

# EAST-AFRICA REGIONAL ALUMNI CAPACITY BUILDING AND NETWORKING SEMINAR

“Enabling services from land and water resources through actor-oriented forest landscape restoration: tools and best practice”



PROCEEDINGS

Copyright Stefanie Fischer

5 – 11 March 2023  
in Kampala, Uganda



# WELCOME

## SEMINAR CONCEPT AND AIM

Not only since the founding of the Global Landscape Forum in 2013, there is a growing recognition that urgent, complex development policy issues require landscape-based approaches to overcome one-dimensional and disciplinary silo-thinking. Solving natural resources management and governance conflicts and crisis require interdisciplinary and holistic ways in policy making and corresponding actions on the ground. This paradigm change manifests in the rise of integrative concepts to natural resources management such as Forest Landscape Restoration (FLR) or Integrated Water Resources Management (IWRM). Such multi-disciplinary approaches impose new demands on traditional disciplines such as forestry, hydrology, ecology, nature conservation or agriculture to think outside the box. It challenges scientists, policy-makers, development practitioners and entrepreneurs to increasingly communicate and cooperate beyond their disciplinary scopes. This regional alumni seminar addresses scientists and practitioners from Eastern Africa, working in universities, research organizations, state administration, civil society organizations, the corporate sector and development agencies having a stake in environmental and natural resources management, including land, water, forest and biodiversity and other relevant fields. The seminar provides opportunities to strengthening capacities on integrative and actor-oriented management and gov-



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ernance concepts at landscape level through scientific exchange and practice-oriented field excursions, including the following aims:

- Strengthening interdisciplinary and holistic perspectives on natural resources and environmental management with a focus on the forest-land-water nexus;
- Exploring actor-oriented and integrated concepts and tools for resolving conflicts and promoting sustainable natural resources planning at landscape level;
- Gaining practical experience through field excursions at landscape level and dialogue with landscape-based actors at different governance scales.

Beyond scientific exchange and practical learning, the seminar aims at consolidating and expanding relationships and partnerships among the alumni in Eastern Africa within and across disciplines, sectors and organizations from politics, administration, science, civil society and the international development cooperation.



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## SEMINAR OVERVIEW AND COVERAGE

The seminar will mainly cover scientific discussions with focus on the following:

- (1) holistic diagnosis of problems in a complex setting (“understanding the big picture”),
- (2) identification of relevant actor groups with their interests and strategies;
- (3) how to engage and integrate actors in setting goals for solutions and actions,
- (4) designing scenarios and action with actors’ participation,
- (5) strategies to implement and review, drawing on best practice experiences.

## IMPLEMENTING PARTNERS

- TU Dresden (Institute of International Forestry and Forest Products, Institute of Hydrology and Meteorology)
- United Nations University (Institute of Integrated Management of Material Fluxes and of Resources, UNU-FLORES)
- Makerere University (School of Forestry, Environment and Geographical Studies)

**Seminar Coordinator:** Dr. Eckhard Auch

**Local facilitation:** Prof. Mnason Tweheyo and Dr. Daniel Waiswa

# PROGRAM

The seminar consists both of scientific exchange and social events. Keynote speeches on integrated natural resources management, planning and landscape governance make up an essential part of the seminar, complemented by presentations of posters from the participants, an excursion to a landscape project and a role play with a landscape planning exercises.

To underpin theory with valuable local practical experience, an exchange with practitioners from forestry and water management in the wider fringe of Kampala will take place.

The seminar is designed to encourage interaction among participants and to facilitate the sharing and discussion of individual experiences and perspectives on the various topics. By this learning and generating insights shall be enabled, for upgrading the competencies of the participants and for improving strategies for natural resource management.

Kindly find the detailed program schedule on the following pages.



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## HIWOT TESHOME ABEBE

hiwothiwi2000@gmail.com

Associate Researcher, Ethiopian  
Institute of Agricultural  
Research, National Fisheries and  
Aquatic Life Research Centre

Ethiopia

### Education

**M.Sc. Organic Agriculture and food systems**

University of Hohenheim, Germany

**M.Sc. in Agricultural Economics**

Haramaya University, Ethiopia

**B.Sc. in Agricultural Business Management**

Haramaya University, Ethiopia

## ABSTRACT

### Riperian community perceptions of river water pollution: The case of Awash River, Ethiopia

Due to the high water-demanding nature of the development activities such as industrialization, agriculture, irrigation, and various individual household uses, water can be highly exploited. Especially, such development activities when constructed and located near rivers or any potential water sources, water get easily prone to pollution. River Awash is one of the longest inland rivers in Ethiopia, with a life of more than 10 million inhabitants where the source started from the Chilimo forest located 100 km far from the capital city of Addis Ababa, Ethiopia. The river water is a drinking water source for both humans and animals, also used for agriculture (irrigation), bathing, washing of vehicles and clothes and other uses. Whereas the community living in the area believe that the only source of pollution is the discharge of untreated wastes from the paper factory planted in nearby the lake. However, the people living around dump household wastes including dead animals in the lake and never know such practices can harm/pollute the river water. In addition, the upper users located on the hilltop near the forest from the sources widely use inorganic fertilizers and chemical sprays and never imagine all these practices can be sources of river water pollution. Consequently, both upper and down users of the paper factory perceive the sources of river water pollution as the paper factory also both users agree the only problem in the area is the existence of a paper factory. Meanwhile, the research result based on the respondent's perception revealed that household waste, animal waste, human waste, industrial waste, and erosion are among the known anthropogenic activities mentioned as sources of river water pollution whereas diarrhoea, skin disease, giardia, and asthma are the most frequent occurred human health problems due to the polluted river water in the area. Thus, to protect the river water from pollution, there is a need to enforce the paper factory to treat wastes before discharging them into the river. Moreover, there is a need to improve community awareness of the sources of river water pollution, harmful practices, and possible damages in the long run.



**DR. HASSAN ELNOUR ADAM ZAKARIA**

[hassan\\_adam@hotmail.com](mailto:hassan_adam@hotmail.com)

**Associate Professor,  
University of Kordofan**

Sudan

## **Education**

**PhD in Geosciences**  
TU Dresden, Germany

**M.Sc. in Tropical Forestry and  
Management**  
TU Dresden, Germany

**B.Sc. in Forestry**  
University of Khartoum, Sudan

## **ABSTRACT**

### **Effects and solutions of conflicts on natural resources in Albaja reserved area, North Kordofan, Sudan**

Albaga area is a natural range reserved for livestock in North Kordofan and neighboring states. The area showed a great change in land use transformation due to conflicts over natural resources and lack of definable land use mapping and policy. The study aimed to classify and mapping of natural resources; and to identify the conflicts and its impacts and solutions in Albaja area. Field survey was conducted in November 2015; and depended on multi-temporal images from landsat5 (TM) 1985, landsat7 (ETM+) 1995 and landsat8 2015. Also 40 structured questionnaires were distributed randomly among respondents at different levels (9 villages) in Albaja area. Collected data was analyzed using ERDAS 9.1, ArcGIS10.3 and SPSS version 18. The results identified fives types of land use and land cover in Albaja area ([poor] sandy soil, agricultural lands, shrubs lands, woody lands and range lands). Classified images showed an increase in range lands from 30% to 46% (1985-1995); an increase in agricultural land from 15.1% to 37.3% (1995-2015); an increase in sandy soil and shrub lands from 9.7% to 16.6% (1995-2015) and from 15.5% to 17.0% (1985-1995). Results revealed a decrease in woody vegetation and agricultural land from 15.1% to 13.3% and 17.6% to 15.1% (1985-1995), respectively. The study revealed that 60% of respondents agreed with the presence of conflicts between farmers and pastoralist on natural resources. Also, 70% of them mentioned the encroachment of agriculture as main reason for conflicts. Some solutions were raised by communities such as prevention of plough in rangelands (70%) and settle of nomadic during rainy season (65%). However, efforts of integrated resources management and proper planning at Albaga area are required with increasing of awareness between farmers and pastoralist.



**DR. ZEINAB MOHAMED HAMMAD ADAM**

**bzeinab14@gmail.com**

**Assistant Professor,  
University of Khartoum**

Sudan

## Education

**PhD in Forestry/Agroforestry**  
University of Khartoum

**M.Sc. in Tropical Forestry and  
Management**  
TU Dresden, Germany

**B.Sc. in Agriculture/ Forestry**  
University of Khartoum, Sudan

## ABSTRACT

### **Agroforestry: The Way to Forest Restoration and Stable food supply in dry-land Africa; Case of Taungya Practice in Sudan**

The purpose of forest restoration is to re-establish the presumed structure, productivity and species diversity of the forest originally present at a site. Sudan National Forest policy Statement 2006, have been designed to make major changes in forest development and management. It is incorporating poverty reduction strategy, improvement of people standards, amelioration of physical environment and combating desertification. The overall objective of this study was to assess the existing agroforestry practice, "Taungya", in the study area as an improved model of participatory forest management aiming to sustainable food security, and forest restoration. The study area, is Nabag reserved Forest, which, is a natural reserved forest located in South Kordofan State, Sudan. Forest National Corporation has introduced the Taungya system to rehabilitate this forest. Five hundred families were participating in the program. For this study, an experiment in which *Acacia senegal* seedlings were planted with three types of agricultural crops using different spacing for three consecutive rainy seasons (2014-2017) was applied. Tree performance and crop productivity were measured for the three agricultural seasons. A social survey, in which a designed questionnaire have been applied for 11% of the population have also been used. Study results with regards to crop productivity, showed highly significant differences, at  $pr \leq 0.0003$ , with some variations from season one and two, which, maybe due to soil fertility factors after three years. With regards to seedlings height, during 2016 - 2017, at  $Pr \leq 0.0008$ , results shows highly significant differences between corps to seedling height. Concerning tree branching, results shows highly significant differences in season, 2016 – 2017, at  $pr \leq 0.0007$ . It is concluded that, agroforestry is an important land cultivation practice in the study area for both food security and forest restoration. It is recommended that Taungya is to be applied throughout the country to restore degraded reserved forests.

## DR. ASMAMAW ALEMU ABTEW

[Asmamaw.alem@uog.edu.et](mailto:Asmamaw.alem@uog.edu.et)

Director for graduate studies  
programs directorate of the  
University of Gondar

Ethiopia

## Education

**PhD in Forest and Nature Society  
(FONASO)**

TU Dresden, Germany &  
Padua University, Italy

**M.Sc. in Sustainable Tropical  
Forestry**

Copenhagen University, Denmark &  
TU Dresden, Germany

**B.Sc. in Forestry**

Hawassa University, Ethiopia

## ABSTRACT

### Market driven afforestation – trajectories in social resilience and environmental sustainability under land-use intensification

An extensive afforestation is taking place in the southwestern part of the Amhara region in Ethiopia. The two major species grown are *Acacia decurrens* and *Eucalyptus globulus*. *A. decurrens* is grown in a 4- 5 year rotation with intercropping cereals (tef) and fodder. The afforestation is farmers' innovation driven by an increasing demand for construction poles and charcoal. In the face of land use intensification and transition, our project examined the current and potential impacts of short rotation forestry on: i) rural household income and gender equity ii) agricultural production and food security iii) carbon sequestration in biomass and soil at a landscape level and iv) soil fertility and long-term sustainability of agricultural and forest production. Trees are grown because they are more profitable for farmers than crops. The value chain developed around the forest cultivation and charcoal production creates job opportunities within seed collection, seedling production, soil preparation, planting, weeding, logging and cutting activities, charcoal making, bagging, transport to road and loading of lorries. Women are also highly involved in several of these steps in the value chain but the men negotiates and takes decisions on selling the produce. Income is used for e.g. better clothes, education, corrugated iron roofs and solar power. Young people work part-time with charcoal and pay their own school fees. Migration from the area is reduced. Stream flow during peak flow is reduced with less flooding and erosion as a result. After the harvesting of *A. decurrens* the yields from the following crop of tef increase. Farmers explain that the soil "become virgin" as if it was cultivated after deforestation of natural forest. Observations made by the farmers indicate that both the nitrogen fixing capacity of *A. decurrens* and the left-over charcoal on the fields (biochar) are important factors in explaining the management of soil acidity and high crop productivity. Generally the market driven afforestation in Fageta Lokoma district have diverse socioeconomic and ecological contributes leading to sustainable tree based farming system in the area.



## DR. ECKHARD AUCH

[eckhardt.auch@tu-dresden.de](mailto:eckhardt.auch@tu-dresden.de)

**Research Associate, Institute  
of International Forestry and  
Forest Products, TU Dresden**

Germany

## Education

**Assessor of forestry service**

Federal state Baden-Württemberg,  
Germany

**Doctor in natural science**

University of Freiburg, Germany

**Forestry Science**

University of Freiburg, Germany

## ABSTRACT

### **Participative Innovation Platforms (PIP) for upgrading NTFP Value Chains in East Africa**

Far reaching changes within socio-ecologic systems have created a series of new challenges in forest management and conservation. To maintain forests and to transform unwanted developments in countries of the Global South, innovative and pro-active strategies are needed for stabilizing the sustainable supply of forest products and services, and for promoting markets in rural areas. Despite the increasing recognition of the need to improve value chains in the forestry sector, a key challenge rests to identify the right approach. In search for the right solutions, the instrument, of the 'Participative Innovation Platform' (PIP) has been developed to design and to adapt continuously tailor-made solutions and strategies for effective cooperation amongst value chain actors. The theoretical foundation of the PIP instrument is rooted in the constructivist, action-oriented and social learning approach which combines the concepts of socio-ecological co-evolution with innovation systems. A PIP is an organised social space where different actors join and collaborate to solve common problems by (i) building mutual respect and trust, (ii) promoting knowledge contribution and sharing and (iii) diagnosing and analyzing their value chain, and (iv) agreeing on their course of action. A PIP can be organized as a single event or as a process with frequent meetings. In this paper, the potential role of PIPs in upgrading NTFP value chains is discussed, drawing on insights and lessons learnt from the bamboo, gum and resin value chains in Ethiopia as well as from ongoing research on timber value chains.

# YVONNE JUSTUS BENGESI

yvonnebengesi@yahoo.com

**Senior Environmental  
Officer, Bulyanhulu Gold  
Mine**

Tanzania

## Education

**M.Sc. in Hydro Science and  
Engineering**

TU Dresden, Germany

**B.Sc. Environmental Sciences and  
Management**

Sokoine University of Agriculture,  
Tanzania

## ABSTRACT

### **The world's water week 2022 theme "Seeing the Unseen: The Value of Water"**

The world's water week 2022 theme "Seeing the Unseen: The Value of Water", shades light on ground water- a resource not seen but, of great value to human livelihoods. In a semiarid, rural water catchment where mining sector is the dominant socioeconomic activity alongside farming and fisheries activities practiced by indigenous communities has put high pressure on both surface and ground water resources. Apart from that, mining in these areas also invites more urban-rural migration in search for work opportunities, creating compacted settlement without proper sanitation services. Such multisectoral activities impacts ground water resources by reducing recharge, increased drawn from mine dewatering, impairment of ground water quality from nitrates and microbial contamination and, changes in water chemistry due to reactions with sulphide minerals giving more saline and acidic water compositions. This impairs water quality for drinking. Despite the vital role ground water has in the face of climate change, this hinders adaption capacity and hence jeopardizing food security. Little research and investigation have been done on climate-ground water interactions and land use change interrelationship. Hence doing this will be a major contribution to IWRM [integrated water resource management] approaches that contributes to formulating policies and practices that will protect and preserve the ground water resource as it serves as a major alternative and substitute to the scarce surface water supply.

## WONDIMAGEGN BEKELE BILISO

wrichy@gmail.com

Technical Officer,  
International Bamboo and  
Rattan Organization (INBAR)  
Ethiopia

## Education

M.Sc. in Tropical Forestry  
TU Dresden, Germany

Natural Resource Management  
Hawassa University, Ethiopia

## ABSTRACT

### **Bamboo-based Agroforestry practice and degraded land restoration (the case of Boke District-Ethiopia)**

The Bonke District is part of the Southern Nation, Nationalities and Peoples' regional state located in the southern part of Ethiopia. The district is known for growing the highland bamboo (*Oldeania alpina*) species in the mountainous landscape within the altitude range of 2532m-3800m above sea level. The local community is dependent on bamboo forest for their livelihood through income generated from non-timber products like honey extraction and diverse use of bamboo poles for house construction, handicrafts, fencing and firewood. Gradually, the extent of bamboo forest coverage starts to decline as the result of deforestation and gregarious type of flowering in most parts of the bamboo forest coupled with settlement of the people in the uphill areas. The problem led the local community to poverty by triggering their living due to climate variability and lack of knowledge on how to restore degraded lands and use it in a sustainable way. In year 2022, INBAR's project initiatives under the Dutch-Sino East Africa Bamboo Development Program helped the local community to implement the bamboo-based agroforestry system in collaboration with the local government body. Then the local government agreed to involve 200 households and provide use access to the nearby the state owned mountainous landscape for practicing restoration activities mainly by planting bamboo and using the space between the planting pits for intercropping of annual crops like potato until the plantation reaches two years before the canopy cover. Currently, 85 ha of degraded land has been covered with highland bamboo plantation and the farmers start to harvest yield from production of the potato for consumption and as additional earning to sustain their livelihood. Plantation was done 4m\*4m spacing in block arrangement and given to selected household farmers who are responsible to manage the bamboo plantation in a sustainable manner by extracting the produce from the intercropped crops. The case study will help to depict the impact of the bamboo-based agroforestry model for socio-economic and environmental benefits.

# CHRISTOPHER CHESIRE

[chesire.chris@yahoo.com](mailto:chesire.chris@yahoo.com)

Research Scientist Botany  
Department, National  
Museums of Kenya  
Kenya

## Education

**M.Sc. in Tropical Forestry**  
TU Dresden, Germany

**B.Sc. Applied Biology**  
Kenya Methodist University, Kenya

## ABSTRACT

### **Implementation of the Shamba System (PELIS) in Kenya: A destructive system or is it just a misconceived hot air?**

Plantation Establishment and Livelihood Improvement Scheme (PELIS), formally known as the Shamba System is a strategic forestry programme implemented by the Kenya Forestry Service (KFS) to enhance success of (commercial) tree plantations while ensuring beneficial advantage to forest adjacent communities through Community Forest Associations (CFA's). The CFA's are allowed the right to cultivate agricultural crops during the early stages of forest plantation for a period of 3 to 4 years until tree canopy closes. PELIS is only implemented in plantation sites and not in natural forests. In one hand, communities living adjacent to forests have lauded the program for its role in boosting small farmer enterprises and for reduction of food deficits. In the other hand, good management of PELIS has enabled KFS to cut on maintenance costs and hence better and faster forest establishment. However, many environmental activists among other persons criticize it, with rare voice from forest ecology experts and forest managers, who would shed factual, scientific and managerial implications of this system. Opponents of the PELIS system cite forest encroachment, other illegal activities and degradation of ecosystem functions, among others as reasons for their contrary view. This presentation invites a discussion from fellow participants on this subject so as to highlight on matters including the following:

- How do forest departments implement plantations in other Eastern Africa countries?
- What changes would participants recommend for the Kenyan case?
- What are the likely results in the event that PELIS is abolished; with consideration of local communities' roles and rights, general forest silviculture by KFS and future forest cover?
- Should the KFS scale down forest plantations? What impact would it have on ecosystem services, timber demands and regional influences?



## STEFANIE FISCHER

[stefanie.fischer@tu-dresden.de](mailto:stefanie.fischer@tu-dresden.de)

PhD candidate and scientist at  
the Chair of Meteorology, TU  
Dresden

Germany

## Education

**M.Sc. in Hydrology**  
TU Dresden, Germany

**B.Sc. Hydrology**  
TU Dresden, Germany

## ABSTRACT

### **Everything is in flow – water balance components in forest ecosystems under changing conditions.**

How do forest ecosystems interact with water balance components such as precipitation, evapotranspiration, water retention and runoff regulation? Is there a need to integrate land management decision-making into the process of integrated water resources management? We will discuss how natural and cultivated forests are subject to changing conditions such as weather extremes or land use change and how this affects the local energy balance and water budget.



## PROF. DR. LUKAS GIESSEN

[lukas.giessen@tu-dresden.de](mailto:lukas.giessen@tu-dresden.de)

Chair holder of the Institute of  
Tropical and International  
Forestry, TU Dresden  
Germany

## Education

**Habilitation in International land use  
governance**

Germany

**PhD in Forestry Policy**

Georg-August University Göttingen,  
Germany

**M. Sc. in Sustainable Forestry and  
Land Use Management**

University of Freiburg, Germany

**Diploma in Forest Engineering**

Georg-August University Göttingen,  
Germany

## ABSTRACT

### **Governance of landscapes: Actors' and sectoral conflicts of interests as driving force and part of selected solutions**

This talk will introduce the concept of governance, consisting of institutional arrangements, actors' interactions and the effects of either of both. It will then extend the governance perspective from single-issue/mono-sectorial perspectives to the case of landscapes. Consequently, it will demonstrate how despite individual actors' interests, also broader interests of policy sectors are colliding when taking a broad landscape perspective. The talk will then analyse the major conflicting interests of sectors and actors in landscapes, paying special attention to the forest-water nexus, before outlining, how such a governance perspective on conflicting interests can be harnessed for developing tools for landscape management.



**ANTENSAY MEKOYA JEMANEH**

[antensaymekoya@yahoo.com](mailto:antensaymekoya@yahoo.com)

**Researcher, Ethiopia Forest  
Development**

Ethiopia

## Education

**M.Sc. in Hydro Science and  
Engineering**

TU Dresden, Germany

**B.Sc. in Meteorology Science**

Arba Minch University, Ethiopia

## ABSTRACT

### **Trees, Forests and Profits in Ethiopia: An Assessment of Tree-Based Landscape Restoration Investment Opportunities in Ethiopia**

According to the Ethiopian Forest Development [Commission], formerly called Environment, Forest and Climate Change Commission of Ethiopia (2020) report, Ethiopia's total wood product demand is projected to increase by about 27% over the next 20 years, reaching an annual consumption of 158 million cubic meters by 2033. To meet the needs of Ethiopia's growing economy, a supply gap of 4.4 million cubic meters industrial roundwood will need to be closed over the next 20 years. This challenge also presents a considerable investment opportunity, as Ethiopia can fill the gap through commercial plantation establishment, sustainable management of natural forests and expansion of the forestry sector's industry. This investment opportunity is typified by two commercial forestry enterprises established by the Ethiopian government in Oromia and Amhara. These forest enterprises engage smallholder farmers through an out-grower scheme, by creating jobs, and generating an annual revenue of \$10.5 and \$4.5 million respectively. There is enormous potential to scale up similar enterprises. The country has approximately 26.80 million ha of suitable land for new commercial forests and 190,000 ha of stateowned plantations in different regions available for development or improved management.

In short, I will try to briefly present the summary of the below document: Environment, Forest and Climate Change Commission. 2020. Trees, Forests and Profits in Ethiopia: An Assessment of Tree-Based Landscape Restoration Investment Opportunities in Ethiopia. Addis Ababa: EFCCC.

# DR. JORAM KAGOMBE

jokagombe@gmail.com

Deputy Director/ Chief  
Research Scientist, Kenya  
Forestry Research Institute  
Kenya

## Education

**PhD in Environmental Sciences**  
Kenyatta University, Kenya

**M.Sc. in Tropical Forestry**  
TU Dresden, Germany

**B.Sc. in Forestry**  
Moi University, Kenya

## ABSTRACT

### **An assessment of the policy and legislative frameworks for commercial forestry management in Kenya**

Population growth is driving demand for wood products in Kenya, which is facing a wood deficit of 10 million m<sup>3</sup>. The country is only able to meet 70% of its demand through sustainable supply, and this has caused small and medium-sized enterprises to operate below capacity. One of the reasons for this deficit is poor forest plantation management. To resolve this, commercial forestry has been suggested as a solution whereby private actors can be involved in the management of public plantation forests through forest concessions and other joint management arrangements. Public-private partnerships could provide access to private sector financial capital as well as benefits from the transfer of technological and operational efficiencies from the private sector into public forest management. It could also boost employment, income generation, and alleviate poverty. This paper explores the policy and legislative framework for commercial forestry in Kenya that includes: the Public-Private Partnership (PPP) policy, law and regulations, and sustainable forest management approaches like forest management certification and chain of custody certification for forest products. The main study approaches used in the development of this paper include literature review and content analysis of reports, government documents, strategies, and publications related to commercial forestry. The aim is to provide a critical assessment that highlights gaps and opportunities to be addressed in future policy formulation and implementation of commercial forestry in Kenya. The paper demonstrates that the Forest Management and Coordination Act (FMCA) 2016 contains most of the requirements outlined in the FAO Voluntary guidelines on forest concessions, though there is need to address some gaps such as: the harvesting value of an area, forest revenue collection, management of rescinded concessions, evaluation of the concession process, the mode of bidding, gender inclusion and independent observation. With regards to certification, although the socio-economic and environmental benefits of certification are sometimes not clear, it has played a major role in the adoption of sustainable forest management practices in forest concessions. In conclusion, to promote willingness to invest in a long term venture such as commercial forestry, there is need for secure land tenure, respect for private ownership, reliable economic guidelines and standards, transparent governance, effective measures for tackling corruption, and efficient conflict resolution mechanism.





**DR. FRED KALANZI**

[kalfrem@gmail.com](mailto:kalfrem@gmail.com)

**Senior Research Officer,  
National Forestry Resources  
Research Institute**

Uganda

## Education

**PhD in Agricultural and Rural  
Innovations**

Makerere University, Uganda

**M.Sc. in Tropical Forestry**

TU Dresden, Germany

**B.Sc. in Meteorology Science**

Makerere University, Uganda

## ABSTRACT

### **Rethinking land restoration in the fragile Mt. Elgon Ecosystem of Uganda**

Mt. Elgon is a unique ecosystem that provides many ecosystem services upon which many lives depend. As the population grows, the functions of this transboundary ecosystem are under threat from human activities such as encroaching on protected areas and cultivation of ecologically fragile areas like steep slopes, swamps and riverbanks. Already, frequent landslides and mudslides, soil erosion and declining soil fertility prove that conditions are worsening. Along with climate change, these challenges impact farm productivity among smallholder farmers. Several strategies have been devised to restore the integrity of the ecosystem in the past, and how these efforts and strategies complement each other has not been fully explored. This study presents a critical analysis of the context and past and present interventions in the Mt. Elgon ecosystem to identify bottlenecks and suggest ways to enhance the ecosystem's integrity for the local people's well-being. There is a need to shift the paradigm and address interventions that foster livelihood and ecosystem-based issues using scientific and traditional knowledge and practices.



**JOLLY KAYIITA**

[jkayiita@gmail.com](mailto:jkayiita@gmail.com)

**Farmer Managed Natural  
Regeneration Specialist, World  
Vision Uganda**

Uganda

## Education

**UNEP/UNESCO International  
Postgraduate Diploma in  
Environmental Management**  
TU Dresden, Germany

**B.Sc. in Environmental Science**  
Makerere University, Uganda

## ABSTRACT

### **Restoring Landscapes and Livelihoods in Uganda using a Farmer Managed Natural Regeneration Model**

Farming systems in Uganda cover a wide range of activities, including the production of traditional cash crops (coffee, sugar cane, cotton and tea), food crops (banana, cassava, maize, sorghum, finger-millet, rice, potatoes and beans) and raising livestock (cattle, goats, pigs and poultry). Agriculture supports the livelihoods of 73% of households in the country and constitutes 20.9% of the national GDP and 80% of foreign currency earnings; yet approximately 95% of the farmers are smallholders with landholdings averaging two hectares. Uganda has been described as one of the most vulnerable countries to climate change in Africa. Unreliable rainfall, frequent droughts, precarious water supply, seasonal fires and endemic poverty are all major climate- related issues.

Uganda is grappling with the challenge of restoring degraded land and forest landscapes that suit the ecological constraints at landscape level as well as the socio-economic circumstances of the landowners or land users, to ensure resilience under future climate uncertainties. Forest and landscape restoration (FLR) is being promoted as a feasible option through which these challenges are being addressed. This, however, is a long-term process of regaining ecological functionality and enhancing human well-being across deforested or degraded landscapes.

Farmer Managed natural regeneration practices are seen a viable solution as they have very high survival rates and are very low cost compared to interventions requiring the growing of trees in nurseries and their subsequent transplanting into cropping, grazing or forest systems. These approaches are innately pro poor and sustainable due to their low cost of adoption and are well suited to very poor farm households which lack the financial capacity to purchase farming inputs.



**DR. AWAD ELKARIM SULIMAN OSMAN KHALIFA**

**Awadelkarim6@gmail.com**

**Dean of the Institute of Gum  
Arabic and Desertification  
Studies, University of Kordofan  
Uganda**

## **Education**

**PhD in Environmental Sciences**  
University of Khartoum, Sudan

**M.Sc. in Desertification Studies**  
University of Khartoum, Sudan

**B.Sc. in Forestry and Range  
Sciences**  
University of Kordofan, Sudan

## **ABSTRACT**

### **Plantation of *Acacia senegal* in Semi-arid land of North Kordofan, Sudan**

The research was conducted in the semi-arid land of North Kordofan to assess the role of plantation *Acacia senegal* seedlings in the rehabilitation of gum Arabic belt of north kordofan as well as combating desertification for environmental balance and sustainable livelihood. The *Acacia Senegal* seedlings was produced in the nursery of the Institute of Gum Arabic Research and Desertification Studies, university of Kordofan and Distributed to the local farmers (Gum Arabic producers). Training and orientation was conducted to the farmer with regard to spacing and other silvicultural operation for the success establishment in the field.

The farmers indicating that *acacia Senegal* seedling was successfully established in their gardens. The farmer also express that their areas of *Acacia senegal* was increased as well as the production of Gum Arabic and income generation. Also the farmers revealed that the production productivity of Agricultural crops was increase in the where cultivated inside the *Acacia senegal* gardens in form of agroforestry system. Also, the farmers showed that in the area planted by *Acacia senegal*, the wind speed was decreased, good microclimate for agricultural crops, and the desert advancement was stopped.

The research concluded that *Acacia Senegal* was successful in rehabilitation of the Gum belt of North Kordofan and serving as defense against desert advancement in the semi-arid land of North Kordofan.



**DR. MOHAMED ADAM KHAMIS**

[mkhamis43@gmail.com](mailto:mkhamis43@gmail.com)

**Chief Editorial Board,  
University of Al Fashir**

Sudan

## Education

**PhD in Forest Inventory and  
Management**

Juba University, Sudan

**M.Sc. in Tropical Forestry**

TU Dresden, Germany

**B.Sc. in Natural Resources and  
Environmental Studies**

Juba University, Sudan

## ABSTRACT

### **Ziziphus spina-christi (L) (Sidr) Fruits, Domestication and Commercialization for sustaining food security and livelihoods, North Darfur State, Sudan**

Ziziphus spina-christi (L) (Sidr) Fruits, Domestication and Commercialization for sustaining food security and livelihoods, North Darfur State, Sudan North Darfur State is located in the Northern part of Darfur region in the Boarder with Libya and Chad. Most of its parts are desert and semi-desert, low rainfall and consecutive drought periods, therefore, irrigated fruits and vegetable plants are limited. Whereas there are many forest trees that produce edible fruits, which are playing an important role in the household food security, and income generation. The value of forest (fruits) in food security has not been given sufficient attention in Sudan as general and North Darfur in particular. Consequently, there are no formal interventions that seek to encourage people to use (fruits) as source of additional food and additional income generation. Study of the role of forest (fruits) in food security could provide important information for development of policies on rational exploitation of natural resources for human sustenance and to reduce the human dependency on food aid provided by the world community during crisis. Zizyphus spina-christi (L), is one of the important multipurpose trees in the area. It is growing naturally in the crop fields. Recently, people keep the trees in their fields for fruit production. The fruits are important as a supplement to daily diet, and at times of food scarcity in dry lands. Some people even tried to graft the Sudanese Sidr trees with the Sidr trees from Iran, the later is characterized by larger fleshy fruits, in attempt to enhance the local one. This indicates that the production of Sider fruits is going towards domestication and commercialization; it could be achieved with little effort and intervention by the researchers and decision makers. This study sheds the light on this issue for further discussions and investigations.



**DR. HUSSEIN MOHAMED LUSWAGA**

**huslus@gmail.com**

**Lecturer, University of  
Dodoma**

Tanzania

## **Education**

**PhD in Agriculture (Forestry)**  
Justus Liebig University, Germany

**M.Sc. in Tropical Forestry**  
TU Dresden, Germany

**B.Sc. in Forestry**  
Sokoine University of Agriculture,  
Tanzania

## **ABSTRACT**

### **Chagga Home Gardens for Rural Community Sustenance. What are services and challenges?**

Chagga is among the famous tribes in Tanzania, known for their entrepreneurial skills. In Tanzania, Chagga are found in the north eastern Tanzania on the foothills of Mount Kilimanjaro. Traditionally, the Chagga in rural communities depend on their home gardens commonly known as Chagga Home Gardens (CHG) for livelihoods as well as other ecosystem services. Due to population pressure over the years, the Chagga parcels of land have been decreasing in size and at present the average size is 0.68 hectares. The CHGs contain a large diversity of fauna and flora species and have been a centre of attention for research. The interesting question is how the CHGs respond to the environmental pressure on its stability? Based on the literature, this discussion paper intends to raise some points on CHGs in terms of structure diversity, ecosystem services, role in livelihood and culture and contemporary challenges facing CHGs. At the end the contribution intends to raise discussion and reflection points on the role of agroforestry systems on bringing services that can sustain communities in rural communities.



## DR. FRANCIS SEVERINI MOYO

[Francis.moyo@nm-aist.ac.tz](mailto:Francis.moyo@nm-aist.ac.tz)

**Lecturer, The Nelson Mandela  
Institution of Science and  
Technology**  
Tanzania

### Education

**PhD in Natural Sciences and  
Forestry Management**  
TU Dresden, Germany

**M.Sc. Agriculture Development  
and Environmental Forestry**  
Wales University, UK & Copenhagen  
University, Denmark

**M.Sc. Dry land Biodiversity**  
Addis Abba University, Ethiopia

**B.Sc. in Forestry**  
Sokoine University of Agriculture,  
Tanzania

## ABSTRACT

### **Contesting colonial conservation through social struggles: A case of Tanzania**

Colonial legacies in conservation, including militarisation of conservation, contribute to the making of environmental subjects by considering livelihoods strategies in Africa as violent and unsustainable for biodiversity protection. Militarised conservation narrowly redefines conservation priorities by focusing on ecological restoration and income generation for states. It weakens democratic forums where rural peoples' access rights are articulated and negotiated, accelerating rural poverty. Militarised conservation thrives in authoritarian regimes that coerce state conservation experts to become obedient to the ruling political elites, and silence opinions by local experts to control natural resources and the benefits thereof. It fits with and reflects wider political and economic dynamics in Africa; that is, authoritarian, rent seeking, and a widespread undemocratic processes and abuses of human rights. I build on existing environmental justice scholarship to demonstrate how social movements across the globe can connect disparate and dispersed place-based struggles to decolonise conservation in Africa.

# ASABENEH MUNUYEE

alemayhuasabeneh@yahoo.com

**Forestry and Natural resource  
economist, Bahir Dar Centre**

Ethiopia

## Education

**M.Sc. in Natural Resource  
Economics and Policy**

Hawassa University, Ethiopia

**M.Sc. in Tropical Forestry**

TU Dresden, Germany

**B.Sc. in Forest Management  
and Utilization**

Hawassa University, Ethiopia

## ABSTRACT

### **Eucalyptus Woodlot Adoption and Its Determinants in Mecha District, Northern Ethiopia**

The area of Eucalyptus plantations has now expanded greatly and growing Eucalyptus at a farm level in a form of woodlot primarily for income generation has become popular among Ethiopian smallholder farmers. Despite its wider use/practice, studies and systematic documentation on the adoption and economic significance are scarce to inform evidence-based policymaking. The aim of this study was to investigate factors affecting the adoption of Eucalyptus woodlot in Mecha District, Northern Ethiopia. A multistage sampling procedure was used to select 186 sample respondent households from three purposively selected villages of the district. Key informants and in-depth interviews, focus group discussions, as well as direct observations, were used and complemented by secondary data. A double hurdle econometric model was used to identify factors influencing households' adoption decisions and the adoption intensity of Eucalyptus woodlot. The result shows number of parcels of land, off-farm work engagement, credit availability and farmers' perception towards woodlot production significantly influence household adoption decisions. Whereas, family size (negatively), land holding size, number of parcels of land, market access, adjacent farm and farmers' perception towards Eucalyptus woodlot production were found to be significantly influencing the adoption intensity of Eucalyptus woodlot. Moreover, lack of support and training, lack of segregation of land and limited technologies were the major constraints. In general, the household's decision to plant Eucalyptus has been influenced by different demographic, socioeconomic, institutional and physiological factors. Fostering support and training, cluster planting, providing alternative options for the farmers, technology adoption, improving and implementing Eucalyptus policies and enforcing rules and regulations are areas that need policy attention to improve the livelihood of the communities.

# JAPHET NOAH MWAMBUSI

[japhet.mwambusi@sua.ac.tz](mailto:japhet.mwambusi@sua.ac.tz)

**Assistant Lecturer, Sokoine  
University of Agriculture**

Tanzania

## Education

**M.Sc. in Tropical Forestry**  
TU Dresden, Germany

**B.Sc. in Forestry**  
Sokoine University of Agriculture,  
Tanzania

## ABSTRACT

### **The Silviculture of Woodlots of Smallholder Forest Producers in Mufindi District, Tanzania: Knowledge and Treatments**

Smallholder forestry is experiencing many challenges like limited understanding of silvicultural treatments to impact the quality and performance of woodlots. This study determined the silvicultural treatments of smallholders in Mufindi district by interviewing 78 respondents then assessing the silviculture of 78 woodlots in 13 sampled villages. The study found out that more than 80% of smallholders had a certain level of understanding of some treatments like weeding and pruning. A major source of knowledge was personal experiences from fellow farmers and Sao Hill Forest Plantation. Based on market demand, *Pinus patula* and *Eucalyptus grandis* were the most planted species in the woodlots. Smallholders reported planting trees at a spacing of 3 x 3 m without clear knowledge on factors to consider for initial spacing. Also, reported harvesting trees for sawn timber at 8-13 years and transmission poles at 6-8 years. Contrary to knowledge, the assessment found out that majority of woodlots had a spacing of 2.5 x 2.5 m. Many woodlots were poorly pruned and surrounded by shrubs which affected timber quality. Generally, woodlots management was unsatisfactory due to insufficient technical knowledge. Thus, more extension services and trainings are needed to strengthen smallholder forestry to ensure sustainable tree farming.





**DR. LAMECK KABAMALIKA NKHONJERA**

[lameck@flametreeminitiative.org](mailto:lameck@flametreeminitiative.org)

**Executive Director, Flame Tree Initiative**

Malawi

## Education

**PhD in Sustainable Energy Science and Engineering**

Nelson Mandela African Institution of Science and Technology, Tanzania

**M.Sc. in Environmental Sustainable Development**

National Central University, Taiwan

**B.Sc. in Mechanical Engineering**

University of Malawi, Malawi

## ABSTRACT

### **Sustainable Energy Access: A catalyst to landscape restoration and water management in rural Malawi.**

The high increase in population over the past two decades in Malawi has contributed to environmental degradation. Out of about 20 million Malawians, 82% live in rural areas. They depend on subsistence agriculture for a living, whereas firewood and charcoal are predominantly used for cooking. The source of water for domestic use is from wells (protected and unprotected) and surface water. The clearing of land for cultivation as well as unsustainable harvesting of biomass for cooking are the main contributors to land degradation. This study argues that energy poverty is one of the salient drivers of the perceptible environmental degradation in Malawi. With access to modern energy, the economic activities in the rural can increase and thus uplifting low income levels of the rural masses and hence enabling them to become good stewards of the natural resources around them. With access to sustainable energy, information and knowledge sharing of the environmental issues in the rural communities can be eased, thus assisting in behavioral change of those who unknowingly cause harm to the environment. With access to energy, smart agriculture in the rural areas is possible and thereby reducing pressure on search for cultivation land as adequate yields can be obtained from the small piece of land. With access to energy, efficient water management is possible. It is therefore concluded that integrating energy access in the landscape restoration and water management programs in rural Malawi has far reaching impacts.



**DR. SEKELA SIMON TWISA**

sekelat@yahoo.co.uk

Senior Tutor, Water Institute

Tanzania

## Education

**PhD in Integrated Management of Water, Soil and Waste**

UNU-FLORES & TU Dresden,  
Germany

**M.Sc. in Integrated Water Resource Management**

University of Dar es Salaam

**B.Sc. in Environmental Science and Management**

Sokoine University of Agriculture,  
Tanzania

## ABSTRACT

### **Analysis of land use and land-cover pattern to monitor dynamics of Ngorongoro world heritage site (Tanzania) using hybrid cellular automata-Markov model**

Assessment of land-use and land-cover (LULC) change of any region is one of the prominent features used in environmental resource management and its overall sustainable development. This study analyzed the LULC changes of Ngorongoro Conservation Area (NCA) and its surroundings using Remote Sensing and Geographical Information System integrated with Cellular Automata-Markov model. The LULC maps for the years 1995, 2005, and 2016 were classified using unsupervised and supervised classification procedure, and projected for 2025 and 2035 under business-as-usual scenario using the CA-Markov model. The results indicated maximum gains and losses in cultivated land and woodland in the study duration, respectively. The projected LULC for the period 2025 to 2035 showed a reduction in bushland, forest, water, and woodland, but an intensification in cultivated land, grassland, bare land, and the built-up area. The natural forests with high environmental values were found to be continuously declining under the current land management trend, causing the loss in the NCA's ecological values. For sustainable management, the authorities must reach conciliation between the existing LULC patterns change and ecosystem services monitoring. A rational land use plan must be made to control the increase of cultivated land and built-up area counting a rational land use plan and ecosystem services protection guidelines. Decision makers should involve stakeholder to support improved land use management practices for balanced and sustainable ecosystem services strategies.

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German Academic Exchange Service



# SEMINAR ADDRESS

## Makerere University

College of Agricultural & Environmental Sciences

Principal's Office CAES

P.O. Box 7062, Kampala, Uganda

+256 414 542277

principal.caes@mak.ac.ug

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