

## NATIONAL RESEARCH CONFERENCE ON SUSTAINABLE USE OF LAND AND NATURAL RESOURCES



### TO ENHANCE FOOD SECURITY IN KENYA



#### About the National Research Conference

Kenya has a total land area of 57.6 million hectares. Of this about 16% or 9.4 million hectares is classified as high and medium potential land for agriculture (Kosura, 1999). The remaining area estimated at 84% makes up the arid and semi-arid lands (ASALs). Out of the ASALs 48 million hectares, about 9 million hectares can support crop production, 15 million hectares is adequate for livestock production while the rest is dry and only useful for nomadic pastoralism. The ASAL supports about 20% of the population, 50% of livestock and 3% of current agricultural output and 7% of commercial output.

Kenya's agriculture remains heavily dependent on rain-fed agriculture yet only about 20% of the country is classified as having medium to high potential for rain-fed crop production (Bryan, 2013). Irrigation development which could help in increasing cultivable land has been very slow due to the seemingly high cost associated with it (Kosura, 1999). Kenya has a relatively large irrigation potential of 1.3 million hectares but only 105,800 ha have so far been developed (Alila, 2005). The rest has not been developed mainly due to reasons such as inadequate funding, weak regulatory and institutional framework, poor knowledge of agricultural irrigation technologies, weak land tenure systems, lack of credit facilities and inadequate research on irrigated agriculture.

Therefore, for growth to occur in agriculture to ensure food security, increasing output per unit land area will no longer be an option but a necessity.

In this regard, the National Land Commission (NLC) in partnership with the National Research Fund (NRF) has organized a virtual National Research Conference scheduled for 24<sup>th</sup> and 25<sup>th</sup> November 2021. The theme of the virtual conference shall be on "Sustainable Use of Land and Natural Resources to enhance Food Security in Kenya".

One of NLC core mandate is to inter alia conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities among others. NRF on the other hand was

established with the objective of facilitating research for the advancement of science, technology and innovation in Kenya. In doing this, NRF purposed to align its funding of research areas with the governments' Big 4 Agenda i.e., Food and Nutrition security, Affordable housing, Manufacturing and Universal Health care.

The National Land Commission and the National Research Fund in pursuit of their respective mandates have carried out numerous researches on matters touching sustainable use of land and natural resources to enhance food security in Kenya. These researches have been documented and some used to generate policy briefs to advise policy makers. There is however an increasing need for a forum to disseminate findings from the completed researches amongst a wider audience comprising of the stakeholders from the sector, policy makers and academia.

This conference is therefore aimed to collate, synthesize and share knowledge on the sustainable use of land and natural resources and consequently generate policy recommendations to enhance sustainable use of Land and Natural Resources to achieve Food Security in Kenya. The conference shall also assist NLC and NRF to identify research gaps that can be pursued in a joint call for funding. Food Security being one of the Big4 Agenda.

The following are the broad thematic areas that shall be discussed during the conference.

1. Sustainable Use of Land to enhance Food Security in Kenya;
2. Sustainable Food Systems in Kenya;
3. Climate Crisis and Food Security;
4. Sustainable utilization of Land Based Natural Resources;
5. Addressing Land Based Natural Resources Conflicts
6. Innovative Technologies for Sustainable Agricultural Production;
7. Land Governance and Management in the use of Land and Natural Resources; and
8. Youth and Women in the Context of Sustainable Land Use.

## Day I: Wednesday, 24<sup>th</sup> November 2021

9.00 - 10.30am:	Ms. Kabale Tache Arero, Ag. CEO, National Land Commission <b>Welcome Remarks &amp; Introductions</b>
<b>Welcome Remarks:</b>	Ms. Kabale Tache Arero, Ag. CEO, National Land Commission
<b>Remarks by Ag. CEO NRF:</b>	Dr.Jemimah Onsare,
<b>Opening Remarks:</b>	Mr. Gershom Otachi, Chairman, National Land Commission
<b>Opening Remarks:</b>	Ms. Farida Karoney, Cabinet Secretary, Ministry of Land and Physical Planning
<b>Official Opening:</b>	By the Chief Guest - Cabinet Secretary, Prof. George Magoha

### Health Break

10:30 – 11:30 am

#### First Panel Session:

#### Sustainable Use of Land to enhance Food Security in Kenya

<i>Session Chair:</i>	<i>Comm. Hon. Esther Murugi</i>
<i>Rapporteur:</i>	<i>Dr. John Maara</i>
11:30 – 11.50:	Sustainable Use of Land and Food Security: The Nexus Husna Mbarak, Lead Governance of Natural Resource, Land Governance Programme Manager, Gender Focal Point, Food and Agriculture Organization (FAO)
11:50 – 12:10:	National Land Use Policy supporting Food Security in Kenya <i>Mr. Augustine Masinde, National Director, Physical and Land Use Planning,</i>
12:10 – 12:30:	Managing Fragmentation of Agricultural Land for Food and Livelihood Security in Kenya <i>Dr. Frida Mugo, University of Nairobi, Department of Urban and Regional Planning</i>
12:30 – 1:00:	Q & A

### Lunch Break

1.00 – 2.00pm: Lunch Break/Networking/video

**Concurrent Break-Out Session** 2.00pm – 4.00 pm

#### Break-Out Session 1(a):

#### Sustainable Food Systems in Kenya for Food Security

<i>Session Chair:</i>	<i>Dr. Mary Macharia, Deputy Director, Research NLC</i>
<i>Rapporteur:</i>	<i>Clementine Wavinya</i>
2:00 – 2:20:	Sustainable Post-Harvest and Agro-Processing Technologies for Improved Livelihoods Among Rural Communities in Elgeyo Marakwet County, Kenya <i>Prof. Augustino O. Onkware, Deputy Vice-Chancellor, Academic and Student Affairs, at Rongo University, Rongo University</i>

2:20 – 2:40:	Equitable and Inclusive Food Systems <i>Dr. Tito Arunga, Head of Agribusiness at Food and Agriculture Organisation, Food and Agriculture Organization</i>
2:40 – 3:00:	Scaling up sustainable land management to reduce environmental degradation in small-scale agriculture in western Kenya <i>Dr. Kennedy Were, Research Scientist, Kenya Agriculture and Livestock Research Organization (KALRO)</i>
3.00 – 4.00:	Discussions, Q & A

### **Break-Out Session 1(b):**

### **Climate Crisis and Food Security**

<i>Session Chair:</i>	<i>Ben Opa, Deputy Director, Natural Resource Management</i>
<i>Rapporteur:</i>	<i>Robert Koech</i>
2:00 – 2:20:	Land Use Land Cover Changes and Implications to Food Security <i>Dr. Frank Masese, Senior lecturer and head of Department of Fisheries &amp; Aquatic Science, University of Eldoret University of Eldoret</i>
2:20 - 2:40:	Characterization of smallholder farmers and exploring trade-offs and synergies in options for ecologically resilient food security in semi-arid lands of Kenya <i>Prof Reuben M. Muasya, Deputy Vice Chancellor in South Eastern Kenya University, South Eastern University</i>
2:40 - 3:00:	Integrated collaborative research on climate change, water resources and food security in upper Ewaso Ngiro river basin for sustainable management and enhanced ecosystem health <i>Dr. James Kimondo, Deputy Director, Forest Productivity and Improvement, Kenya Forestry Research Institute</i>
3:00 – 3:10:	Averting climate change crisis in Lower Eastern Kenya through weather-based advisories: are the existing policies effective and supportive enough? <i>Dr. Hezron Rasugu Mogaka, Lecturer, University of Embu</i>
3.00 – 4.00:	Discussions, Q & A

### **Break-Out Session 1(c):**

### **Addressing Land Based Natural Resources Conflicts**

<i>Session Chair:</i>	<i>Comm. Gertrude Nguku</i>
<i>Rapporteur:</i>	<i>Edmond Gichuru/Janet Leina</i>
2:00 – 2:20:	Land Use Conflicts from a Regional Perspective <i>Esther Obaikol, Land Governance Expert/Coordinator Land Governance Unit, IGAD</i>
2:20 - 2:40:	Resolution of Historical Land Injustices in Kenya <i>Judge Peter Herbert O.B.E. (retired) Chair of the Bandung Conference</i>
2:40 – 3:00:	Transforming Land based conflicts through ADR <i>Dr. Francis Kariuki, Lecturer, Strathmore University Law School</i>
3.00 – 4.00:	Discussions, Q & A

## Day II: Thursday, 25th November 2021

Opening Remarks -

Abraham Samoei, President, Institution of Surveyors of Kenya

### Second Panel Session:

### Sustainable utilization of Land Based Natural Resources

*Session Chair:*

*Prof. Walter Oyawa, Director General, NACOSTI*

*Rapporteur:*

*Jacob Kamwariah*

9:00 – 9:20:

Enhancing land use planning as a tool for sustainable land based natural resources

*Dr. Herbert Musoga, Director Land Use Planning, National Land Commission*

9.20 – 9:40:

Enhancing Role of Communities to support sustainable utilization of Natural Resources

*Dr. Chris Kiptoo CBS, Principal Secretary, Ministry of Forestry*

9.40 – 10:00:

Establishing Optimal community forest access and management units for enhanced community livelihoods and better forest management

*Dr. Felix Ming'ate, Senior Lecturer, Department of Environmental Studies and Community Development Kenyatta University*

10:00 – 10:10:

Which River catchment pollutes Lake Victoria, Kenya the most? A proof of concept for management implications

*Dr. Christopher Mulanda Aura, Director in charge of Research in Freshwater Systems. Kenya Marine and Fisheries Research Institute (KMFRI), Kisumu Station*

10:00 – 10:30:

Panel Discussions, Q & A

### Health Break

**10:30 – 10:45 am**

### Concurrent Break-Out Sessions:

**10.45 – 1.00 pm**

### Break-Out Session 2 (a):

### Innovative Technologies to Sustainable Land Based Natural Resources

*Session Chair:*

*Comm. Prof. James Tuitoek*

*Rapporteur:*

*Nancy Cheron*

10.45 – 11:05:

Agricultural Transformation Technologies and Innovations

*Prof. Gideon Obare, The Executive Director Tegemeo Institute*

11:05 – 11:25:

Cage farming in Kenya

*Prof. James M. Njiru (PhD), Director General, Secretary Kenya Marine and Fisheries Research Institute.*

11:25 – 11:45:

Geo-mapping riparian zones/lands for catalyzing sustainable development in the designated special economic zones in Kenya

*Dr Charles Lange, Deputy Director, National Environment Management Authority*

11:45 – 11:55:

Planting pits as a Sustainable Land Management Strategy

*Dr. Rebecca Yegon, Soil and Water Specialist, University of Embu*

11:55 – 12:30:

Discussions, Q & A

**Break-Out Session 2(b):****Land Governance and Management in the use of Land and Natural Resources**

<i>Session Chair:</i>	<i>Comm. Reginald Okumu</i>
<i>Rapporteur:</i>	<i>Stellamaris Ogutu</i>
10:45 – 11:05:	Responsive Land Governance to support Sustainable Use of Land and Natural Resources <i>Prof. David Kuria, Director, Geo Information Management, National Land Commission</i>
11:05 - 11:25:	Harnessing Digital Platform to facilitate Sustainable Land Governance in Kenya <i>Mr. Augustine Masinde, Director, Physical and Land Use Planning, Ministry of Lands and Physical Planning</i>
11:25 – 11:45:	The role of Information Communication and Technology (ICTs) in Land and Water Resources Management and Food Security in Kenya: A Case Study of Kericho and Uasin Gishu Districts. <i>Ms. Mainye Marcella M., Registrar Academic &amp; Students' Affairs, The Presbyterian University of East Africa</i>
11:45 – 11:55:	Efficiency and Sustainability of Land – Resource use in Arid and Semi-Arid Lands (ASALs) Dryland Areas of Kenya <i>Dr. Benjamin Mutuku Kinyili, Regional Forest Conservation Area Office (RFCAO), Kenya Forest Service</i>
11.45 – 12.30:	Panel Discussions, Q & A

**Break-Out Session 2(c):****Youth and Women and Sustainable Use Land for Food Security**

<i>Session Chair:</i>	<i>Comm. Tiyah Galgalo</i>
<i>Rapporteur:</i>	<i>Dr. John Maara</i>
10:45 – 11:05:	Youth and Women as agents of sustainable use of land and food security <i>Faith Alubbe, Chief Executive Officer, Kenya Land Alliance</i>
11:05 - 11:25:	Promoting progressive inclusion of youth in Land <i>Mr. Charles T. Sunkuli, CBS Principal Secretary State Department for Youth Affairs</i>
11:25 - 11:45:	Promoting progressive inclusion of women in Land <i>Ms. Jessica Oluoch, Programme Manager, KELIN</i>
11.45 – 12.30:	Panel Discussions, Q & A

**Lunch Break:**

1.00 – 2.00 p.m.

**Third Panel Session:****Closing Session**

<i>Session Chair:</i>	<i>Comm. Getrude Nguku</i>
<i>Rapporteur:</i>	<i>Clementine Wavinya</i>
2:00 – 2:30:	Closing Remarks from the Principal Secretary, State Department for University Education and Research - Amb. Simon Nabukwesi,
2:30 - 3:00:	Closing Remarks from the Principal Secretary, State Department for Crop Development and Agricultural Research - Prof. Hamadi Iddi Boga,
3:00 – 4:00:	Conference Declaration Programme Coordinator: Elijah Letangule

**1) Sustainable Post-Harvest and Agro-Processing Technologies for Improved Livelihoods Among Rural Communities in Elgeyo Marakwet County, Kenya.**

*Augustino O. Onkwere - Rongo University; Violet Kadenyeka Mugalavai - University of Eldoret; Peter Ooko Ouma - University of Eldoret; Paul Kimurto - Egerton University; Eng. Mutai Emmanuel - University of Eldoret; Washington Ochola Adede - Kisii University; Vincent Cheruiyot - KEBS-Eldoret; Rael Kipyego - Ministry of Agriculture, Elgeyo Marakwet County; Robinson Ouma - Rongo University*

**Abstract**

The handling, transportation, drying, storage, and processing of agricultural products generally form part of the postharvest stages on the agricultural value chain. Use of proper tools, equipment, materials, and technologies in these stages can retain or even improve the value of the products. However, inappropriate, poor, low-quality handling, storage, drying, or processing can cause a reduction in the quality or quantity of the products; a process generally termed “postharvest loss”. Such loss can lead to food and nutrition insecurity, and precarious livelihoods. The current research was carried out to determine the level of food and nutrition challenges and postharvest management levels for a variety of agricultural products, food diversity, and cottage level value addition activities in the Kerio valley. Poor post-harvest management, inadequate value addition knowledge and skills, undiversified staples and limited market access were identified as major challenges to food and nutrition security, and improved livelihoods in the study area. Attempts were made to generate and adapt improved technologies for reducing postharvest losses and value addition of staple food crops. County Government officers, organized groups and individuals were exposed to the technologies on

site and at University of Eldoret Food Processing and Incubation Centre where youth and women groups were trained in product development and entrepreneurship. By the end of the research, some of the technologies, including drying and storage of cereals, fruits and vegetables grown in the study area together with value added composite flours for improved community nutrition had been taken up by various groups as livelihood ventures, and County Government officers for out-scaling.

**2) Scaling up sustainable land management to reduce environmental degradation in small-scale agriculture in western Kenya.**

*Kennedy Were, George Ayaga & David Kamau*

Land degradation is widespread and underlies low agricultural productivity in western Kenya. Although the region receives good amounts of rainfall and has high agricultural potential, yields of the staple food crops has remained low due to poor and unsustainable agronomic practices. The situation is exacerbated by the rapidly growing human population. This high population has led to increased demand for land, food, shelter, water, energy, and waste disposal; hence, putting tremendous pressure on the natural resource base and leading to land degradation. The local communities who are largely smallholder farmers have encroached into the forests, opening up new farms and degrading the forests in their quest for timber, fuel wood and medicinal herbs for sale to supplement their farm incomes. Consequently, the forest is severely threatened despite its multiple benefits. To reduce and reverse this problem, the Global Environment Facility (GEF) has funded a Sustainable Land Management (SLM) Project to foster the uptake of different SLM and agro-biodiversity conservation technologies across the Kakamega-Nandi forest

landscape through promotion of a holistic process that includes provision of suitable technical options while also enhancing the socio-economic environment, managing barriers to change, and supporting policies and institutions that can ensure successful scaling up.

In this presentation, we have described the land resource problem in western Kenya, objectives of the SLM Project, the implementation approaches and process, as well as some of the key achievements.

*Keywords:* Sustainable land management, land degradation, agricultural productivity.

### 3) Land use Land Cover Changes and Implications on Food Security in Kenya

*Dr Frank O. Masese; Department of Fisheries and Aquatic Sciences, University of Eldoret, P.O. Box 1125-30100 Eldoret, Kenya.*

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Land use is a key underlying aspect of all food systems that enables food security. About 38% of the Earth's land area is being used in agricultural production, while 31% of the remaining land being under forest cover and the other half being less suitable for agricultural production due to edaphic, topographic and/or climatic factors. Although agriculture is the starting place for all food production, changes in other aspects of the food system are also profoundly affected by environmental and land use change. Land use and land cover changes (LULC) have been identified as major precursors to greenhouse gas emissions to the atmosphere. In addition to this direct link to climate variability, LULC are strongly linked to water availability and modulation of microclimate, all of which have strong implications on biodiversity, crop yields and food security. Many studies have

addressed the expansion of agriculture (crop and livestock production), as a driver of LULC, and agricultural expansion at the expense of forest cover is often aimed at increasing food production and food security. However, deforestation has been a major driver of LULC that has been linked to declining water resources (quality and quantity) and biodiversity loss, which can have negative consequences on crop yields and food security by minimizing the water available for irrigation and loss of pollinator diversity. In this paper, I will discuss the linkages between LULC and food security in Kenya with the aim of creating awareness on the need to protect and conserve forests for the myriad ecosystem goods and services they offer, including water resources, a liveable climate and food security.

**Key words:** biodiversity, climate change, deforestation, food security, land use and land cover change, nutrition.

### 4) Characterization of smallholder farmers and exploring trade-offs and synergies in options for ecologically resilient food security in semi-arid lands of Kenya

*Muasya, R. M.; Wambua, J. M.; Muli, B. K.; Nguluu, S. N.; Theuri, A.W., Mwami, B. M. and Luvanda, A. M.*

According to the World Health Organization, Food Security is achieved “when all people, at all times have physical and economic access to adequate/sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. Kenya Government has over the years strove to achieve national, household and individual food security throughout the country with mixed success where about 51% of the Kenyan population lack access to adequate food. The purpose of this study was to characterize the smallholder farmers and explore the trade-offs and synergies in options for ecologically resilient food security. The study was carried out in Kitui, Machakos and Makueni Counties. Multi-stage sampling method was used to select the households. A sample of 1158 households was interviewed. Household cross-sectional survey research method was used during data collection. Methods of data analysis were descriptive and regression using SPSS and Stata statistical software. Results showed that,

the percentages of male and female headed households across all the counties were 84.5% and 15.5%, respectively. For the specific Counties, within Kitui County, the percentages of male and female headed households were 86.5% and 13.5%, respectively. About 81.6% and 18.4% of the households were headed by men and females in Machakos County, respectively. In Makueni County, about 85.0% and 15.0% of the households were headed by men and females, respectively. In regard to the education level of the household heads in all the Counties, the percentages of the households were 8.4%, 51.6%, 27.8% and 12.2% in none formal education, primary, secondary and Tertiary, respectively. Descriptive statistics of the age of the household heads in all Counties showed that, the mean was 51.9 years. In terms of access to adequate/sufficient at all times, results showed that, within each County, about 56.8% of the households in Kitui was food insecure while 43.2% was food secure. In Machakos County, about 53.2% of the households was food secure whereas 46.8% was food insecure. About 55.8% of the households in Makueni County was food insecure while 44.2% was food secure. Therefore, with households being food insecure and secure in each County, there were trade-off and synergies in options for the ecologically resilient food security.

**Key words:** Determinants; Food access; Households; Policy implications

## 5) Enhancing Role of Communities to Support Sustainable Utilization of Natural Resources

*Dr. James M. Kimondo and Stephen M. Kiama;  
Kenya Forestry Research Institute*

Upper Ewaso Ngiro River Basin (UENRB) is an important water catchment covering an area of about 15,634 km<sup>2</sup> and spanning across six arid and semi-arid Counties in northern Kenya. In the basin highlands, land fragmentation is common, being associated with subsistence form of cultivation, declining crop yield and high poverty level among households. As a result, there is undue pressure on natural resources, including cutting of trees for charcoal, encroachment of protected areas and conversion of private forest patches or woodlots into cultivation areas. The dry lowlands of the basin are also experiencing an increase in both human and livestock populations. As a result of overgrazing, land degradation is evident in most of the group ranches where bare patches have

gradually been expanding in recent years. Here, landscapes have transitioned from tree-grass mosaic having sub-dense and continuous perennial grass cover to bare-tree matrix having relatively connected bare patches. Other key challenges that have been noted include unsustainable land use practices, declining wildlife ranges, increasing stocking densities, habitat fragmentation, and depletion of grass, browse and water. Generally, ecosystem services in UENRB have largely been undermined by overarching challenges of catchment degradation, degradation of water resources, environmental degradation, soil erosion, declining biodiversity and inability to cope with the changing climate leading to human to human as well as human to wildlife conflicts. In order to address these challenges, an integrated framework was conceptualized employing engineering design and fabrication, multispectral Remote Sensing analyses, biophysical and hydrological modelling and sustainable livelihood approaches. A particular focus was on the analysis of value chains that would be appropriate levers in stimulating sustainable development in the basin. This paper focuses on the findings of a survey that was conducted among smallholder farmers in Laikipia West Constituency, located in the highland part of UENRB, and whose aim was to understand the factors hindering or incentivizing farmers to engage in commercial forestry. From the results, developing trust is key, and farmers in UENRB require contractual and financial incentives and/or arrangements in order to engage in long-term business partnership of commercial tree-growing and trading in trees.

## 6) Averting Climate Change Crisis in Lower Eastern Kenya Through Weather-Based Advisories: Are the Existing Policies Effective and Supportive Enough?

*Debra Onyango, Hezron Mogaka, Lydia Muriithi,  
Kizito Kwena*

Dissemination of agro-advisories for climate variability and change has the potential to enhance adaptation through creation of awareness thus enabling informed-decision making at the farm level. Different pathways are used to disseminate this information. However different pathways enable varied reach across farming populations. Additionally, dissemination requires effective policies that facilitate the development and flow of information from providers to end users. This study interviewed 400 farming households and 15 key informants in lower eastern Kenya to determine the



type of agro-advisories accessed by farming households in the region. The study also determined the effectiveness of the existing policies in facilitating the dissemination of climate change adaptation information. Principal Component Analysis (PCA) was used to determine the type of information received from ICT, farming groups, and extension agents while thematic analysis and descriptive statistics were used to determine the effectiveness of four policy instruments relevant to information dissemination; institutional arrangements, funding, legal framework and expertise. The findings revealed that extension agent pathway is soil/water conservation and crop/variety adjustment practices specific while ICT is specific to information on farm operation adjustment practices. For policies, funding and institutional arrangements were the least effective instruments supporting dissemination of agro-advisories. Based on these findings, there is need to develop advisories on other adaptation strategies such as off-farm adjustment practices and environmental protection practices. The existing policies also need to be reviewed for practical institutional arrangements and timely, effective and consistent funding mechanisms. Access to agro-advisories will enable improved farm productivity and food secure communities ultimately.

**7) Establishing Optimal Community Forest Access and Management Units for Enhanced Community Livelihoods and Better Forest Management**

*Dr. Felix Lamech Mogambi Ming'ate  
Department of Environmental Studies and  
Community Development, Kenyatta University,  
Kenya.*

Establishment of clear forest and community management units for access and management of forest resource for enhanced community livelihoods and improved forest management presents major challenges in forest management in current literature. The government of Kenya has been implementing participatory forest management in various forests reserves for over two decades and thus this research forms a good case for analyzing how the forest resources access boundaries can be established in order to improve the livelihoods of forest dependent communities. The key players for collaborative governance of forests in Kenya include: NGOs, Government

Ministries and community members. The aim of this research was therefore to examine the extent to which boundaries for access of forest resource units by CFAs in Kenya's participatory management approach established and how can they be made to contribute in the delivery of sustainable livelihood outcomes to the forest adjacent communities depend on them forest for their livelihoods. The study collected qualitative data from 47 participants through audio recordings from different forest resource users' groups' leaders, key government informants involved in the Participatory Forest Management namely: Kenya Forest Service, Kenya Forest Research Institute, Kenya Wildlife Service, the Kenya National Museum and key informants from NGOs. All the data collected was checked for auditability compared with the original recordings and transcription was done then, similar themes were grouped together to answer the study objectives. The study concludes that forest resource and resource users' boundaries are essential for optimal community forest access and management units for enhanced community livelihoods and better forest

**Key words: Community Forest, Management Units, Better Forest Management, Community Livelihoods**

**8) Which major river catchment pollutes Lake Victoria, Kenya the most? a proof of concept for management implications**

**Dr. Christopher Mulanda Aura (PhD):** *Kenya Marine and Fisheries Research Institute P.O. Box 1881-40100, Kisumu, Kenya.*

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**Abstract**

The study uses Multi-metric Index of Biotic Integrity (MMIBI) methodological approach that allows for the ranking of major river catchments based on land and lake use pollution in the Kenyan portion of Lake Victoria, Africa. The study has a broader applicability to all of Lake Victoria, other African Great Lakes, and all lakes that have riverine discharges. The method presented utilizes water quality and environmental data, local knowledge, and pre-existing literature. The parameters considered were sampled from 2016 to 2018 during the dry season (July sampling) and the wet season (March sampling). Separation power of Mann-Whitney U test ( $p < 0.05$ ) qualified the

requisite discriminant metrics for phytoplankton, macroinvertebrate and fish samples into the scoring system of 1, 3 and 5 in the formulation of final MMIBI. Rivers in the northern section had lower MMIBI scores as compared to southern counterparts. The MMIBI ranking herein was validated by community perceptions on pollution levels. River Nzoia catchment emerged as the most polluted, followed by River Yala, River Kuja, and Sondu-Miriu. Siltation, domestic washing, litter and refuse emerged as the main agents of pollution. Management authorities ought to reinforce a balanced utilization of the vital water resources to minimize future impacts, and promote catchment wide practices that ensure ecological health sustainability of the lake ecosystem.

## 9) Agricultural transformation technologies and innovations for sustainable utilisation of land

*Prof. G.A. Obare; Tegemeo Institute of Agricultural Policy and Development, Egerton University.*

Agriculture continues to be the core of the development of our nation and the significance to creating equitable and sustainable growth. The population continues to grow, and agricultural productivity rises slowly or not with daunting food supply problems, poverty, underemployment, climate change, and associated risks. With interventions to substantially increase small farm productivity and enhance the resilience of livelihoods and production systems to climate variability and other related risks, the crisis may be averted. The importance of agriculture has been emphasised in Kenya through Vision 2030 and the Medium-Term Plan III. Most recently, the President's Big Four priority agenda for 2017-2022, which emphasizes the importance of 100% food and nutrition security for all Kenyans. Agricultural transformations could increase the benefits that accrue to the rural economy. Projections of food demand and supply for the county are overwhelming. Demand for food is expected to rise by about 2.9% a year from now to 2050, primarily due to population growth. Agriculture must grow to feed the rising population, earn foreign exchange, supply labour to expand employment in the industrial and service sectors, and provide a market for growing manufacturing output. A transformation of agricultural systems is a pre-

condition in making the agricultural services more productive and resilient while adopting ways to reduce the drivers of climate change. Transformation is achieved through modernisation in production, input, input markets, value addition, shift into more productive agricultural practices and changing demand for what people eat. Technologies, Innovations and Management Practices are core in Transformation, and they are applied for sustainable utilisation of land and natural resources.

## 10) Cage Culture in Kenya

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Aquaculture production system where fish are held in floating net cages. Cage culture is believed to have originated in 1800 in southeast Asia with fishermen who used cages to store fish to take to market.

Cage farming is a new socioeconomic frontier with good prospects to contribution to national fish production, increased job opportunities, enhanced food security and incomes for both rural and urban dwellers in light of the blue economy. In Africa the major aquaculture producers are Egypt, Nigeria and Ghana Kenya and Zambia.

With rise in cage culture investments, concerns on environmental degradation arise, since it brings about discharge of particulate and dissolved nutrients such as uneaten waste feed, fecal matter, and excretory products which are bound to negatively impact the fishery environment by causing anoxic conditions in sediments underlying the cages thus changing the abundance and composition of biotic communities.

Furthermore, the haphazard installation of cages could spell doom for the lake ecosystem.

The sector is bedevilled with many challenges that include; lack of quality seeds and feeds; poor infrastructure, lack of information, diseases, biosecurity, extension services; Constraining sociocultural factors such as norms, land ownership, women and lack of technology transfer.

Using satellite and GIS technologies, in 2019 the same portion of the lake was found to contain 4,357 fish cages covering 62,132 m<sup>2</sup> (Hamilton, Aura et al., 2020). When sustainably managed, cage technology has the potential to provide significant contribution to national fish production, increased job opportunities, enhanced food security and incomes for both rural and urban dwellers in light of the blue economy. Therefore, the brief gives suggests suitability locations of cage culture based on sound scientific findings to help management and authority agencies in making policy decisions and development guidelines of cage culture that will be essential to the sub-sectors value chain.

### 11) Geo-mapping Riparian Zones/Lands for Catalyzing Sustainable Development in the Designated Special Economic Zones in Kenya

Lange, C<sup>1</sup>, Opa, B<sup>2</sup>, Muriuki, C<sup>1</sup>, Odongo, K<sup>2</sup>. & Maithya, S<sup>1</sup>.

<sup>1</sup>National Environment Management Authority;  
<sup>2</sup>National Land Commission.

Riparian zones/lands which are ecosystems that flag wetlands are vital ecosystem. This is because they often support rich biodiversity, serve as buffers for controlling erosion, filtering chemicals in addition to other ecological services. Despite the critical role riparian zones/lands play in ecological and economic development, they face a myriad of challenges that make their sustainability for supporting ecological goods and services as well as socio-economic prospects uncertain. The development trajectory in Kenya pose the most critical challenge to riparian zones/lands despite existence of relevant legal frameworks and institutions focusing on riparian zones/lands. Among the areas where development appears may pose monumental challenge to riparian zones/lands is the designated special economic zones (SEZs). The development in these areas if fail to mainstream riparian zones/lands conservation in planning the development trajectory may wipe or destroy these critical ecosystems unnoticed. To provide information for aiding sound conservation of riparian zones/lands in SEZs developments, a study was undertaken jointly by NEMA and NLC to Geo-map riparian lands/zones in three designated SEZs (Lamu Mombasa and Kisumu), code looming encroachments and invent a public e-riparian portal for referencing riparian zones.

Using GIS applications involving satellite imageries', all riparian lands/zones in the three SEZs were mapped and planned development overlaid to code looming encroachments and an e-riparian portal developed to provide easy to use citizen tool for cross-checking if planned developed may fall in riparian lands/zones. The results of mapping will be presented in this conference and tend to point to encroachments of some planned developments at these SEZs on riparian zones/lands. The developed e-riparian portal to provide easy public verification tool on status of areas proposed for development against legal provision on riparian distances following EMCA regulations appeared to provide opportunity for easy self-regulation on compliance with riparian zones conservation in developments. The study provides great contribution to enhancing riparian zones/lands and wetlands conservation in SEZs and catalyzing sustainable development in Kenya.

### 12) Planting Pits as a Sustainable Land Management Strategy.

Dr. Rebecca Yegon, Department of Water and Agricultural Resource Management, University of Embu

Kenya comprises 84% (455 408 km<sup>2</sup>) arid and semi-arid lands (ASALs). Water deficit due to erratic, short duration rainfall and low soil fertility limit crop production in ASALs. The character of rainfall in ASALs results in 70 to 85% rainfall loss through evaporation, percolation and runoff leaving only 15 to 30% for plant growth and development. Rainwater harvesting (RWH) can harness this water. Policies on RWH in Kenya mainly focus on macro water harvesting. Micro catchment systems capture and store rainwater where it falls, thus improving soil moisture content by increasing infiltration and reducing runoff and evaporation. Micro catchment systems include planting pits that include incorporation of manure and fertilizer improving soil fertility. Planting pits have different names, shapes and sizes, including *Chololo*, *Five by Nine*, *Tumbukiza* and *Zai*. Planting pits have demonstrated increased crop yields in below average rainy seasons and reduced yields in above average seasons. This paper recommends incorporating micro water harvesting systems in RWH policies for sustainable land management in the changing climate.

## Responsive Land Governance To Support Sustainable Use of Land And Natural Resources

*David N. Kuria*

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Land governance is an important cog in the development agenda of any nation. Land governance has been defined to encompass policies, processes and institutions by which land, property and natural resources are managed. This includes decisions on access to land, security of land rights, use of land and land development. Good and transparent land governance will serve a country's national resources management, the rights of its citizens, and lead to a reduction of poverty. In addition, sound land governance is crucial to achieving relevant sustainable development goals (SDGs).

At the heart of good and responsive land governance, is land management. Land management concerns putting land resources to efficient use, such as producing food, providing shelter, preserving the environment and making sustainable use of natural resources. Land administration is traditionally the responsibility of the government; governments at local and central levels enforce land policies and legislation through land administration. The production, dissemination and use of land information is necessary to inform different land administration aspects, such as tenure security provision, regulation of property markets, promotion of effective land use planning and taxation. The land management paradigm can be used by any organization, especially national governments, to design, construct, and monitor Land Administration System (LAS). The core idea is to move beyond mapping, cadastral surveying, and land registration to use land administration as a means of achieving sustainable development.

A well-functioning land sector can boost a country's economic growth, foster social development, shield the rights of vulnerable groups, and help with environmental protection. The Land Governance Assessment Framework is a diagnostic instrument to assess the state of land governance at the national or sub-national level. The LGAF employs a participatory process that draws on local expertise and brings together representatives of government, academia, civil society, and the private sector. The process aims to identify good practice and reach consensus on priority areas for reform and for the testing, evaluation, and roll-out of new approaches to address key gaps in land governance. In many cases this process has pushed land issues higher up on a country's agenda and created a broad-based consensus on key reforms that supports continued multi-stakeholder dialogue based on progress monitoring at the national or sub-national level.

## 13) The Role of Information Communication and Technology (ICTs) in Land and Water Resources Management and Food Security in Kenya: A Case Study of Kericho and Uasin Gishu Districts.

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As the world moves towards globalization and advanced technology, information communication and technology become very crucial in all spheres of life. Despite the tremendous strides in Information Communication and Technology (ICT), Kenya has not done quite well on technology and its infrastructural systems to enhance water resource management and hence, improve food security effectively for her growing population. A project on the role of ICTs for Water Resource Management and Food Security in Kenya was conducted in Kericho and Uasin Gishu Districts from the year 2008 to 2009. This project was funded by the then Commission for Higher Education (CHE) now Commission for University Education (CUE). The project involved dissemination of information to the farmers in the two districts that are the breadbasket of this country. A random sample of 282 farmers; 151 from Kericho and 133 from Uasin Gishu was done. A total of 34 key informants were picked and trained; 16 from Uasin Gishu and 18 from Kericho. After the implementation of the project, interview schedules were conducted and structured questionnaires were administered for data collection as part of feedback. The results indicated that food insecurity and destruction of water catchments were serious problems facing the country. It was also reported that political instability due to land issues after every five years was an impediment in the two districts hence affecting proper infrastructural plans. This critically interfered with farmers settling and doing proper farming and yet this is arable land good for farming. Conclusions from the project indicated the two districts suffered from digital divide due to lack of proper infrastructure both in transportation and communication networks. Also it was noted that about 80% of the farmers lacked awareness on the use of ICTs for water resources management and food security in the two districts. The project recommended that local communities should be exposed to ICTs. This would enhance water resource management and food security in the two districts and the country in general. Monitoring and evaluation has been going on and the report indicates that there is improvement in infrastructure. However, due to termination of funds for the project, the sensitization stalled and the project was not able to

achieve its goal fully. There is an appeal for second part of the project for completion purposes and sustainability.

**Key words:** Information, Communication, Technology, Digital divide, Land resource management, Water resource management, Food security, Political instability, arable land, infrastructure, sustainability.

#### **14) Efficiency and Sustainability of Land-Resource Use in Arid and Semi-Arid Lands (ASALs) Dryland Areas of Kenya.**

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The drylands of Kenya that comprise of Arid and Semi-Arid Lands (ASALs) make up about 80% of the total land area and are largely inhabited by agro and nomadic pastoralists. Despite the large area, their contribution to Gross Domestic Product (GDP) is about 5%, mainly through livestock husbandry and dryland farming. Modern approaches to land resources utilization may provide decision-makers with sustainable land resource management scenarios that improve productivity and sustainability in the face of increasing food security. In Arid and Semi-Arid Lands (ASALs) of Kenya, land resources remain essential for humans' survival, and different methods of land- resource use depend largely on the local natural context. Because of the harsh ecological conditions in these areas, there is need for efficient use of land-resource to ensure sustainability in the long run. There are however, fragmented information concerning the efficiency and sustainability of land resources in ASALs in Kenya. In this review we assess land resource use in terms of efficiency and sustainability in ASALs in Kenya. The review clearly indicates low land-use efficiency in ASALs. It is clear that a guiding principle is to allow the people and participatory approaches and governance to enable policies and institutions to support the achievement of sustainable land-based natural resource management. Clearly an integrated land resource management process in ASALs should incorporate multiple stakeholders and sectors. Policies and institutional support are crucial at all scales to match national and county economic, social and environmental goals with the needs of stakeholders (public and private-sector) and to manage trade-offs and inequalities among several stakeholders.

**Keywords:** Land use, Land resource, Dryland areas, Sustainable Utilization of Land, Arid and Semi-Arid Lands, Food security

#### **15) Promoting progressive inclusion of women in land.**

*Lead Author: Jessica Oluoch*

Historically, women have stood in a disadvantaged position in accessing land often being viewed as temporary persons (in their childhood homes) or trustees (in their marital homes) when it comes to beneficial ownership of land. To remedy this the Constitution of Kenya, 2010 entrenched as one of its foundational values equality and non-discrimination. This value is espoused in a number of provisions in the Constitution including the provision on the right to a family, which guarantees the right to equality within marriage. The principle of equality is also seen in the land law regime that came into effect after the Constitution, which has sought to ensure equal or equitable access to matrimonial land.

This paper seeks to examine the inability of women to secure access to land has been occasioned by misinterpretation of the applicable traditions and cultures; the planned research and documentation will assist in visualizing the correct cultural positions thereby reducing levels of abuse and exploitation of the vulnerable due to lack of written accounts of cultural positions. The researches will also facilitate the collection of information to conduct public interest litigation in respect of the harmful traditional practices thereby providing lasting solution concerning some of the harmful practices. This would be the fourth objective that the project seeks to achieve. The development of easy to follow steps for succession and inheritance matters will assist in addressing the levels of ignorance and failure to claim succession and inheritance rights among the marginalized thereby reducing the number of violations occasioned by exploitation of the ignorance of the vulnerable groups like widows and orphans.

The failure to apply human rights principles to service delivery, including inclusiveness, nondiscrimination, social justice, human dignity, equality and protection of rights by service providers at the National and County governments provides further room for violation of rights of women as they relate to land and property. Facilitation of engagements between the widows, orphans and elders with County government entities and the building of their capacities on the

rights approached to service delivery and advocating for support to traditional dispute resolution mechanisms will seal the current vacuum on accessing rights and services as already explained. KELIN works with the cultural structures to resolve disputes between the widows and their in laws through traditional resolution mechanism to ensure the women are resettled back to their homes and their land and properties restored. Disinheritance of widows adversely affects the rights of the orphans and vulnerable children. A total of 940 cases have been resolved so far.

We are engaging in documentation and development of compendium of cases to visualize the correct cultural positions thereby reducing levels of abuse of the vulnerable due to lack of written accounts of cultural positions. We have also developed easy steps for succession and inheritance matters to assist in addressing the levels of ignorance and failure to claim inheritance rights.

We have also been at the centre of policy review processes in the country and specifically on laws touching on marriage, ADR and property and the paper will answer the following questions

- a) What is the legal obligation created by article 27 of the constitution of Kenya
- b) What does the formal recognition of marriages have to do with property rights
- c) Why must we seek to realign the primal inheritance law with the constitution
- d) What are the gendered issues in law and culture that provide an opportunity for changing the lens to property rights.;

In seeking to answer the above questions, the research paper seeks to consider informed by available jurisprudence, conducted research and lived experience of women to reiterate the place of women in Land.