 Way forward

- The need to hold the conference every two years to assess the status and progress of the sector
- Establishment and operationalization of the Kenya Commercial Forestry Innovation and Investment centre to continue the discussion on improving commercial forestry in Kenya and development of a strategy for the same
- Create platform for continuous engagement with stakeholders from both public and private sectors including
- Promote initiatives to support youth and women in commercial forestry
- Engage with stakeholders on better markets and prices of FTP and NTFPs-on going
- Maintain the momentum of the commercial forestry engagement by holding quarterly meetings and webinars on key and emerging issues on sustainable commercial forestry.
- Design resource mobilization mechanisms among stakeholders for harnessing resources to support commercial forestry investment in Kenya, incentives, proposals
- Prepare commercial forestry conference proceedings and share widely by,
- Profile and maintain data base of the actors in commercial forestry
- Development of a policy and regulations to support commercial forestry in Kenya
- Development of innovative incentive models to support commercial forestry (REDD+, and PES schemes

16.3 Speech by The Principal Secretary

SPEECH BY DR. CHRIS KIPTOO, THE PRINCIPAL SECRETARY, MINISTRY OF ENVIRONMENT AND FORESTRY DURING THE OFFICIAL CLOSING OF THE 1ST KENYA COMMERCIAL FORESTRY INVESTMENT CONFERENCE AND EXPO 2021, AT KEFRI HEADQUARTERS, MUGUGA ON 25TH NOVEMBER 2021

The Chairman KEFRI Board of Directors, The Board of Directors of various Government Parastatals Directors of Public and Private Agencies, Representatives of Embassies, The Director KEFRI, Representatives of International and national institutions/organizations Stakeholders, Invited guests Conference participants, Ladies and Gentlemen,

Good afternoon,

It is my pleasure to join you this afternoon to officiate in this important ceremony that marks the end of the 1st Kenya Commercial Forestry Investment Conference and Expo. I therefore take this opportunity to thank all of you for having participated in this Conference, which enabled us to achieve the set objectives.

Ladies and Gentlemen

The main objective of this Conference was to provide a platform for exchange of knowledge and experiences on commercial forestry investment in Kenya. I am happy to note that this objective has been fully met through: interactive presentations and in-depth plenary discussions facilitated by a wide range of experts, poster sessions and exhibitions. I am informed that this Conference was attended by a daily average of 250 delegated physically and 100 virtually from 50 institutions and organization.

I have been informed that a total of 50 papers have been presented and discussed on the following key areas;

- Tree Seed Production, Distribution and Trade,
- Commercial Plantation Management and Improvement,
- Bamboo Production, Processing and Utilization,
- Trade in Forest Products,
- Forest Investment and Financing Models, and
- Capacity Building to Support Commercial Forestry.

The launch of solar drying facility for tree seeds as well as various technical documents was also very crucial. The tree seed drying facility will be very instrumental in provision of high quality tree seed towards meeting and maintaining the country's 10% tree cover.

On the other hand, the publications provide exhaustive information on; development of high quality germplasm through tree breeding, innovative landscape restoration and rehabilitation guidelines through aerial seeding; and biodiversity conservation of our natural resources. I encourage you participants to make use of these important information products.

I note with satisfaction that the major output of this conference were comprehensive discussions on steps towards establishing a Kenya Commercial Forestry Innovation and Investment Centre that will be key in catalyzing commercial forestry in the country.

Distinguished delegates, as institutions/organizations and persons charged with the responsibility to sustainably manage and protect the environment, we need to reflect, aspire and join efforts as a team committed to leveraging on financial mechanisms through joint projects that entail a PPP model.

Distinguished delegates, As the Conference comes to an end, let us take pride in what has been achieved during the 3-day forum and purpose to commit to applying lessons from this unique Conference and expo. Let us continue the dialogue as we take cognizance of the resolutions and way forward which we have collectively agreed upon.

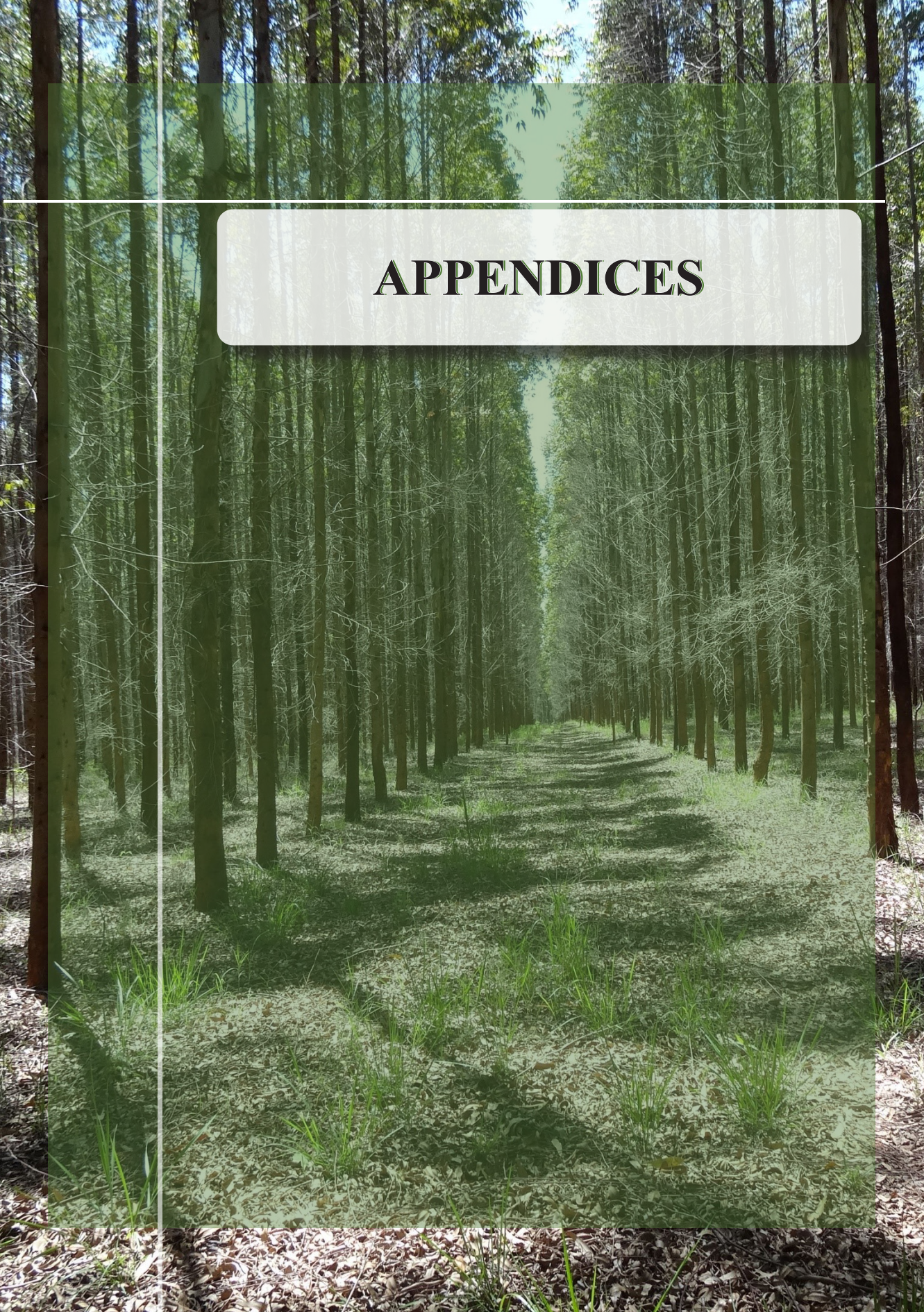
To all Partners, representatives from the embassies, International Agencies, and participants from the region, delegates and guests, our distinguished farmers and tree growers, I say thank you for your commitment in this collective endeavour of making commercial forestry a reality as a vehicle towards livelihood improvement and environmental conservation.

Distinguished delegates, Ladies and Gentlemen, it is now my duty to declare

THE 1ST KENYA COMMERCIAL FORESTRY INVESTMENT CONFERENCE AND EXPO officially closed

THANK YOU

APPENDICES



17.1 APPENDIX I: Exhibition Posters

KENYA FORESTRY RESEARCH INSTITUTE

COMMERCIAL FORESTRY INVESTMENT FOR WEALTH CREATION, BOOSTING MANUFACTURING, FOOD SECURITY, HEALTH, AND ATTAINMENT OF 10% TREE COVER IN KENYA

SOIL RESEARCH FOR ENHANCING FORESTRY DEVELOPMENT AND FOOD SECURITY AT CHERP

Introduction

- Soil fertility decline is the root cause of deteriorating land productivity in Kenya
- Soils in CHERP are often deficient in Nitrogen & Phosphorus
- KEFRI undertakes soil research to guide forestry and agro-forestry development
- Appropriate soil management recommendations are paramount for improved food security and forestry development at CHERP

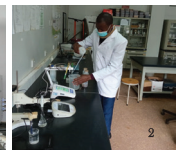
Interventions to soil management challenges

- KEFRI offers soil testing services to farmers and other stakeholders
- Develop technologies for soil and water management
- KEFRI offers advisory services to stakeholders on soil and water management technologies
- Continuous research to guide species-site matching
- Development of optimal seedling growth media for nursery managers/ owners

For More Information, Contact
The Director,
P.O. Box 20412, 00200 Nairobi,
Tel: +254 (0) 724259781/2 or +254 722157144,
Email: director@kefri.org


On-farm soil sampling for lab tests


Sample extraction for analysis at CHERP Soil lab



Soil Analysis using AAS (1) and pH meter (2)

KENYA FORESTRY RESEARCH INSTITUTE

COMMERCIAL FORESTRY INVESTMENT FOR WEALTH CREATION, BOOSTING MANUFACTURING, FOOD SECURITY, HEALTH, AND ATTAINMENT OF 10% TREE COVER IN KENYA

SANDALWOOD: IT'S POTENTIAL FOR COMMERCIAL FORESTRY

Introduction

- Kenya is in the process of domesticating the indigenous East African Sandalwood (Osyris lanceolata) and introducing the exotic Indian Sandalwood (Santalum album).
- EA Sandalwood (Osyris lanceolata) is widely distributed in Kenya while S. album occurs mostly from coastal dry forests up to 1200 m elevation in India.
- Sandalwoods have been exploited for over 5000 years and many of the natural populations of these species are now classified as vul-

Indian Sandalwood

East African Sandalwood

Uses:

- Sandalwood oil is highly valued in Fragrance, Perfumery and Pharmaceutical Industries.

Sandalwood oil and products

Demand/ Market:

- The worldwide market for sandalwood is expected to grow at roughly 10.3% over the next 5 years to reach over 140 million US$ in 2024 from 78 US$ in 2019.

Commercial potential:

- On average about 500 trees can be planted on one hectare (6m*3m spacing) and the average yield per tree is about 15 to 20 kg of scented heartwood after 13 years.
- One kilo of heartwood is 130 US$. 1 hectare can therefore fetch 975,000 US$ (500*15*130)
- Sandalwood oil obtained at 12- 15 age may range from 3.5 to 4 percent with good percentage of total santalol content.

Current KEFRI's sandalwood research

- To compare germination of the sandalwoods when subjected to different pre-sowing treatments
- To compare the sandalwoods when nursed by different host species, raised under different shade levels, soil fertility status, hosted at varying time period and pot sizes.
- Establishment of seed and conservation stands,
- Determination of oil content and genetic variation from different populations
- Development of silvicultural regime for EA Sandalwood.
- KEFRI in collaboration with other partners intends to plant 120 hectares (300 acres) for economic exploitation anticipating to produce 200 tonnes at Sh12.5m per tonne at current market prices (2018).
- The produce can earn the country Sh15 billion in export value per harvest.

Community propagating EA Sandalwood in Agroforestry

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KENYA FORESTRY RESEARCH INSTITUTE

COMMERCIAL FORESTRY INVESTMENT FOR WEALTH CREATION, BOOSTING MANUFACTURING, FOOD SECURITY, HEALTH, AND ATTAINMENT OF 10% TREE COVER IN KENYA

Cypress Breeding Program in Kenya for Commercial Forestry

Background information

Intensive genetic improvement of *Cupressus lusitanica* in Kenya started in early 1961 with substantial gains achieved through selection of superior (plus) trees for improved productivity of plantations and quality of products. This has yielded improved germplasm whose productivity levels are currently at Mean Annual Increment (MAI) of 25 $m^3ha^{-1}yr^{-1}$

Breeding Objective: Growth, light branching & Cypress Canker tolerance
Main product: Sawn timber

Base populations
Imports from SA and France (1905), New Zealand, Australia and Mexico (1955).
Land race selections from KFS plantation and PT's 1950, 2004-2020

Breeding strategies

Recurrent mass selection of CPTs
- ✓ 74 CPTs in 1950 from local land races
- ✓ 390 CPTs between 2004-2019 from KFS plantations in RV
- ✓ 125 CPTs in 2020 from Londiani, Nyeri and Meru

Progeny trials tests (PTs)
- ➢ F1 PT trial RV in 1950 from 74 CPTs
- ➢ 3 F1 PTs in Kamara in 2006, 2008 and 2013

Seed orchard (SO) establishment
- ➢ 2 F1 clonal SO established in 1968&1969 in Muguga
- ➢ 10 clonal SO established in RV and Muguga between 2004-2019

Vegetative Propagation

Flowering seed orchard

Way forward
- ➢ F2 Progeny trial establishment in 2021
- ➢ Establishment of 3 clonal seed orchards in 2022
- ➢ Conduct genetic diversity studies
- ➢ New infusions from East Africa and New Zealand
- ➢ Monitor the genetic gains/ improvement

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HIGH QUALITY TREE SEED: PRODUCTION AND OPPORTUNITIES

Introduction

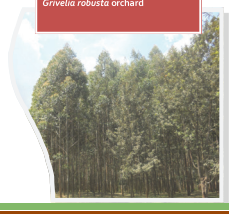
- KEFRI is mandated to produce and distribute high quality tree seeds used in establishment of plantations and in reforestation programs
- This mandate is executed through;
  1. Identification, selection, establishment and registration of suitable seed sources from superior germplasm.
  2. Collection, processing and distribution of high quality seeds.

Seed Testing for Quality Assurance

Distribution of High Quality seeds

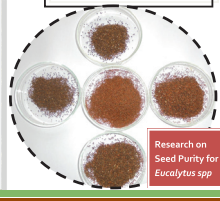
Establishment of High quality seed sources for

Grivelia robusta orchard



Seed research for improved seed quality

Improved national forest cover



Research on Seed Purity for *Eucalytus spp*

Minimum acceptable seed quality standards for commercial tree species

Species	Purity %	MC %	Germination %	Expected seedlings per kg
Casuarina equisetifolia	90	8	40	270,000
Cupressus lusitanica	95	8	65	138,000
Eucalyptus camaldulensis	90	8	75	400,000
Eucalyptus grandis	90	8	75	400,000
Eucalyptus saligna	90	8	75	400,000
Eucalyptus urophyla	90	8	75	400,000
Grevillea robusta	90	8	75	50,000
Pinus patula	98	9	75	100,000
Vitex keniensis	99	8	50	1,000

Opportunities in High quality Seed Production

- Entrepreneurship
  1. Privatization of on-farm seed production
  2. Production of high quality seedlings.
  3. Increased tree productivity
  4. Increased incomes

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TREE NURSERY ESTABLISHMENT AND MANAGEMENT FOR PRODUCTION OF QUALITY TREE SEEDLINGS

Introduction

Eucalyptus Woodlots for Transmission Poles

- Eucalyptus tree is the most popular and most preferred species by farmers for commercial forestry because of its fast growth, good stem form, coppicing ability, reasonable durable wood, tolerance to water logging, multipurpose use and ready markets for its products
- The above characteristics presents an excellent opportunity for tree growers with enough land thinking of an investment that can give good returns after 8-12 years
- Eucalyptus should not be planted on riparian reserves, hard pans, wetlands, and marshy areas, along rivers, areas around ponds, swamps, estuaries and other bodies

Recommended Eucalyptus Species for Transmission Poles

- *Eucalyptus grandis, Eucalyptus Saligna,* Eucalyptus Clones

The best planting areas are western Kenya, rift valley and Central highlands
Altitude range of 1800 m and 2700 m
Mean annual Rainfall of 750 mm to 1800 mm per year.

Eucalyptus woodlot planted for transmission poles

Eucalyptus of fuelwood harvested ready

Cost Benefit Analysis for Establishment of 1 ha of eucalyptus grandis for transmission poles (12 years)/ Fuelwood (32 years)

Details	Value (KES)	Value (KES)
	Eucalyptus (Transmission poles)	Eucalyptus (Fuelwood)
Initial investment at year 1	(131,207)	(139,150)
Other costs from year 2-12/ 2-32	(166,100)	(283000)
Revenue from sale of poles at 8 years	3,000,000	800000
Revenue from sale of fuelwood at year 16		800000
Revenue from sale of fuelwood at year 24		800000
Revenue from sale of fuelwood at year 32		800000
Revenue from sale of extra overgrown poles between years 9-12	388,500	
Total Revenue	**3,388,500**	**3,200,000**
Net revenue	**3,091,193**	**2,777,850**
Net present value	**1,143,517**	**346,158**
Internal rate of return	**55.21%**	**28.14%**

Conclusion: It is more profitable to grow eucalyptus for transmission poles with a net present value of KES 1,143,517 in comparison to growing eucalyptus for fuelwood

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MAJOR INSECT PESTS OF COMMERCIAL TREE SPECIES IN KENYA

Introduction

- Insect-pests affect tree physiology through sap sucking, stem boring, formation of galls and debarking
- Most insect-pests are exotic and invasive .

Eucalyptus pests

- Eucalyptus snout beetle *(Gonipterus scutellatus)*- feeds on leaves
- Winter bronze bug (*Thaumastocoris peregrinus)* a sap sucker
- Eucalyptus chalcid (BGC)(*Leptocybe invasa*) a sap sucker. Causes galls on trees
- Red gum lerp Psyllid (RGLP) (*Glycaspis brimblecombei*) a sap sucker. Produces sooty moulds on leaves

Cypress: Cypress aphid(*Cinara cupressivora*)

Pine : Pine woolly aphid (*Pineus boerneri*)

Grevillea: Termites, Shot hole borer

BGC, damage & parasitoid

RGLP, damage & parasitoid

Bronze bug,damage & parasitoid

ESB, damage & parasitoid

Cypress aphids, parasitoid

Pine wooly **aphid, parasitoid**

Termite attack, termiticide

Shot hole borer, damage

Impact

- Stunted growth in trees
- Reduced quality in products leading to 30% loss in income and 15% on management interventions.
- In mid 90's, Cypress aphid outbreak led to loss of tress.
- Currently, Eucalyptus invasive pests are causing severe losses

Management of major insect pests of Eucalyptus

Use of Classical Biological Control

- Red gum lerp Psyllid (RGLP)- *(CBC) Psyllaephagus bliteus enemies*
  - Winter bronze bug- Biocontrol agent, *Cleruchoides noackae*
  - Eucalyptus snout beetle (ESB)- An egg parasitoid, *Anaphes*

Management of major insect pests of Cypress

- Cypress aphid-Biological control agent-*Pauesia juniperolum*
- Growing of resistant species.

Management of major insect pests of pine

•Pine woolly aphid- Parasitoid,
Biological control- *Tetraphleps raoi*

Management of major insect pests of Grevillea

Shot hole borer (*Apate indistincta*)-

- Cultural method such as pruning
- Mechanical by inserting wires into the holes

Termites

- Chemical– Use of termiticides

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Tissue culture of *Melia volkensii*

Why Melia tissue culture

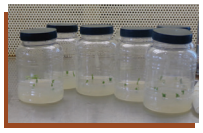
1. Faster access to adequate high quality improved germplasm
   - Multiplication factor x8 to x10
2. Cheaper cost of seedlings
   - Mass production/Economies of scale
3. Clonal plantations
   - Uniformity/Less variation
   - Mechanization
4. Clean, disease-free germplasm

Stages in Melia tissue culture

1. Explant source / Clonal bank establishment

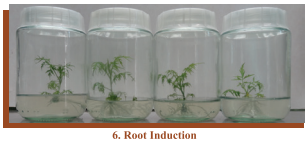
2. Media Preparation

3. Explants Harvesting



4. Shoots Initiation

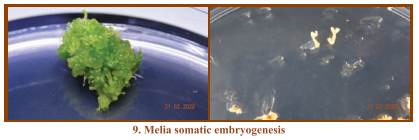
5. Shoots Multiplication



6. Root Induction

7. Hardening

8. Seedling Acclimatization (nursery phase)



9. Melia somatic embryogenesis

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TREE NURSERY ESTABLISHMENT AND MANAGEMENT FOR PRODUCTION OF QUALITY TREE SEEDLINGS

Introduction

Tree nursery is a place where healthy and vigorous tree seedlings are raised before out planting in the field. It is a cornerstone for forestry.

Successful commercial forestry requires the use of planting material that meet appropriate genetic, morphological and physiological quality standards

KEFRI offers training on tree nursery establishment and management to individual farmers and other stakeholders both at the institute and onsite.

Selection of a nursery site

- Easily accessible
- Secure
- Salty free regular water supply
- Gentle sloping and well drained area
- Free from frost and flooding
- Market for the seedlings
- Skilled labour force
- Facilities and amenities

Operations for proper nursery management

- Watering
- Pot filling
- Seed sowing
- Pricking out
- Weeding
- Sorting and grading
- Shading
- Root pruning

Alternative potting materials

Unigrow trays

Root trainers

Wooden boxes

Non-woven bags

Ellepot growbag

Tumbler

Nursery facilities : Seedbeds and nursery beds, office/store, greenhouse , perimeter fence, working shade, latrines, water storage and piping

Tools: Rakes, jembe, shovel, panga, pruning knives, soil sieves, wheelbarrow, watering cans and pipes, dibler, shade nets

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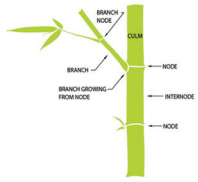
RESEARCH ON BAMBOO PROPAGATION

Introduction

- Bamboo is a group of perennial species belonging to grass family Poaceae, subfamily Bambusoideae. It is an enduring natural resource that is beneficial to over 2.2 billion people worldwide
- It is among the fastest growing woody plants in the world and has become popular due to its multipurpose use.
- Most of bamboo resources in Kenya comprise one indigenous species, *Oldeania alpina* commonly known as highland bamboo. Introduced species include being widely grown in the country are; *Bambusa tulda, Bambusa Vulgaris, Dentrocalamus gigantis,* and *Dentrocalamus asper.*



Bamboo anatomy


Seed propagation technique


Offset/rhizome


Incubation technique

Bamboo propagation techniques

The availability of the planting materials is a crucial aspect of bamboo cultivation. The plantings may come in form of;

1.) seeds

2.) wildlings

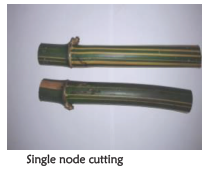
3.) offsets/rhizomes

4.)culm cuttings (Single and double node)

5.) macro proliferation

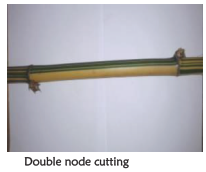
6.) tissue cultured plantlets

KEFRI continuously undertakes research for development of appropriate propagation techniques for mass production of each bamboo species


Single node cutting


Seedlings raised from seed


Culm cutting technique


Double node cutting


Mature bamboo culm

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Investment Opportunities in Commercial Forestry in Kenya

Cost Benefit Analysis for a commercial woodlot establishment for Eucalyptus production (Transmission poles and


Eucalyptus woodlot planted for transmission poles


Eucalyptus fuelwood harvested ready for use in KTDA factories

Eucalyptus Woodlots for Transmission Poles

Description

Eucalyptus tree is the most popular and most preferred species by farmers for commercial forestry because of its ***fast growth, good stem form, coppicing ability, reasonable durable wood, tolerance to water logging, multipurpose use and ready markets for its products***

The above characteristics presents an excellent opportunity for tree growers with enough land thinking of an investment that can give good returns after 8-12 years

Recommended Eucalyptus Species for Transmission Poles

Eucalyptus grandis, Eucalyptus Saligna, Eucalyptus Clones

The best planting areas are western Kenya, rift valley and Central highlands

Note: Eucalyptus should not be planted on riparian reserves, hard pans, wetlands, and marshy areas, along rivers, areas around ponds, swamps, estuaries and other bodies of standing water and areas with less than 400mm rainfall

Cost Benefit Analysis for Establishment of 1 ha of eucalyptus grandis for transmission poles (12 years)/ Fuelwood (32 years)

Details	Value (KES)	Value (KES)
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Total Revenue	**3,388,500**	**3,200,000**
Net revenue	**3,091,193**	**2,777,850**
Net present value	**1,143,517**	**346,158**
Internal rate of return	**55.21%**	**28.14%**

Item/ Activity	Unit	Qty	Unit Price (KES)	Total Amount (KES)	Qty	Unit Price (KES)	Total Amount (KES)
		Eucalyptus (Transmission Poles)			Eucalyptus (Fuelwood)		
Cost of tree Seedlings	No	1,111	10	11,110	1,600	10	16,000
Cost of Transportation of tree Seedlings	No	1,111	3	3,333	1,600	3	4,800
Land Clearing	Man days	13	250	3,250	13	250	3,250
Staking	Man days	18	250	4,500	18	250	4,500
Ploughing/ Ha	Ha	1	7,410	7,410	1	7,410	7,410
Pitting	Man days	10	250	2,500	10	250	2,500
Planting	Man days	22	250	5,500	22	250	5,500
Beating up seedlings + Transport	No	278	13	3,614	400	13	5,200
Beating up labour	Man days	5	250	1,250	5	250	1,250
DAP fertilizer	Kgs	128	80	10,240	128	80	10,240
Manure	Tonnes	8	2,000	16,000	8	2,000	16,000
Termiticides	Litres	1	2,000	2,000	1	2,000	2,000
Weeding	Man days	22	250	5,500	22	250	5,500
Fencing cost	No	1	50,000	50,000	1	50,000	50,000
Maintenance/security costs per ha/ Year	Years	12	5,000	60,000	32	5,000	160,000
Harvesting costs (1st harvesting, yr 8)	m3				320	100	32,000
Harvesting costs (Coppice 1, Yr 16)	m3				320	100	32,000
Harvesting costs (Coppice 2, Yr 24)	m3				320	100	32,000
Harvesting costs	No	1,111	100	111,100			
					320	100	32,000
Total cost (KES)				297,307			422,150

Conclusion: It is more profitable to grow eucalyptus for transmission poles with a net present value of KES 1,143,517 in comparison to growing eucalyptus for fuelwood with an NPV of 346,158.

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DISEASES OF MAJOR ECONOMIC IMPORTANCE FOR KEY PLANTATION/COMMERCIAL SPECIES IN KENYA

Introduction

- Tree diseases research in Kenya dates back to 1939 and focused on softwood plantations
- Common disease symptoms are dieback, cankers, and gum production, stem and root rots leading to stunted growth and gradual tree death

Eucalyptus

- Botryosphaeria canker causing stem rot, twig and shoot dieback

Cypress

- Cypress canker causing stem rot, twig and shoot dieback and tree death

Pines

- Dothistroma blight and Diplodia dieback diseases affecting the pine needles

Grevillea

- Canker affecting stems and branches

Casuarina

- Casuarina wilt causes cracking of the bark

Common disease

- Armillaria root rot

It causes rot on the roots leading to death.

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A) Mycosphaerella Leaf Diseases and B) Stem Canker on Eucalyptus

C) Armillaria root rot and D) Stem canker on Cypress

E) Dothistroma blight of Pines F) Diplodia dieback

G) Grevillea canker and H) Casuarina wilt disease

Impact of diseases

- Loss of yield (lead to 40% loss of revenue)
- Reduced quality of wood products
- Death of trees.,it is estimated that diseases lead to 30% tree loss annually

Disease prevention:

- Use clean and certified seed for seedling production.
- Maintain Optimum spacing and limit shading diseases.
- Ensure proper species site matching

Management of Eucalypts diseases

- For canker and dieback remove affected plant parts and burn
- Plant disease resistant germplasm
- Sterilize tools used when pruning and thinning with copper based fungicides

Management of Cypress diseases

- Remove affected plant parts and burn

Armillaria root rot : Remove affected trees and burn

Management of Pine diseases

- Plant resistant tree species.
- Proper species-site matching to reduce plant stress that attracts disease

Management of Grevillea diseases

- Remove the affected parts or trees and burn
- Plant resistant cultivars and clean seed
- Timely silvicultural management

Management of Casuarina wilt disease

- Selection and planting of resistant trees
- Introduction of resistant germplasm

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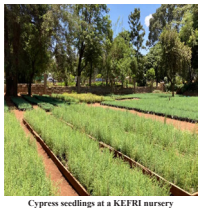
THE KENYA COMMERCIAL FORESTRY INVESTMENT CONFERENCE AND EXPO 2021

Theme: Commercial Forestry Investment for Wealth Creation, Boosting Manufacturing, Food security, Health, and attainment of 10% tree cover in Kenya

Investment Opportunities in Commercial Forestry in Kenya

Cost Benefit Analysis for a commercial woodlot establishment for sawn timber production

Mature cypress plantation in Kericho County, Kenya



Cypress seedlings at a KEFRI nursery

CYPRESS PRODUCTION

Description

It is an evergreen tree which grows to a height of approximately 40 M and 70 CMS in diameter

Benefits of the tree

- Timber: Easy to saw and has straight fine grain,
- Produces building poles
- Produces pulp
- Branches used as firewood
- Used for live fence
- Good for shade/ shelter
- May serve as ornamental trees

Cost for establishing 1 Ha (2.46 acres) of Cypress for sawn timber for 1 rotation cycle (28 Years)

Item / Activity	Unit	Qty	Unit Price (Ksh)	Total Amount (Ksh)
Cost of tree Seedlings	No.	1,600	10	16,000
Cost of Transportation of tree Seedlings	No.	1,600	3	4,800
Land Clearing	Man days	13	250	3,250
Staking	Man days	18	250	4,500
Ploughing	Ha	1	6,175	6,175
Pitting	Man days	10	250	2,500
Planting	Man days	22	250	5,500
Boating up seedlings + Transport	No.	400	13	5,200
Boating up labour	Man days	5	250	1,250
Manure	Tonnes	8	2,000	16,000
Termiticides	Litres	1	2,000	2,000
Weeding	Man days	22	250	5,500
Maintenance/security costs per ha/ Year	Years	28	5,000	140,000
Thinning 1 (Year 7)	No.	712	20	14,240
Thinning 2 (Year 12)	No.	355	20	7,100
Thinning 3 (year 17)	No.	178	20	3,560
Thinning 4 (year 22)	No.	89	20	1,780
Cost of final harvesting	No.	266	200	53,200
Total Cost (KES)				**292,555**

Cost Benefit Analysis for establishing 1 Ha (2.46 acres) of Cypress for sawn timber for 1 rotation cycle (28 Years)

Details	Value (KES)
Initial investment at year 1	(77,675)
Other costs from year 2-28	(214,880)
Revenue from Thinning 1 in year 7	1,744,400
Revenue from Thinning 2 in year 12	1,491,000
Revenue from Thinning 3 in year 17	1,050,200
Revenue from Thinning 4 in year 22	685,300
Revenue from final harvesting in year 28	2,660,860
Total Revenue	7,630,900
Net revenue	7,338,345
Net Present Value @ 12% interest rate	1,376,776
Internal rate of return	67.1%

Key details & Assumptions

CYPRESS PRODUCTION
• Rotation age is 28 years
• Spacing of 2.5 m x2.5m
• Temperatures: 10 to 28 deg Cel
• Annual rainfall: 800 – 1500 mm
• Altitude: 1000 – 4000 M a.s.l
• The survival rate for the planted seedlings is 75% (Seedling losses is 400)
• Task rates per Munday Ksh 250 per Munday,
• Final crop density is 1,600 stems/ha,
• 1st thinning is sold KES 2,450 per tree at year 7
• 2nd thinning is sold KES 4,200 per tree at year 12
• 3rd thinning is sold KES 5,900 per tree at year 17
• 4th thinning is sold at KES 7,700 per tree at year 22
• Final clear-felled trees sold at KES 10, 000 per tree at year 28
• Final crop is 266 Trees
• Cost of final harvesting is 200/- per stem
• Cost of thinning per stem is 20/=
• General yearly maintenance cost involves spot weeding, slashing, Vermin and pest control, Security/tree guarding/fire protection and general tree growth observation

Conclusion:

Both cypress and Pine production had positive net present values implying that they were both profitable ventures. Cypress production was however more profitable with an NPV of KES 1,376,776 as compared to pine at 631,003. There exists high demand for cypress in the country because of its attributes making it easy to work with in the construction and furniture making industry leading to ready market and high prices

For More Information, Contact: The Director, P.O. Box: 20412, 00200 Nairobi, **Tel:** +254 (0)724259781/2 or +254 722157144, **Email:** director@kefri.org

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

APPENDIX II

17.2 ORGANISING COMMITTEE

17.2.1 Partners

No.	NAME	ORGANISATION
1.	Anthony Ngugi	Gatsby Africa
2.	Benjamin Barwa	KCIC
3.	Bilhah Inyanya	Family Bank
4.	Jonathan Kioko	WE-EFFECT
5.	Chanda Ginsberg	UNDP
6.	Charity Njenga	Family Bank
7.	Eric Magu	KCIC
8.	Ernest Chitechi	KCIC
9.	Samwel Osee	COMPLY
10.	Sammy Chege	KAKUZI
11.	Esther Mutuma	KOMAZA
12.	James Mwai	Gatsby Africa
13.	Joseph Njigoya	KFS
14.	Julius Coredo	UNDP
15.	Jan Vandebeele	Better Golobe Forestry
16.	Katsuro Saito	JICA
17.	Joan Kariuki	JICA
18.	John Ngugi	JICA
19.	Faith Ngige	KEPSA
20.	KCB	KCB Foundation
21.	George Oselu	KTDA

NO.	NAME	ORGANISATION
22.	Kennedy Berenju	KCIC
23.	Kennedy Ouma	KCIC
24.	Kent Njuru	Gatsby Africa
25.	Lilian Magak	Gatsby Africa
26.	Lydia Theuri	KCIC
27.	Maina Gakuru	WE-EFFECT
28.	Mercy Njane	FSK
29.	Micah Muema	Base Titanium
30.	Nancy Njau	Family Bank
31.	Noor Hussein	KFS
32.	Oscar Mukolwe	Gatsby Africa
33.	Philip Kisoyan	FAO
34.	Wesley Rotich	Cooperative Bank
35.	Solomon Irungu	KCIC
36.	Tomo Kumahiri	KOMAZA
37.	Valentina Bowyer	Base Titanium
38.	Victor Ndiege	KCIC
39.	Vincent Ogaya	KCIC
40.	Yuki Honjo	JICA
41.	Zipporah Cherotich	KFS
42.	George Onyango	We Effect

17.2.2 KEFRI Organising Committee

NO.	NAME
1.	Dr. Joshua Cheboiwo
2.	Dr. Jane Njuguna
3.	Dr. Joram Kagombe
4.	Dr. Musingo Mbuvi
5.	Dr. James Kimondo
6.	Dr. Vincent Oeba
7.	Dr. Eston Mutitu
8.	Paul Tuwei
9.	Fredrick Ochieng
10.	Norah Koima
11.	Dr. Anthony Macharia
12.	Jonah Kiprop
13.	Abdalla Kisiwa
14.	Priscilla Kimani
15.	Emily Njagi
16.	Joyce Ojino

NO.	NAME
17.	Joseph Machua
18.	Charles Koech
19.	Isaac Odhiambo
20.	Godfrey Maripet
21.	Gilbert Busolo
22.	Roseline Magero
23.	Esther Manyeki
24.	Henry Kosgei
25.	Ann Wairimu
26.	Jacinta Nyamai
27.	Joyce Chege
28.	John Mutua
29.	Getrude Kimutai
30.	Abigael Kiprop
31.	Valarie Irungu
32.	Elizabeth Waiganjo

17.3 Invited guests

NO.	NAME	ORGANISATION
1.	Hon. Keriako Tobiko, EGH, CS	Cabinet Secretary, MoEF
2.	Hon. Chris Kiptoo, CBS	Permanent Secretary,MoEF
3.	HE. Caroline Vicini	Ambassador of Sweden
4.	Ms. Claudia Milena Vaca	Deputy Embassy of Colombia
5.	H.E. Giovanna Valverde Stark	Ambassador of Costa Rica
6.	HE. Carla Mucavi	FAO Resident Representative
7.	Mr. Julius Kamau, EBS	Chief Conservator of Forests, KFS
8.	Dr. Samwel Kareithi	CEO-Gatsby Africa
9.	Mr. Alfred Gichu	Conservation Secretary
10.	Dr. Harun Warui	UNDP
11.	Ruth Ndegwa	Director Corporate Service, KCIC
12.	Rebecca Mbithi	CEO, Family Bank Foundation
13.	Dr. Edward Mungai	CEO, KCIC
14.	Mr. Sammy Toniok	CEO, NETFUND
15.	Jack Steege	Programme Manager- Gatsby Africa
16.	Benjamin Wamugunda	Chairperson - FSK
17.	Krunal Negandhi	Jans Bamboo
18.	Harjt Singh	Brunel University London
19.	Alfred Gichu	MoEF
20.	Silvano Nano	Cooperative Bank
21.	Dr. Sammy Letema	Chairman, KEFRI
22.	Dr. Joshua Cheboiwo	Director, KEFRI
23.	Dr. Jane Njuguna	SDD-R&D, KEFRI

17.4 Participants

NO.	NAME	ORGANIZATION
1	Abdalla Kisiwa	KEFRI
2	Abdi Somo	ENNDA
3	Abdikadir Aden, HSC	UNDP
4	Abdulaziz Gakuria	Munda Rural Service
5	Abdulwalli Shariff	TUNASCO
6	Adrian Leitoro	UNDP
7	Alex Njenje	INBAR
8	Alexandar Kituku	KCIC
9	Allan Wafula	KEFRI
10	Aloice Romans	KCIC
11	Ambachew Admassie	EBF
12	Amondi T. Ochieng	Gatsby Africa
13	Andrew Ndiema	K24
14	Anita Soina	UNDP
18	Ann Wanja	KEFRI-Karura
19	Ann Njeri	KCIC
20	Anna Wamache	Gatsby Africa
21	Anne O. Tek	Gatsby Africa
22	Anne Wageni	Kingdom
23	Anthony Aluvale	Gatsby Africa
24	Anthony Gatura	Cube Inc Limited
25	Anthony Ngugi	Gatsby Africa
26	Anthony Nyambegera	KFC
27	Anthony Rume	Science Africa
28	Antony Mutua Kioko	KCIC
29	Bartimore Kasuu	NMG
30	Beatrice Sabaye	KEFRI

NO.	NAME	ORGANIZATION
31	Beatrice Atemo	MEF
32	Benard Ochieng	KCIC
33	Benard Wesanga	Nyandarua Farmer
34	Benard Irukan	KEFRI
35	Benard Kamondo	KEFRI
36	Benjamin Karanja	FAO
37	Benjamin Wamugunda	FSK
38	Benjamini Barwa	KCIC
39	Benson Ogundu	KEFRI
40	Beryl Otieno	KEFRI
41	Beth Ruga	Kingdom Bank
42	Betty P. Njoki	KEFRI
43	Betty Cherop	KONZA
44	Bilha Kwamboka	KEFRI
45	Bilhah Inyanya	Family Bank
46	Binott Martin	FFSPAK
47	Boaz Kiboi	FAO
48	Bonface Wagombe	Family Bank
49	Bonface Kaberia	KCIC
50	Boniface Mwaura	Private
51	Brenda Mulunga	KCIC
52	Brenda Mwei	KCIC
53	Bryam Bondi	WE-EFFECT
54	Carla Mucavi	FAO
55	Carol Maganga	KEFRI
56	Caroline Kariuki	Greenpot Enterprises
57	Celestine Musavi	UNDP
58	Charity Njenga	Family Bank

NO.	NAME	ORGANIZATION
59	Charles Kimani	Gatsby Africa
60	Charles Koech	KEFRI
61	Charles Muti	Muti Investments support services
62	Charles Ngunjiri	KFS
63	Charles Wambua	Magnifique Consult
64	Chemuku Wekesa	KEFRI
65	Chesang Korir	KEFRI
66	Christian Benard	Science Africa
67	Christine Mwangi	KCIC
68	Collins Barmwato	KCIC
69	Collins Ochieng	KCIC
70	Cynthia Mukhiyi	KCIC
71	Cynthia Adie	Fruity Schools Africa
72	Dan Kimaili	KCIC
73	David Langat	KEFRI
74	David Mwangi	FAO
75	Dennis Otieno	KCIC
76	Dickens Mwanga	Bamboosa Green Living
77	Dickens Mwanga	Bamboosa Green Living
78	Doreen Karimi	KCIC
79	Dorothy Ochieng	KEFRI
80	Dr. Benjamin Kinyile	KFS
81	Dr. Eston Mutitu	KEFRI
82	Dr. George Muthike	KEFRI
83	Dr. Harsit Singh	Brunel University London Uk
84	Dr. James Kimondo	KEFRI
85	Dr. James Ndufa	KEFRI

NO.	NAME	ORGANIZATION
86	Dr. Joram Kagombe	KEFRI
87	Dr. Joseph Githiomi	KEFRI
88	Dr. Kiyalo	KEFRI
89	Dr. Magrate Kaigongi	KEFRI
90	Dr. Robert Nyambati	KEFRI
91	Dr. Vincent Oeba	KEFRI
92	Dr. Caroline Mulinya	Kaimosi University
93	Duncan Mutwiri	KNA
94	Eddah Mwihaki	Individual
95	Edna Kimenju	KCIC
96	Edward Kanguru	Gatsby Africa
97	Edward Onsongo	Gatsby Africa
98	Edwin Karioki	KFS
99	Edwin Komen	Family Bank
100	Ela Njiru	Cooperative Bank
101	Elijah Mboko	FAO KE
102	Elizabeth Nyamache	KEFRI
103	Elizabeth Akinyi	AFC
104	Elizabeth Njoki	KEFRI
105	Elizabeth Waiganjo	KEFRI
106	Elizabeth Wambui	CFA
107	Ella Kinyua	Cooperative Bank
108	Elly Wanjala	UNDP
109	Elyas Hassan	KEFRI
110	Emily Kitheka	KEFRI
111	Emily Le Cornu	AECOM
112	Emily Moraa	UNDP
113	Emily Yobterik	KEFRI

NO.	NAME	ORGANIZATION
114	Emmanuel Makatiani	KEFRI
115	Emmanuel Oduor	KEFRI
116	Emmanuel Sangalali	GA Tanzania
117	Eric Ronss	FAO
118	Ernest Chitechi	KCIC
119	Esa Haapasalo	NIRAS
120	Esther Munio	KEFRI Attachee
121	Esther Mutuma	KOMAZA
122	Eunice Mukami	AFC
123	Evans Akumu	Farmer
124	Evelyne Wanjoki	Enso Impact
125	Faith Atieno	Science Africa
126	Fatuma Fadhili	UNDP
127	Flora Awino	Bamboosa greenliving
128	Florence Cherono	KEFRI
129	Fred Yaubo	Gatsby Africa
130	Frederick Tabo	Gatsby Africa
131	Fredrick Kamau	KCIC
132	Frida Mwaniki	Individual
133	Genji Shin	JICA
134	Geodfrey Ali	Alogo Enterprises
135	Geoffrey Wanyama	FFSPAK
136	George Oponet	KEFRI
137	George Kamau	BMS
138	George Kombe	UNDP
139	George Otieno	KEFRI
140	George Tarus	KFS
141	Getrude Kimutai	KEFRI

NO.	NAME	ORGANIZATION
142	Gichuru Muhani	UCIL
143	Gichuru Muchane	KCIC
144	Gilbert Busolo	KEFRI
145	Goldin Ochieng	Mediatec
146	Gordon Sigu	KEFRI Maseno
147	Grace Gitonga	Enso impact
148	Hamisi Omar Mwachome	UOE
149	Harrisson Kamau	Farm and Forest Facility
150	Hassan Ibrahim	Coast Development Authority
151	Hellen Maina	KCIC
152	Henry M. Komu	KEFRI
153	Hillary Muriuki	KFS
154	Hudson Anzane	Biashara Master
155	Ichangai Waweru	KCIC
156	Imende Joyce	NEMA
157	Isaac Owiri	KCIC
158	Isabellah Wanjiru	ENSO IMPACT
159	Ivy Wanjiku	KEFRI
160	J. Laigong	UOE/Gatsby africa/KFS
161	Jack Steege	GATSBY
162	Jackline Kidaha	KNA
163	Jackline Namadi	Evergreen
164	Jackson Mulatya	KEFRI
165	Jacob Cheptaiwa	KEPHIS
166	Jacqueline Ngure	KFS
167	James K. Nyingi	KEFRI
168	James Kimwemwe	KEFRI-KARURA

NO.	NAME	ORGANIZATION
169	James Mburu	KCIC
170	James Maua	KEFRI
171	James Mwai	Gatsby Africa
172	James Opuya	KCIC
173	Jan Vandanabeele	Better Globe Forestry
174	Jane Njuguna	Kingdom
175	Janet Chelangat	KEFRI
176	Janet Yiamai	Gatsby Africa
177	Jason Kariuki	KEFRI
178	Jimmy Mason	KEFRI
179	Joan Kariuki	JICA
180	Joash Onyango	KFS
181	Joeph Kibugi	SCOFOA
182	John Kimani	KCIC
183	John Maclaria	LAPSET
184	John Njeru	Base Titanium Ltd
185	John Otuoma	KEFRI
186	John Wambugu	PLANTECH
187	John Kabue	Techdirect
188	John Ngugi	JICA
189	John Waimiri	Family Bank
190	John Wambugu	Plantech
191	John Wangai	UNDP
192	Jonah Kiprop	KEFRI
193	Jonathan Kituku	FARMER
194	Jonathan Musyoka	KFS
195	Jonstone Maloba Malingu	KFC
196	Joram Mbinga	KEFRI
197	Joseph Mwakima	UNDP
198	Joseph Njenga	FOW
199	Joseph Machua	KEFRI
200	Zipporah Toroitich	KFS
201	Zwigy Malesi	Bamboosa Greenliving
202	Veronicah Njeri	CFA
203	Joseph Ndwiga	Gatsby Africa
204	Joseph Obuor	Marubeni
205	Josephine Wanjiku	KEFRI
206	Joshua Ochieng	UNIVERSITY OF ELDORET
207	Joshua Maluli	KEPHIS
208	Joy Wanjiru	Fruity Schools Africa
209	Joyce Ojino	KEFRI
210	Joyce Chege	KEFRI
211	Joyce Okumu	KEFRI-TURBO
212	Julius Coredo	UNDP
213	Justine K Chepkony	KCIC
214	Kamau Mercy	KEFRI
215	Katsu Yanaphdi	Marubeni
216	Katsuhito Yamaguchi	Marubeni
217	Kelvin Kimanthi	KCIC
218	Kelvin Mukaria	AFC
219	Kennedy Odoyo	Fruity Schools Africa
220	Kevin Kiptoo	Gatsby Africa
221	Kibet K Nelson	Gatsby Africa
222	Kinyua Mugambi	AFC
223	Krunal Negandhi	JANS
224	Kwtsima Ambaka	FAO
225	Lal Abdullahi Abdi	Horn Afrik Gums

NO.	NAME	ORGANIZATION
226	Lenaiyem leparakwo	KEFRI
227	Leonida Cherotich	KEFRI
228	Leshan Waithira	KCIC
229	Lewis Kirimi	INBAR
230	Lilian Magak	Gatsby Africa
231	Linus Mwangi	KEFRI
232	Linus Wekesa	KEFRI
233	Louis Kiuma	KFS
234	Lucy Kioko	Gatsby Africa
235	Lucy Mbora	KEFRI
236	Lucy Njeri	Enso Impact
237	Lucy Wairimu	C.F.A
238	Ludvine Achieng	KCIC
239	Lydia Theuri	KCIC
240	Lydia Theuri	KCIC
241	Magdalene Kaitei	ENSDA
242	Malesi Mwanga	Bamboosa Green Living
243	Mapesa Elvis	Gatsby Africa
244	Margaret Kinyanjui	KCIC
245	Maria wachira	Bamboosa Green Living
246	Mark Mwengei	KEFRI
247	Martin Muchoki	KEN CPA LTD
248	Mary Miingi	KEFRI
249	Mary Waweru	KEFRI
250	Mathews Mauya	KEFRI
251	Mathews Oyior	KEFRI
252	Maureen Mwanu	KCIC
253	Mercy Gichora	KEFRI
254	Mercy Njane	FSK
255	Mercy Jerotich	KFS
256	Meshack Kiplagat	UNDP-COAD
257	Meshack Muga	FAO
258	Metu Mitei	KEFRI
259	Mgeni Nassoro	UNDP
260	Micah Muriithi	ESCA
261	Micah Muema	Base Titanium
262	Michael Kimondo	KEFRI
263	Michael Breetzke	SWIFT
264	Michael Mukolwe	KEFRI
265	Mike Howard	Fractal Forest Africa
266	Minzui Gathogo	KEFRI
267	Mirriam Wainanina	KEFRI
268	Mitsonori Mori	MARUBENI
269	Mohamed Elema	KEFRI
270	Monica Wambui	KEFRI
271	Monica Makenzi	Base Titanium
272	Moraa Zipporah	KFS
273	Moses Marua	KCB
274	Mr. Ngala Oloitiptip	ENSDA
275	Muriuki Ngari	UNDP
276	Mwaniki Musya	KEFRI
277	Naftali Otieno	KCIC
278	Nancy Bor	KEFRI
279	Ndambiri J.	KFS
280	Ndichu Judy	UNDP
281	Nellie Oduor	KEFRI
282	Newton Adika	KEFRI
283	Newton Mweti	KENA

NO.	NAME	ORGANIZATION
284	Ngao Daniel	KCIC
285	Nicholas Gituhu	Private
286	Nicholus Koigu	KCIC
287	Nick Embden	Gatsby Africa
288	Nickson Sananka	UON/CEBIB
289	Nicole Wangari	KEFRI
290	Norah Khamuye	KCIC
291	Nyasha Mureriwa	Swift Geospatial
292	Okello Patrick	KEFRI
293	Onditi Wycliffe	UNDP
294	Oscar Mukolwe	Gatsby Africa
295	Oseno Vincent	Gatsby Africa
296	Patrick Kwirigia	KEFRI
297	Patrick Mwenje	KEFRI
298	Paul Opanga	FSC
299	Paul Mwangi	KEFRI
300	Paul Okoth Masin	FF-SPAK
301	Paul Tuwei	KEFRI
302	Pauline Nyambura	Gatsby Africa
303	Peris Muthoni	AQUASORD
304	Peris Wanja	Technical
305	Peter K. Kungu	KEFRI
306	Peter Karanja	Gatsby Africa
307	Peter M. Angaine	KEFRI
308	Peter Simiyu	KFS
309	Peter Muiruri	KFS
310	Peter Mwangi	KEFRI
311	Peter Nzambia	Kotda
312	Philip Anagaza	Mianzi Production
313	Philip Kichana	KEFRI
314	Philip Kisoyan	FAO
315	Philipine Jepkosgei	INBAR
316	Pius Kimei	KFS
317	Prabhakar Vanam	KCIC
318	Pricilla Kimani	KEFRI
319	Priscah Wamuyu	Mediatec
320	Proff Balozi Bekula	UOE
321	Quiller Brouhe	Gatsby Africa
322	Rahab Nyambura	KEFRI
323	Rebecca Bor	TARDA
324	Rebecca Nenkai	KEFRI
335	Reuben Shanda	KEFRI
336	Richard Maina	AQUASORD
337	Rotich Wesley	Cooperative Bank
338	Ringa Charles	UoE
339	Red Trevor	ENSO IMPACT
340	Robert Mwachai	KEFRI
341	Robinson Kamba	KCIC
342	Roble Garad Abdow	Horn Afrik Gums
343	Ronald Keter	KCIC
344	Rory Mack	Gatsby Africa
345	Ruth Njuguna	KEFRI
346	Rory Macu	Gatsby Africa
347	Rose Ng'ang'a	KEFRI-Karura
348	Roselyne Magero	KEFRI
349	Rosemary Bargasei	UOE
350	Rosemary Muthoni	Mediatec
351	Ruhi Esther	UoE, Gatsby
352	S. Nouo	Cooperative Bank
353	Samson Tontok	NETFUND

NO.	NAME	ORGANIZATION
354	Samuel Kerianga	UNDP
355	Samuel Kariithi	Rayson Hub Ltd
356	Sandra Sabina	KCIC
357	Sarah Wanjiru	KEFRI
358	Saumu Juma	Science Africa
359	Sausan Mogine	KEFRI
360	Shem Olela	LAPSET
361	Simoh Wakaba	KEFRI
362	Simon Kamonde	Muguga CFA
363	Simon Ngigi	KEFRI
364	Simon Ngundo	KCIC
365	Simon Nyale	KEFRI
366	Simon Wairungu	KEFRI Nyeri
367	Simon Wakaba	KEFRI
368	Solomon Kipkoech	KEFRI
369	Solomon Oketcho	UTGA
370	Solomon Oketch	Uganda Timber Growers Association
371	Sophia M.	KEFRI
372	Stanely Nadir	KEFRI
373	Stephen Barasa	KCIC
374	Stephen Kasyoki	KEFRI
375	Stephen M Ndungu	KEFRI
376	Stephen Chivatsi	KCIC
377	Stephen Kiama	KEFRI
378	Stephen Musyoka	Cooperative Bank
379	Dr. Stephen Omondi	KEFRI
380	Stephen Thiga	Self
381	Sudi A. Bindo	MYCHA
382	Susan W. Karani	KEFRI

NO.	NAME	ORGANIZATION
383	Sylvester Muthama	KCIC
384	Sylvia Mwalewa	KEFR
385	Tabitha Gichiru	KCK
386	Tadashi Shimiza	JICA
387	Teddy Kinyanjui	Seedballs Kenya
388	Teddy Odhiambo Barry	WAZARI ART.C.
389	Teresiah Gituanja	KEFRI
390	Theresa A. Otieno	ANGAZA CBO
391	Thomas kiplagat	KEFRI
392	Tim Njiru	Gatsby Africa
393	Tommaso Menini	AGAR
394	Tonny M. Kiamba	KCIC
395	Tonny Olubayo	KONZA
396	Vaine Akoth	UOE
397	Valerie Irungu	KEFRI
398	Veronicah Njeri	CFA
399	Victor Jaoko	KEFRI
400	Victor Kamau	KEFRI
401	Victor Ndege	KCV
402	Victor Otieno	Strathmore University
403	Vincent Omondi	KCIC
404	Violet Opati	Bamboosa greenliving
405	Wambui Mwangi	KEFRI
406	Wamugunda Geteria	FSK
407	Warsawe Adow	KCIC
408	Wendy Omanga	UNDP
409	William Omondi	KEFRI
410	Willis Atieno	KEFRI Kakamega

LIST OF ORGANISATIONS THAT PARTICIPATED

1	Architecture, Engineering, Consultancy, Operation $ Maintenance (AECOM)
2	Agricultural Finance Company (AFC)
3	Australian Group on Antimicrobial Resistance (AGAR)
4	ALOGO Enterprises
5	ANGAZA Company
6	AQUASORD
7	Bamboosa green living
8	Base Titanium ltd
9	Better Globe Forestry
10	Biashara Master
11	Brunel University London UK
12	Chartered Financial Analyst (C.F.A)
13	Coast Development Authority
14	Cooperative Bank
15	Cube inc limited
16	European Banking Federation (EBF)
17	Environmental Development Action in the Third Word (ENDA)
18	Ewaso Nyiro South Development Authority (ENSDA)
19	El Nino - Southern Oscillation (ENSO)
20	European Secretariat for Cluster Analysis (ESCA)
21	Ecogreen
22	Family Bank
23	Food and Agriculture Organization of the United Nations (FAO)
24	Farm and Forest Facility
25	Farm Forestry Smallholder Producers Association of Kenya (FF-SPAK)
26	Friends of Women Foundation (FOW)
27	Furniture Forest
28	Fruity Schools Africa
29	Forest Stewardship Council (FSC)
30	Forest Society of Kenya (FSK)
31	GA TANZANIA
32	Gatsby Africa
33	Garissa Million Tree
34	GREENPOT ENTERPRISES
35	Horn Afrik Gums
36	International Bamboo and Rattan Organization (INBAR)
37	Imara CBO
38	JANS

39	Japan International Cooperation Agency (JICA)
40	K24 TV
41	Kaimosi University
42	Kenya Commercial Bank (KCB)
43	Kenya Climate Innovation Centre (KCIC)
44	Kurdistant Communities Union (KCK)
45	Kenya Climate Ventures (KCV)
46	Kenya Forestry Research Institute (KEFRI)
47	Kenya Forestry Service (KFS)
48	Kingdom Bank
49	Kenya News Agency (KNA)
50	KOMAZA Company
51	KONZATechnopolis
52	Konza Technopolis Development Authority (KoTDA)
53	LAPSET Corridor Development Authority
54	Magnifique Consult
55	Marubeni Cooperation
56	Mediatec
57	Ministry of Environment and Forestry (MOEF)
58	Mianzi Production

59	MUGUGA Chartered Financial Analyst (CFA)
60	Munda Rural Services
61	Mpambe Organics
62	Muti Investments support services
63	MYCHA Training Programme
64	Mrigra Youth for Change
65	National Environment Management Authority (NEMA)
66	NETFUND
67	NIRAS International Consulting
68	National Media Group (NMG)
69	PLANTECH
70	Rayson Hub Ltd
71	Science Africa
72	South Coast Forest Owers Association (SCOFOA)
73	Seedballs Kenya
74	Strathmore University
75	Swift Geospatial
76	Tana and Athi Rivers Development Authority TARDA
77	Techdirect
78	Technical

79	TUNASCO
80	Uranium Corporatin of India LTD (UCIL)
81	Uganda Timber Growers Association
82	United Nations Development Programme (UNDP)
83	University of Eldoret
84	University of Nairobi
85	Uganda Timber Growers Association (UTGA)
86	WAZARI ART.C.
87	WE – EFFECT
88	Kentucky Fried Chicken Organization (KFC)
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