SOKOINE UNIVERSITY OF AGRICULTURE

# DIRECTORATE OF POSTGRADUATE STUDIES, RESEARCH, TECHNOLOGY TRANSFER AND CONSULTANCY (DPRTC)

# 3RD SUA SCIENTIFIC CONFERENCE ABSTRACTS

**23rd – 24th MAY 2023, Edward Moringe Campus**

## THEME:
## ENABLING ENVIRONMENT FOR AGRICULTURAL TRANSFORMATION

**2023**

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# ABSTRACTS

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# BACKGROUND

Sokoine University of Agriculture and her collaborators are committed to contribute to sustainable development to attain Tanzania National Development Priorities and Sustainable Development Goals through provision of quality Research, Outreach and Consultancy services. Researchers and collaborators of SUA conduct various applied research activities to address challenges in agricultural productivity in crops and livestock, livestock and human health, socio-economic dynamics, climate change, natural resources management, education and environmental conservation. To commem- orate, celebrate and honour the life and legacy of the late Hon. Edward Moringe Sokoine (former Prime Minister of the United Republic of Tanzania), SUA wishes to share the generated knowledge, innovations, solutions, and findings to the national and international scientific community. In this spirit, SUA will hold the 3rd SUA Scientific Conference with the Theme "ENABLING ENVIRONMENT IN AGRICULTURAL TRANSFORMATION" within the Sokoine Memorial Week.

The goal of the conference is to bring up scientific arguments and solutions to agricultural transformation by demonstrating enabling environment that encompasses factors that have a positive influence but are controlled by scien- tific evidence and policy domains for youth and other stakeholders' engagement in the agricultural value chain. Today's agriculture routinely uses sophisticated technologies and tools such as robots, temperature and moisture sensors, aerial images, artificial intelligence, Internet of Things, GPS technology etc. These advanced technologies and tools as well as precision agriculture and robotic systems allow businesses to be more profitable, efficient, safer, and more environmen- tally friendly. The policy domain fosters collaboration between the public and private sectors, and builds social capital.

# THE ORGANIZING COMMITTEE

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# ORAL PRESENTATION

## Sub-Theme 1:
## Transformation Technologies and Innovations

# AI - driven Adaptive Smart Systems for Future Agricultural Production and Food Systems in Africa

**Alcardo Alex Barakabitze[1], Joan Jonathan[1], Camilius Sanga[1]**

[1]AI4D Research Group, Department of Informatics and Information Technology
Sokoine University of Agriculture, P.O Box 3038, Morogoro, Tanzania.

Corresponding Author E-mail: alcardo.alex@sua.ac.tz

*Digital and data-driven agriculture using Artificial Intelligence (AI), Blockchain, big data analytics, remote sensing, and Internet of Agro -Things (IoATs) in farming industry necessitates the integration of various tools across the entire agricultural production system, as well as the use of enhanced systems-based techniques (i.e., a System of Systems based approach (SoS)) to ensure that it is scalable, adaptive, and sustainable. This paper provides a novel digital and data-driven techniques for improving agriculture productivity of small-holder farmers in Africa using ML and IoATs. We provide our experience of developing digital agriculture platforms, climate-smart agriculture, and farming as a business approach for farmers in Tanzania. We present key technologies and applications in digital and data-driven agriculture including: (a) Internet of Things (IoT) based agricultural systems, (b) blockchain for food supply chain monitoring and management, (c) AI/ML for increasing agricultural productivity, and (d) remote sensing techniques for digital agriculture (e.g., imagery treatment and prediction in mapping).*

*We present a real-time implementation of ML –driven IoATs architecture for monitoring and predicting crop yields for farmers at a district and farm –level using machine learning techniques. The agricultural yield data was collected from the Ministry of Agriculture for the past 10 years (2012- 2022) while the agricultural IoT data was collected from SUA farming sites. We use multisource data (climatic data, weather data, agricultural yields, and crops soil data) to help farmers and decision-makers predict the annual maize and sorghum crop yields in Tanzania. The preliminary results indicates that the ML-IoATs can monitor the crops growth through key performance indicators (temperature, humidity, soil moisture etc) and enable a farmer to make informed decisions. We provide future challenges, trends, and research directions of digital and data-driven agriculture in the context of Africa.*

***Keywords:*** Artificial Intelligence, Machine Learning, IoTs, Remote Sensing, Digital Agriculture

# Small-Scale Chicken Farmers' Perception of Use of Social Media to Access Market Information in Arusha City-Tanzania

***Juma Almasi[1], Ahmad K. Athman[2], Gosbert L. Shausi[2] and Dismas L. Mwaseba[2]**

[1]Department of Project Planning and Management-Tengeru Institute of Community Development, Tanzania
[2]Department of Agricultural Extension and Community Development-Sokoine University of Agriculture, Tanzania

*almasijuma@yahoo.co.uk

*This study examined small-scale chicken farmers' perceptions of using social media to access market information in Arusha City-Tanzania. Data were collected between June and August 2022 from 260 small-scale chicken farmers (SSCFs) in Arusha City. 130 were served by Kuku Uchumi, and 130 were non-Kuku Uchumi beneficiaries selected using a simple random sampling technique. Both quantitative and qualitative data were collected using questionnaire and key informant interview guide, respectively. Descriptive statistics, the chi-square test, and the ordinal logistic regression model were used to analyse quantitative data. While, qualitative data were transcribed from audio and translated from Kiswahili to English, and extracts were developed. According to the study, SSCFs who use WhatsApp, both Kuku Uchumi and non-Kuku Uchumi beneficiaries, have positive perception of using social media to access market information than those who do not. Furthermore, SSCFs (both Kuku Uchumi and non-Kuku Uchumi beneficiaries) who do not use Facebook and Instagram to access market information have negative perception than those who do. Generally, it was also revealed that Kuku Uchumi beneficiaries have a more positive perception about social media use than their non-Kuku Uchumi counterpart. The study concludes that SSCFs have a positive perception toward the use of social media in accessing market information. Thus, extension agents may use social media platforms to provide information on chicken production. Other SSCFs whose perception toward the use of social media to access market information is negative may be capacitated on the use of social media in order to access market information.*

***Keywords:*** Perception, small-scale chicken farmers, social media, Kuku Uchumi, market information

# Determinants of Digital Literacy among Smallholder farmers: A case of Hai and Moshi Districts, Kilimanjaro-Tanzania

**Hassani, M.S.[1], Mohamed, H.I[2], Urassa, J.K[1], Muhanga, M.I.[3]**

[1]Department of Policy, Planning and Management, College of Social Sciences and Humanities (CSSH), Sokoine University of Agriculture (SUA), P.O.BOX 3035, Morogoro, Tanzania
[2]Department of Language Studies, College of Social Sciences and Humanities (CSSH), SUA, P.O.BOX 3035, Morogoro, Tanzania
[3]Department of Development and Strategic Studies, College of Social Sciences and Humanities (CSSH), SUA P.O.BOX 3024, Morogoro, Tanzania

Corresponding Author email: mariamhassani2719@gmail.com

*The fourth industrial revolution provides an opportunity for farmers to use information communication technologies (ICT) to access agricultural information for the transformation of their subsistence farming and consequently poverty reduction and increased food security in rural areas. The extent to which this opportunity has been tapped by smallholder farmers requires empirical investigation. Therefore, the current study determines smallholder farmers' digital literacy and the factors associated with the same. The study adopted a cross-sectional research design whereby data were collected using a structured questionnaire from 200 purposefully selected smallholder farmers. In addition, focus group discussions and key informant interviews were used to collect complementary data. Data were analyzed using IBM- SPSS (Version 20) and STATA software. Study findings show that 74.5% and 25.5% of the farmers fall under the category of low and high digital literacy levels respectively. Study findings further show that one's sex (p=0.068), training on ICTs (p=0.013), access to social media (p=0.001), extension services (p=0.006) and support from NGOs (p=0.000) were significantly associated with farmers' digital literacy. It can thus be concluded that the majority of the smallholder farmers had a low level of digital literacy due to a lack of training and skills to make good use of ICT. Therefore, it is hereby recommended that the agricultural and ICT departments and other interested stakeholders should collaborate and conduct awareness campaigns and training in rural areas to enhance digital literacy among smallholder farmers improved. Thus, enabling smallholder farmers to use ICT and transform their agricultural production*

***Keywords:*** Digital literacy, ICT, Smallholder farmers, agricultural productivity

# Digitalization of Agricultural Information System: Lesson from Agricultural Routine Data System in Tanzania

**Judith Samwel Kahamba[1]*and Respikius Martin[2]**

[1]Department of Development and Strategic Studies, Sokoine University of Agriculture, Tanzania
[2]Department of Agricultural Extension and Community Development, Sokoine University of Agriculture, Tanzania

*Corresponding author Email: judysamwel@gmail.com

*Many countries in Africa including Tanzania have fully or partially digitalized their agricultural information systems to benefit from the advantages offered by the digital systems which include improving efficiency and productivity among others. However, the performance of the adopted digital systems is not fully investigated and understood. Using the case of the Agricultural Routine Data System (ARDS) this paper seeks to assess how the system is performing in terms of its strengths and weaknesses in order to draw lessons that can help design effective digital agricultural information systems. To gather data, a survey of 30 agricultural extension agents working at ward and village levels was conducted. Also, additional data were collected through in-depth interviews with six key informants. The study findings reveal that ARDS's strengths are its capacity to capture essential agricultural-related information using a standardized form. The system's opportunity comes from the high demand for agricultural data by the government and other development stakeholders to inform the agrarian sector development planning. Combining information for crops and livestock and a poor communication system are the system's main weaknesses. In general, the performance of the ARDS is good as it is the main system used to collect agricultural information on a monthly basis. However, the system faces many challenges which affect the quality of data collected. The main lesson is that the participation of stakeholders is important in developing any agricultural information system. To improve the performance, the paper recommends periodic evaluation of the system and training for all people who use the system.*

***Keywords:*** Agriculture, information system, evaluation

# Adoption of Artificial Intelligence and Precision Control Technologies in Agriculture as a Tool to Increase Food Security in Tanzania: An Overview

**Baitu, G.P.[1]*, A.N.Towo[1], A.J.Kasenene[2] and K.G.Fue[3]**

[1]University of Dar es Salaam, College of Agriculture and Food Technology, Department of Agricultural Engineering.
P.O. Box 35091 & 60091 Dar es Salaam - Tanzania
[2]Tanzania Agricultural Research Institute – Uyole. P.O. Box 400, Uyole, Mbeya - Tanzania
[3]Sokoine University of Agriculture, School of Engineering and Technology
Department of Agricultural Engineering. P.O. Box 3000, Chuo Kikuu, Morogoro - Tanzania

*Corresponding author e-mail: prudencegeofrey@gmail.com

*This review paper presents an overview of the national adoption of artificial intelligence (AI) and precision control technologies in Tanzanian agriculture and their potential to increase food security in Tanzania. Agriculture is the backbone of the Tanzanian economy. Nevertheless, the sector faces numerous challenges, including low productivity, climate change, and limited access to technology which makes it impossible to attain sustainable development goal 2. The population of Tanzania is projected to double by 2050, which will intensify the current situation of food shortage. Fortunately, there has been a growing interest in using AI and precision control technologies to improve productivity, efficiency, and sustainability in agriculture, which is also stated in the third Tanzanian Five-Year Development Plan (FYDP III). This is possible now due to the increased computational capability of machines that can utilize data efficiently for decision-making. This systematic review paper highlights the current state of the adoption of these technologies in Tanzanian agriculture, examines challenges that hinder their uptake, and proposes potential solutions. The review draws on existing literature and case studies to identify the key barriers to adoption, including limited access to data, inadequate infrastructure, insufficient financing, and low levels of digital literacy among farmers. The paper also explores potential solutions to these challenges, including increasing investment in infrastructure, building capacity among farmers, and strengthening public-private partnerships. Overall, this review provides insights into the potential of AI and precision control technologies in transforming agriculture to increase food security in Tanzania and the need for collaborative efforts to overcome adoption challenges.*

***Keywords:*** Tanzanian agriculture, food security, artificial intelligence, precision agriculture.

# Production Efficiencies of Mobile Sawmilling Industries in Tanzania

**Lynder Gesase[1]*, Ernest Mauya[2], and Gabriel Mangi[3]**

[1]Department of Forest Engineering and Wood Sciences, College of Forestry, Wildlife and Tourism,
Sokoine University of Agriculture, Box 3012, Morogoro Tanzania.

Correspondence: lgesase@sua.ac.tz

*Sawmilling operations represent one of the most important phases of the wood supply chain because they connect the conversion flow of raw materials into finite products. However, to date very few studies have been reported in Tanzania with few samples which can be used to generalize the countrywide potential application of these machineries. In this study, lumber recoveries for mobile sawmillings operating in four different locations in Tanzania were estimated. A total of 11 mobile sawmillings were studied. On each mobile sawmilling, data on log sizes including bottom, mid, and top diameter as well log lengths were recorded. Data were analyzed using descriptive statistics presented using error bars and tables. The results showed that, the number of logs per machinery was ranging from 5 to 40 with average 28 logs. The mid diameter of the logs was ranging from 8 cm to 44.60, with average value of 20.58. The number of lumber produced for each log was varying from 1 to 9, with the average of 3 across all the sites. The lumber recovery (%), was varying depending on the machine, machine type, source of logs and sites. For all the machineries, the average lumber recovery (%) per machinery was ranging from 16.15% to 62.79 %. Among the three mobile sawmilling machinery, Horizontal band mill (woodmizer) turned up to have relatively higher lumber recovery (56%) as compared to the roller bench circular sawmills (Ameck and Ding-Dong). Results from ANOVA indicated that, there was statistical significant effect of, site, source of lumber, machine type, and size of logs on the lumber recovery (%). The study concluded that, mobile sawmilling in Tanzania produces sawn timber at an acceptable range of lumber recovery. However, further studies are recommended to further examine the technical and cost aspects of the mobile sawmilling*

***Keywords:*** lumber, sawmili, production, efficiency, viability

# Towards human-elephant conflicts mitigation: An Artificial Intelligent tool for reducing elephant crop raiding in Tanzania

**Jamal Banzi[1]*, Robert Byamungu[2], Aman Kitegile[2] and Alfan Rija[2]**

[1]Department of Tourism and Recreation, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Department of Wildlife Management, Sokoine University of Agriculture, Morogoro, Tanzania

*jamalbanzi@sua.ac.tz

Human-elephant conflicts resulting from crop raiding are escalating in Tanzania, impacting both the species' survival and community livelihoods and food security in many rural communities bordering protected areas across Tanzania. Despite the increasing application of various strategies such as acoustic deterrents (e.g., farm guards, yelling, setting off firecrackers), light-based deterrents (e.g. spotlights), agricultural-based deterrents (e.g. chill-greased fence, chilli dung, etc.) to mitigate human-elephant conflicts and prevent crop destruction on farms, yet crop raiding by elephants continues to increase suggesting that these strategies are less effective. This paper presents an Artificial Intelligence (AI) based technology (Elephant-eye) that helps in the early detection of elephants before reaching the farms thereby enhancing quick deterrence and prevention of crop raids. Field data collection was conducted by capturing two thousand images of elephants from Mikumi, Tarangire, and Saadani National Parks. We utilized animal recognition convolutional neural networks based on MobileNetV3 specifically tuned to mobile phone processors through the optimization, modification, and improvement of the lightweight MobileNets. We conducted a laboratory experiment, whereby training was set to 50 epochs using the Adam optimizer, the learning rate was set to 0.002, and the batch size was 128. To check the effectiveness of the elephant eye, we tested the model in the laboratory with 1024 images of different qualities taken from different real-world locations. Our laboratory tests before field piloting show that the developed model is capable of detecting elephants with an accuracy of 96.45%, indicating that the elephant eye tool has great potential in curbing human-elephant conflicts. Further, the validation test accuracy reached 75.05% in the laboratory, demonstrating its capacity in detecting live elephants and reducing elephant raids on crops–enhancing harvests, hence ensuring rural household's food security. Finally, the sensitivity analysis in the laboratory suggests that the elephant eye technology can be integrated with a swift feedback mechanism to control centers to capture and relay real-time crop raid incidences, particularly in elephants infringed rural areas.

***Keywords:*** Animal Detection, Convolutional Neural Networks, Crop-raiding, Deep Learning, Feature Extractor.

# Characteristics, performance, innovation propensity of bamboo entrepreneurs and empirical factors affecting their innovativeness: A case study of Southern Highlands of Tanzania

**Paulo J. Lyimo[1]*, Japhet S. Japhet[2], Gladness E. Kaaya[2], Frank M. Ntenga[2], Kosei Masaka[3], Gimbage Mbeyale[4] and Suzana Nyefwe[5]**

[1]Department of Ecosystems and Conservation, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3010, Chuo Kikuu, Morogoro, Tanzania.
[2]Bamboo and Rattan Association of Tanzania (BARATA), P.O. Box 3100, Morogoro, Tanzania.
[3]Department of Forest and Environmental Economics, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3011, Chuo Kikuu, Morogoro, Tanzania.
[4]Department of Forest Resources Assessment and Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3013, Chuo Kikuu, Morogoro, Tanzania.
[5]Nelson Mandela African Institution of Science and Technology (NM-AIST), P.O. Box 447, Arusha, Tanzania

* Corresponding Author Email: paulo.lyimo@sua.ac.tz

*Throughout the globe, bamboo is the most significant non-timber forest product (NTFP). It provides rural residents with employment opportunities in the fields of raw material collection, processing, and marketing. Bamboo has unique mechanical and chemical qualities that make it a material which many enterprises can use. Bamboo-based innovations are developed into eco-innovations that improve eco-efficiency and the circular economy. In Tanzania, bamboo resources are less investigated, the innovation scope and its efficiency are little recognized. This study aimed at determining characteristics, performance, innovation propensity of bamboo entrepreneurs and factors which influence their innovativeness in Tanzania's Southern Highlands. Households involved in bamboo value chains were selected using systematic random sampling by proportional allocation using a sampling frame that was generated with the help of village leaders. The results showed that traditional knowledge and one's own ideas were the primary sources of innovation, as evidenced by their percentage contributions, 42.27% and 30.28% respectively. Local competitors came in second with a 10% contribution, while other sources of innovation such as the internet, mass media, and expert advice each contributed less than 10% to innovation. The location of raw material supply was the most crucial variable for economic performance as stated in percentage, top three factors for raw material location, were short distance (79.63%), cheap (75.93%), and large culm size (37.04%). The final two were good aesthetics (34.0%) and just by tradition (33.33%). Therefore, bamboo resources make a significant contribution for raising people's living standards and achievement of sustainable development goals.*

***Keywords:*** Bamboo, entrepreneurs, innovation, performance and Tanzania.

# Alternative Methods for Harvesting of Mandarin (*Citrus reticulata* Blanco.) Fruits for Small-Scale Farmers in Tanzania

**Ramadhani O. Majubwa[1]*, José X. Chaparro[2], Donald J. Huber[2], Mark A. Ritenour[3], Charles A. Sims[4], Theodosy J. Msogoya[1], and Steven A. Sargent[2]**

[1]Crop and Horticultural Sciences Dept., Sokoine University of Agriculture, P.O. Box 3005, Morogoro – Tanzania.
[2]Horticultural Sciences Dept., Univ. of Florida/IFAS, P.O. Box 110690, Gainesville, FL 32611
[3]Indian River Research and Education Center, Univ. of Florida/IFAS, 2199 S. Rock Road, Fort Pierce, FL 34945.
[4]Food Science and Human Nutrition Dept., Univ. of Florida/IFAS, Gainesville, FL 32611.

*Corresponding author Email: omaryrama@sua.ac.tz

*About 79.1% of citrus growers in Tanzania use Drop-Catch (DC) method for harvesting mandarin fruit rendering them unmarketable. A study was conducted in 2015/2016 harvest seasons to evaluate effectiveness of the introduced Cutting pole (CP) and ladder plus bag (L+B) fruit harvesting approaches against the DC. One factor experiment in a completely randomized block design (CRBD) in three replications used. Fruits from each harvest method were packed in stackable plastic crates and stored for 12 days at ambient conditions (25 oC, 85±3% RH). Significantly ($P < 0.05$) higher fruit drop were on CP (19.16%) than on the L+B (6.4%) or DC (4.4%). CP required 48.52 minutes (min)) to harvest 250-300 fruits compared to 15.05 min, 13.10 min for CPD and L+B, respectively. Fruit plugging was 6.8% on CP compared to 0.3% and 0.5% on CPD and L+B, respectively. Percentage weight loss per day was significantly higher on day three (3.28%) than on successive days of storage (1.82%). Fruit decay was higher on CP (16.32%) than on L+B (12.3%). Soluble Solid Content (SSC) on fruits from DC was significantly higher on day 8 (10.7 oBrix) than on day 0 (9.8 oBrix), and day 6 (9.6 oBrix) of storage. For the L+B, SSC was significantly higher on day 12 (10.2 oBrix) than on day 0 (9.7 oBrix). A farmer can save more money when using the L+B over CP than over DC. L+B recommended over CP and DC for reduction of harvest/postharvest loss, improving quality of mandarin fruits along the value chain.*

***Keywords:*** Citrus harvesting methods, Postharvest handling, Mandarin fruits, Fruit quality, Ladder Plus Bag harvesting method

# Potential of Multi-Competence Based Learning for Sustainable Urban Ecology Management: A case study of Challenge-Based Pedagogical Approach

**Ernest Mauya[1]*, Theofrida Maginga[2], Justo Jonas[1] and Sami Madundo[1]**

[1]Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Department of Informatics and Information Technology, Sokoine University of Agriculter, Morogoro, Tanzania

*mauya@sua.ac.tz

*Multi-Competence Learning (MCL) is a challenge-based learning pedagogy (CBL) approach that focus on the engagement of multidisciplinary student teams in active collaboration with mentors, stakeholders, and peers to come up with evidence-based, digital solutions that has the potential of sustainable impacts. In this study evidence-based digital solutions which aimed to address societal issues using geospatial data were developed using MCL approach implemented by 25 undergraduate students from Sokoine University of Agriculture in Tanzania. DigiCampus e-learning platform was used to deliver background materials that guided students towards problem identification and exploration of digital solutions through open data and Geospatial tools. A novel approach of this MCL methodology was the development of solutions by students which could support sustainable urban ecology management by using problem-based approach. The inclusion of mentors from diverse background, including informatics, geospatial sciences, and societal industry experts from municipal and forestry sectors further enhanced CBL pedagogical approach. The provided feedbacks were vital in supporting students to come up with a range of applications. These proposed evidence-based solutions, ranges from geospatial analysis of flood occurrence, green infrastructure, land cover change, digital tree checklists, and evaluation of the urban tree diversity for carbon stock management and climate change mitigation. These developed solutions were then presented to different stakeholders for potential integration into sustainable urban ecology management processes. Our findings emphasize on the efficiency of the MCL approach in promoting multidisciplinary collaboration, enhancing problem-solving skills, and contribution to sustainable development in Tanzania.*

***Keywords:*** Multi-Competence Learning, Tanzania, Geospatial, Data, Digicampus (max 5 key words)

# Sub-Theme 2:
# Vector and Pest Management, Animal and Public Health Management

# Detection and Characterization of Zoonotic Bartonella spp in Rodents and Shrews Ectoparasites from Kigoma and Morogoro Regions-Tanzania

**Ginethon G. Mhamphi[1,2,3]* Venance T. Msoffe[4], Charles M. Lyimo[5], Abdul S. Katakweba[2,3], Apia W. Massawe[2,3], Erick V. G. Komba[5], Ladslaus L. Mnyone[6]**

[1]Department of Wildlife Management, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Institute of Pest Management, Sokoine University of Agriculture, Morogoro, Tanzania
[3]The Africa Centre of Excellence for Innovative Rodent Pest Management and Biosensor Technology (ACE IRPM & BTD), Sokoine University of Agriculture Morogoro, Tanzania
[4]Mkwawa University College of Education, Iringa Tanzania
[5]Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture, Morogoro Tanzania
[6]Livestock Research Institute, Ministry of Livestock and Fisheries development, Dodoma, Tanzania
[7]Ministry of Education, Science and Technology, Dodoma Tanzania

*Correspondence author e-mail: mhamphi@sua.ac.tz

*Bartonellosis is a vector-borne zoonotic disease transmitted by hematophagous arthropods. This study isolated and characterized Bartonella spp. from ectoparasites of rodent and shrew that were trapped form indoor, perido-mestic, farms, fallow and natural habitats. A total of 141 ectoparasites pools of mites (Laelaps spp.), fleas species, ticks (Haemaphisalis spp.) and lice (Haplopleura spp.) were analyzed by Conventional PCR targeting the gltA gene at 379 bp. and sequenced for Bartonella spp. identification and phylogenetic relatedness. Bartonella DNA was found in 34.8% out of 141 pools of ectoparasites tested. Mites detected 32.9%, fleas 40%, ticks 12.5% and lice detected 50%. There were statistically significant differences in Bartonella spp. DNA detected among the habitats sampled ($\chi^2 = 8.589$, $df = 3$, $p = 0.035$), and the ectoparasites species detected ($\chi^2 = 16.5646$, $df = 7$, $p = 0.0243$). Phylogenetic and haplotype analysis revealed a sparse distribution of Bartonella spp. genotypes from different clades, evolutionary closely related to Bartonella spp. from Uganda, Kenya and South Africa. Each of the detected genotypes showed different lineages with independent haplotypes, although the majority of Bartonella spp. from fleas share the same haplogroup. This study discovered two Bartonella spp. in fleas from house rats and field rats related to zoonotic; Bartonella elizabethae and Bartonella tribocorum. This suggests a possible connection role for the transmission of bartonellosis in human settlements. Therefore, consideration for screening humans, companion animals and livestock was suggested, since the vectors and reservoirs are widely spread in many rural settings of Tanzania where there are higher interactions.*

***Keywords:*** Bartonella, gltA, reservoirs, rural settings, habitats, regions, Tanzania

# Mycoplasma gallisepticum and Infectious Bronchitis virus infections in small-scale commercial chicken production

***C. Mathew, E.B. Mngumi, A.B. Matondo**

Department of Veterinary Anatomy and Pathology, College of Veterinary Medicine and Biomedical Sciences,
Sokoine University of Agriculture, Morogoro, Tanzania
*colethamat@sua.ac.tz

*Commercial poultry production is important for economic growth and food security; however, its growth is limited by several factors including diseases. Lack of sufficient evidences on presence of diseases negatively affect planning for prevention. Although Mycoplasma gallisepticum and infectious bronchitis virus (IBV) are among the common pathogens of respiratory diseases in chicken, sufficient information is lacking to ascertain their presence in Tanzania. A cross sectional study was carried out in Kibaha District and Morogoro Municipal Councils to investigate presence of antibodies against Mycoplasma gallisepticum and IBV in chicken sera using ELISA kits. A total of 198 blood samples were collected from 3-5 randomly picked chickens from 45 farms. In addition, a semi structured questionnaire was administered to 120 selected farmers to collect information on potential risk factors for respiratory infections. Individual seroprevalence of Mycoplasma gallisepticum was 23.2% (n=56) and 9.2% (n=142) for Kibaha and Morogoro respectively, whereas seroprevalence for IBV was 64.3% (n=56) and 73.2% (n=142) for Kibaha and Morogoro respectively. Nine farms (n=45) had evidence of exposure to both Mycoplasma gallisepticum and IBV. Farmers housing chicken with other types of poultry in the same houses had higher risk of Mycoplasma gallisepticum (OR 3.5, 95% CI 0.75-16.32) and IBV (OR 11.7, 95% CI 1.14-3.66) thought not statistically significant. Inclusion of larger sample size would assist to reach a more reasonable conclusion. Nevertheless, the findings*

*suggest presence of Mycoplasma gallisepticum and IBV in Tanzania and the need for awareness creation on biosecurity in poultry husbandry to minimize risks of pathogen transmission.*
***Keywords:*** Viral-diseases, Poultry, Respiratory-conditions

## Pigeon Peas: An Opportunity for Dietary Improvement among Resource Poor Households to ensure Sustainable Health

**Zahra Majili**

Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Box 3006, Morogoro, Tanzania.

*majilizahra11@gmail.com or zahra_majili@sua.ac.tz

*Pigeon pea is an affordable legume and important sources of protein, fibre, vitamins and minerals Despite its nutritional importance, the crop has not been adequately utilized for human consumption in Tanzania due to limited recipes. This creates an opportunity to explore possibilities of using pigeon peas to improve individuals diet. This study aimed at improve dietary using pigeon pea for sustainable health among resources poor households. Laboratory based experiments and consumer preference test were conducted in Morogoro and Lindi region. A total of 452 consumers were involved during data collection. Analysis of Variance was used to compare mean difference between samples. Tukey test was used to determine differences between the samples at $p<0.05$. Multivariate analysis was used to determine relationship between samples and sensory attributes. Five-point scale (1=less preferred and 5=extremely preferred was used to rank the sensory attributes. Noodles, instant porridge, chapati, biscuits, African donut and bread were developed and tested for their culinary attributes. Highest preference scores for colour, aroma and mouthfeel were observed in all pigeon pea-based products with differences between samples. Samples PPBN718 (noodles), PPIPofspr (porridge), PPBS123 (biscuit), PPBC412 (chapati), PPAD234 (African donut) and PPBB917 (bread) were most preferred among others. The most preferred products were porridge (392), biscuits (388), African donut (384), noodles and chapati (379), bread (265). Reason for preferences differ significantly among age groups at $p < 0.05$. Based on the most preferred sensory attributes (colour, mouthfeel and aroma), it is possible to incorporate pigeon peas flour into different foods to improve diet quality of resource poor households.*
***Keywords:*** Pigeon pea-based products, dietary improvement, sensory attributes, resource poor household

## Effects of biodegradable mulch films in common bean (*Phaseolus vulgaris* L.) performance in Morogoro, Tanzania: on-station trials

**Boniface H. Massawe1*, Lakuya Moisan1, Tumaini Semu1, Susan Nchimbi-Msolla1**

[1]Sokoine University of Agriculture, Morogoro, Tanzania

*Corresponding author Email: bhjmassawe@sua.ac.tz

*Different types of mulches have varied levels of efficiency. This study compared effects of using biodegradable mulch films (BMF) in common beans production compared with selected types of dead mulches used in Tanzania. Two different experiments in four replications were conducted using completely randomized block design on-station at SUA. In the first experiment, the treatments were BMF, pimento grass, maize straw and control. In the second experiment the treatments were BMF, butterfly pea, maize husks, and control. Crop performance indicators including germination, number of leaves, plant height and number of pods were recorded weekly using 9 representative plants in each plot. Number of weeds were counted physically weekly using quadrant method. Dry grain yield was also recorded in each experiment. The data were analysed for the effects of treatments to experimental units using ANOVA at 5% significance level. Results from the first experiment showed that BMF performed significantly better than other tested mulches in yield, weed control, branching, number of leaves, and number of pods. BMF did not do well in seed germination and plant height. Results from the second experiment showed that BMF had significantly better performance in terms of number of pods, grain bean yield, weed infestation control, plant height and number of branches. These initial results on use of industrial BMF calls for further research which may lead to promotion of use of these environmentally friendlier mulch films as compared to very slowly degradable plastic mulch films currently used in some farming systems in Tanzania.*
***Keywords:*** Biodegradable mulch films, common beans, dead mulches,

# Consumption of NCD-protective and NCD-risk Food Groups among Women and Children in Rural Areas, Tanzania: Cross Sectional Assessment using Global Diet Quality Questionnaire

**Akwilina Wendelin Mwanri[1]*, Suleiman Rashid[2], Dismas Mwaseba[3], Fulgence Mishili[4] and Susan Nchimbi-Msolla[5]**

[1]Department of Human Nutrition and Consumer Sciences, P.O Box 3006, Chuo Kikuu, Morogoro.
[2]Department of Food Science and Agro-processing, P.O Box 3006, Chuo Kikuu, Morogoro
[3]Institute of Continuing Education, P.O Box 3044, Chuo Kikuu, Morogoro
[4]Department of Agricultural Economics and Agribusiness
[5]Department of Crop Science and Horticulture, P.O Box 3005, Chuo Kikuu, Morogoro

*Corresponding author: akwmwanri@sua.ac.tz

*Malnutrition among Tanzanian children below five years has been persistently high especially in the rural areas while prevalence of overweight/obesity among women of reproductive age is increasing. Although some interventions have been implemented to reduce the rate of malnutrition in Mvomero district, improvement is slow than expected. This study aimed to assess food consumption among rural women and children of age 6 to 23 months. The cross-sectional study involved 512 randomly selected mother-child pairs in Mvomero district. A structured questionnaire and the Global Diet Quality Questionnaire for women and children were used to collect the data and estimate the dietary habits. The data were analysed using STATA and SPSS and association between variables determined using Chi-square and Kruskal-Wallis test. The result shows that almost all women (92%) and children (80%) consumed cereal grains with a limited intake of animal source foods. Only 12% of the women and 8.8% of the children consumed the recommended five food groups. About one third of the mothers met the medium dietary diversity score. The mean NCD-risk scores were 0.77±1.10 for women and 0.7±1.04 for children. The mean NCD-protect scores were 3±1.45 and 2.3±1.49 for the mothers and the children, respectively. There was an association between food self-sufficiency and dietary diversity score, food group diversity, NCD-risk score, and NCD-protect score. The rural communities should be supported to diversify food production and sources of income so as to increase purchasing power while considering proper food choices to avoid the risk for NCDs.*
***Keywords:*** dietary diversity, rural, children, women, diet quality

# Knowledge and Practices on prevention and management of Type 2 Diabetes Mellitus among adults in Dodoma urban, Tanzania

**Safiness Simon Msollo[1]*, Gosbert Lukenku Shausi[2] and Akwilina Wendelin Mwanri[1]**

[1]Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture in Morogoro, Tanzania
[2]Department of Agricultural Extension and Community Development,
Sokoine University of Agriculture in Morogoro, Tanzania

Correspondence: msollosafiness@yahoo.co.uk

*Diet-related non communicable diseases are increasing globally and in low-income countries including Tanzania. The study aimed to assess knowledge and practices on prevention and management of type 2 diabetes mellitus among adults in Dodoma city. A cross- sectional study was conducted among 313 randomly selected adults. A pre-tested questionnaire adapted from Tanzania STEPS SURVEY was administered face to face to obtain demographic information, practices and management of diabetes. Fasting blood glucose was tested by Gluco-plusTM and data analyzed using SPSS™ version 20. The mean age of adults was 41±12.5 years and 62.6% (n=91) were female participants. About 11% (n=35) had diabetes and 23% (n=72) pre-diabetes. Among the diagnosed participants, 6.5% (n=21) were diagnosed for the first time during the study. Forty eight percent of respondents reported overweight/obesity as a risk factors for diabetes. Sixty percent knew that diabetes can be prevented through doing physical activities (34%, n=64) and eating balanced diet (21.3%, n=40). About 41.2% (n=129) did not know the right foods for diabetes while 14% (n=44) mentioned low energy foods. Thirty six percent of participants had tested their blood glucose previously of which 16.6% (n=19) had high levels. Management for diabetes was reported to involve diet controls (52.5%), weight reduction (32%) and physical activities (47%). Prevalence of type 2 diabetes was higher than the national average. Majority were undiagnosed with diabetes before the study. There was limited knowledge on the prevention and management of diabetes which creates a need for community education.*
***Keywords:*** Diabetes Knowledge Practices Prevention Management

# Accumulation and Distribution of Mercury in Agricultural Soils, Food Crops and Associated Health Risks: A case Study of Shenda Gold mine, Geita Tanzania

**Tumikia R. Sanga[1,4,5]*, Kenneth K. Maseka[1], Mohanadoss Ponraj[1], Clavery Tungaraza[2], Marco E. Mng'ong'o[3], Eliezer B. Mwakalapa4**

[1]Department of Biological Sciences, School of Mathematics and Natural Sciences,
The Copperbelt University, P. O. Box 21692, Kitwe, Zambia
[2]Department of Geography and Environmental Studies, College of Science and Education,
Sokoine University of Agriculture, P.O. Box 3038, Morogoro, Tanzania
[3]Department of Applied Sciences, College of Science and Technical Education,
Mbeya University of Science and Technology, P. O. Box 131, Mbeya, Tanzania
[4]Department of Natural Sciences, College of Science and Technical Education,
Mbeya University of Science and Technology, P. O. Box 131, Mbeya, Tanzania
[5]The Copperbelt University Africa Centre of Excellence For Sustainable Mining,
P. O. Box 21692, Kitwe, Zambia

*Corresponding author e-mail: tumikiasanga@gmail.com

*The present study focused on determining total mercury (Hg) levels in agricultural soils and food crops around Shenda gold mine in Geita Tanzania using Cold Vapor Atomic Fluorescence Spectrometry (CVAFS). Furthermore, the study estimated health risks of Hg from consumption of food crops. The levels of total Hg determined were in the ranges of; soils (0.003-0.1220 mg/kg), rice (0.0752-0.1587 mg/kg) and vegetables (0.0556-0.3439 mg/kg), all measurement were on dry weight (DW) basis. All soil samples were within maximum allowable concentration (MAC) set by Tanzania Bureau of Standards (2 mg/kg) and United Kingdom (1 mg/kg). Total Hg levels in food crops (DW) were converted into fresh weight (FW) and compared with the MAC. Total Hg in potato leaves, pumpkin leaves and Chinese cabbage were within the MAC while cassava leaves and rice exceeded the MAC by Chinese National Standard (Hg for leafy vegetables and grains are 0.01 and 0.02 mg/kg (FW) respectively). The estimated weekly intake (EWI) of Hg due to consumption of rice was above the provisional tolerable weekly intake (PTWI) set by FAO/WHO (0.0016 mg/kg bw/week) while for leafy vegetables were below the PTWI. Target hazard quotient (THQ) was < 1 due to consumption of vegetables while THQ value for rice was > 1, indicating a potential non-carcinogenic risk to adult population from consumption of rice from the study area. Therefore, residents near Shenda gold mine might be potential victim of Hg accumulation in soil and food crops, thus necessary management options have to be in place.*

***Keywords:*** total mercury, soil, leafy vegetables, rice, health risk

# Sub-Theme 3:
# Policy and Good Governance for Agriculture Transformation

# Income Effect of Participation in Agricultural Production: The case of Smallholder Maize Farmers in Tanzania

**Daudi Moses Msengi* and Adam Akyoo**

[1]College of Economics and Business Studies, Department of Agriculture Economics and Agribusiness, Sokoine University of Agriculture, P.O. Box 3007, Morogoro, Tanzania.

*Corresponding author: daudimsengi21@gmail.com

*Agriculture is an important sector of the Tanzanian economy, contributing about 26.9% to GDP and 80% of the population depends on agriculture as a source of income and poverty reduction. Extant literature shows mixed results with regards to the relationship between agricultural participation and income. This study investigated the effect of agricultural participation on income in Tanzania. The National Sample Census of Agriculture data 2019/2020 with a sample of 11,812 households was used. The study employed a Quasi-experimental research design with propensity score matching as a method of analyzing the effect of household participation in maize production on income in Tanzania. The finding reveals that households participating in maize production, contribute negatively and significantly to household income. We also found that the use of fertilizer, off-farm employment, land size, and type of seed used positively and significantly influence participation in maize production. On the other hand, sex of the household head, membership in cooperative, use of irrigation as well as herbicides had negative and significant effects on participation in maize production. The study emphasizes on the need for provision of necessary agricultural input such as fertilizer and more enabling environment for land ownership to be used in maize production among smallholder farmers.*

***Keywords:*** participation, agricultural production, maize, income, PSM

# Extension Systems and the Promotion of Agro-ecology in Tanzania: A Literature Review Perspective

**[1]Nyamba, S.Y., [2]Sangeda, A.Z., [3]Mosha D.B. and [4]Mwaseba, D.L**

[1&4]Department of Agricultural Extension and Community Development of Sokoine University of Agriculture, P.O Box 3002, Morogoro, Tanzania
[2]Department of Animal, Aquaculture and Range, Sciences of Sokoine University of Agriculture, P.O Box 3004, Morogoro, Tanzania
[3]Directorate of Institute of Continuing Education (ICE), Sciences of Sokoine University of Agriculture, P.O Box 3044, Morogoro, Tanzania

siyote@sua.ac.tz *

*This paper addresses the role of extension in promoting agroecology movement in Tanzania. Extension is viewed as the main channel for assisting farmers to develop their farm technical and managerial skills. The research question to address is; how extension system operates today so as to meet the emerging global food sustainability demands. We hypothesized some difficulties for extension agents operating to promote agroecology movement and or accomplishments while playing fair against government interest. Data was collected through literature review and its analysis was guided by Braun and Clarke's six phases of thematic analysis. We found little evidence of extension pushing agroecology intensification. There are deficiencies about the way agroecology is being promoted by extension systems not just to farmers but also to many other parts of food systems. The conclusion is that; any successful uptake of agro-innovations rest on the presence of support frameworks, thus extension will continue to be a key factor in easing and bringing agroecology to steadiness. Extension has not fully embraced the wide-ranging benefits of agroecology. The study recommends responsible agencies to prepare extension agents for the shift from the already overemphasized synthetic agriculture. Thus, an ideal extension paradigm is necessary. Again, primary research need to be conducted to find out way(s) extension system could follow to influence agroecology movements. Ideally let there be no any ideological barriers or bias against agroecological movements; and that the government should prioritize agroecology in agricultural extension services and education.*

***Keywords:*** Extension systems, agroecology movements in Tanzania

# Optimisation of the Ingredients and Processing Parameters for the Tanzanian Sauces

**Amina Ahmed[1,2,3]* and Rashid Suleiman[1]**

[1]Department of Food Science and Agroprocessing, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Division of Quality of Plant Products, University of Goettingen, Goettingen, Germany
[3]Department of Food Science and Technology, Mbeya University of Science and Technology, Mbeya, Tanzania
4Department of Biology, University of Antwerp, Antwerp, Belgium

*mimomed88@gmail.com

*High postharvest loss of tomatoes (Solanum lycopersicum) and carrots (Daucus carota subsp) is reported in Tanzania. To reduce this loss, local sauces made from these vegetables were studied. The composition and preparation of these sauces offered on local markets were unknown and varied. Therefore, assessing whether they contribute to a healthy diet was not always possible. Therefore, local recipes for making sauces from the Morogoro region were studied, and tomato and carrot sauces were developed. The sauces consisted of 33% of either tomatoes or carrots with baobab fruit powder (6%), peanut paste (6%), onion (4%), ginger (1%), garlic (2%), and salt (2%). The sauces were then cooked at 87±3°C for 20, 25, or 30 minutes and analysed for physicochemical properties and sensory characterisation. Generally, the pH of the sauces was within The East African proposed standard EAS 66-2:2016; pH<4.5, ranging from 3.3 to 3.7. The tomato sauce had high ascorbic acid retention (71.96% - 45.79%) than carrot sauce (58.32% - 43.83%) ($p<0.05$). The β-carotene content of all the sauces significantly increased after cooking. The tomato sauce had higher acceptability than carrot sauce. The higher acceptability of tomato sauce was related to its consistency and saltiness. Therefore, the prepared sauces carrots had known composition, high nutrient retention and sensory acceptability. Adaptation and continuous improvement of the new recipe according to consumer preference would reduce the postharvest loss of surplus tomatoes and carrots, contribute to food and nutrition security and generate alternative income for small-scale processors, especially women and youth in Tanzania.*

***Keywords:*** Tomatoes, carrots, sauces, nutrient retention, sensory evaluation

# Governing the Commons: Appraisal of Ostrom Principles in the Context of Community Forest Management Agreement in Zanzibar, Tanzania

**Mohamed Khamis Said***

Department of Geography and Environmental Studies, the University of Dodoma, Tanzania
P.O. Box 259 Dodoma, Tanzania

*mokhasa2005@gmail.com

*Ostrom Design Principles (ODPs) are widely used as an analytical tool for assessing governance of common pool resources including Community Forest Management (CFM). This study, applied ODPs to assess the practices of the Community Forest Management Agreement (COFMA) in Zanzibar, Tanzania. Data collection based on interviews, interpretation of satellite images (2009 and 2014 Landsat images) and Geographical Information Systems (GIS) analysis. This paper found that the COFMA adapted the nine ODPs. However, it has been found that there is low local community participation in implementing various COFMA activities. The Chi-squire test revealed that participation in conservation meetings during COFMA establishment had significant association with participation in zoning community land and formulation of by-laws among local community members ($P<0.000$). In, COFMA financial motivation and alternative sources of income in community are emphasised to reduce community dependence on forest resources, while in ODPs are silent. It is concluded that COFMA has adopted all ODPs to govern community forest. Nevertheless, the full implementation of ODPs in COFMA has been difficult because the communities lack reliable alternative sources of livelihood and the idea of COFMA was not community initiative, since; it was opposed by some of the community members. This paper recommends that successful adoption and implementation of ODPs in COFMA, community lead should take place. Also, financial motivation and distribution of incentives among the community members should be included in by-laws.*

***Keywords:*** Community participation, Community forest management, forest resources, wildlife conservation, Ostrom's principles

# Does Differential Export Tax Increase Leather Export Shares? The Case of Imposition of Levies on Hide and Skins in Tanzania

**Charles Peter Mgeni[1]*, Hilder Charles Nyangi[2], Dismas Mwacha[2], and Felix Adam Nandonde[2]**

[1]Department of Agricultural Economics and Agribusiness, College of Economics and Business Studies, Sokoine University of Agriculture, Tanzania
[2]Department of Accounting and Finance, College of Economics and Business Studies, Sokoine University of Agriculture, Tanzania

*chrlsmgeni099@sua.ac.tz

*Tanzania has the second largest population of livestock in Africa, representing a formidable supply of hides and skins, based on an animal population consisting of 21.5 million cattle, 15.4 million goats and 5.9 million sheep. The livestock sector has the potential to produce at least 4 million hides and approximately 6.1 million skins annually. The Tanzanian government in 2012 imposed an 80 percent export levy on raw hides and skins, and 10 percent on wet blue aiming at discouraging the exportation of raw hides and skins and stimulate the domestic value addition of hides and skins in the country. This study evaluates the effect of 80% export levy on the exportation of raw hides and skins in Tanzania from (2015-2020). The study uses cross-sectional research design. Data were collected from tanners and cobblers in Dar es Salaam and Kilimanjaro. A trend analysis was employed to evaluate the impact of the impose levies. Findings indicate a slight increase in the processing of hide and skins of about 3.6 percent. Importation of processed leather decreased slightly by 1.2 percent. Major bottleneck of the leather industry as highlighted by the tanners and cobblers was lack of technology that could produce quality leather. Tanners also, complained of lack of supply of quality hides and skins from livestock keepers. The study recommends support from the government on importation of required technologies, particularly to the tanneries. Moreover, training should be provided to livestock keepers on how to keep hides and skins that will produce quality leather.*
***Keywords:*** Levy, hide and skin, leather industry, Tanzania

# Hunting Pangolins: A Case Study of Pangolin Uses and Trade in Community's adjacent to Ruaha National Park, Tanzania

**Charles Peter Mgeni[1,3]*, Rose Peter Kicheleri[2,3], Ernest Mauya[3], Fenrick Filbert Msigwa[3], Simon Joshua Chidodo[3], Michael Honorati Kimaro[3,4], Courtney Hughes[3,5], Nyemo Amos Chilagane[3], Camille Warbington[3,5], Elisante Azaeli Kimambo[3], Hillary Thomas Mrosso[3], and George Bunyata Bulenga[3,6]**

[1]Department of Agricultural Economics and Agribusiness, College of Economics and Business Studies, Sokoine University of Agriculture, Tanzania
[2]Department of Wildlife Management, Sokoine University of Agriculture, Tanzania
[3]Tanzania Research and Conservation Organization
[4]GELIFES Institute, University of Groningen, Netherlands
[5]University of Alberta, Edmonton, Alberta, Canada
[6]Department of Natural Resources and Environmental Conservation, Mbogwe District Council, Geita, Tanzania
*chrlsmgeni099@sua.ac.tz

*Pangolins are one of the most trafficked animals in the world, primarily used for food, traditional medicines, and cultural practices, traded through international markets as well as in the local cultures from which they are harvested. However, there is little known about pangolin harvest in Tanzania, including the derivatives used and trade patterns. To better understand pangolin harvest, use and trade, 22 villages bordering Ruaha National Park were surveyed. Chi-squared test was used to test the influence of demographic factors of trade and on these trade-offs was assessed by using a Structural Equation Model (SME). Findings indicate that age strongly influenced local pangolin hunting activities, while the level of education only had a marginal influence on proclivity to hunt pangolins. Pangolin scales were the primary product involved in trade, mainly used for traditional medicine and cultural practices. Buyers of pangolin products were pastoralists, traditional healers, persons with epilepsy, and international tourists were among those that purchased pangolins and their derivatives. The buyer also influenced the price of pangolin scales, with an average price of 34 USD per scale. Lastly, we found that some respondents acknowledged a decrease in demand for pangolins in the village markets because of their scarcity compared to previous years and proper law enforcement. Findings provide baseline information to aid in the development of effective pangolin conservation interventions in our study area. This will help inform the scaling up of pangolin conservation initiatives across Tanzania, and contribute to the broader literature on pangolin harvest, use and trade.*
***Keywords:*** conservation, pangolin, semi-structured interview, Tanzania, trade

# Optimization of Inulin Extraction from Sisal Wastes Using Response Surface Methodology

**Nuria Majaliwa[1], Jamal Kussaga[1], Faith Mabiki[2], Beatrice Kilima[1], Frida Nyamete[1]**

[1]Department of Food Science and Agro-processing, Sokoine University of Agriculture, P.O. Box 3000, Morogoro, Tanzania
[2]Department of Chemistry, Sokoine University of Agriculture, P.O. Box 3000, Morogoro, Tanzania

*nuria.majaliwa@sua.ac.tz

*Inulin is normally extracted from Jerusalem, Chicory plants and other gallic spp. However, sisal waste contain high amount of inulin, a natural prebiotic dietary fiber with several health benefits. Inspite of its potential, the extraction of inulin from sisal has not been well explored or optimized for industrial processing. Extraction of inulin from other plant sources has created a foundation for inulin production from sisal waste, but more knowledge is needed about critical factors for inulin yield and optimizing extraction for higher yield and quality. This study sought to identify and optimize important factors associated with inulin extraction from sisal-waste. This was done using Response Surface Methodology (RSM) with Central Composite Design involving three levels of three independent variables: extraction temperature, extraction time, and solvent concetration, and yield of the extracted inulin was used as response variable. The results showed that juice yield increased with extraction temperature, extraction time. The optimal extraction conditions were found to be an extraction temperature of 80 °C, an extraction time of 90 min, and solvent concentration of 40 %. The optimum percentage yield of the extracted inulin under these conditions was 18.24 %. ANOVA results indicated that the model was highly significant, with a coefficient of determination (R2) of 0.9205. The optimization of the extraction process of inulin from sisal waste resulted in a significant increase in the yield of the extracted inulin. Therefore, sisal waste can be a potential source of inulin, and the optimized extraction process can be useful in industrial applications.*

***Keywords:*** optimization, inulin extraction, sisal wastes, response surface methodology

# Assessment of the Morphological Diversity of Maize Landraces for their Potential for Use in Maize Improvement in Tanzania

**Luseko Amos Chilagane[1]*, Newton Lwiyiso Kilasi[1], Richard Rafael Madege[1], Mbwana Macheli Abdallah[2]**

[1]Sokoine University of Agriculture, Department of Crop Science and Horticulture, Box 3005, Morogoro, Tanzania
[2]Tanzania Agricultural Research Institute (TARI) Seliani Centre, Box 6024, Arusha, Tanzania

*Corresponding author Email: chilagane@sua.ac.tz

*Maize (Zea mays L.) is an important crop of dietary energy and nutrients in sub Saharan Africa, Tanzania inclusive. It is an open pollinated crop, hence difficult to keep track and maintain the germplasm especially the landraces cultivated by farmers without formalized seed system. This research aimed to investigate the morphological diversity of maize landraces grown in Tanzania as potential materials for breeding and cultivation. 64 genotypes were used in a RCBD experiment to assess their morphological characteristics. Results indicated significant differences among landraces in most of traits indicating wide range diversity that is key in crop improvement. Among others, days to anthesis and silking indicates the presence of some early maturing genotypes that would escape drought and hence being used for drought tolerance breeding. In a subset experiment using 13 genotypes; 10 local, 3 improved (2 hybrids and 1 OPV) results indicated differences ($P<0.001$) between cultivars on the occurrence of Fall Army Worm with landrace Katumbili (1.33) presenting the lowest occurrence and Hybrid variety Meru 517 presenting the highest occurrence. There was also significant differences ($P<0.001$) between cultivars in both disease incidence and severity for Maize Lethal Necrosis Virus Disease; lowest incidence (0%), Severity (0) and highest incidence (65%) and severity (9) Maize Streak Virus Disease; lowest incidence (0%), Severity (0) and highest incidence (73%) and severity (6), Rust; lowest incidence (0%), Severity (0) and highest incidence (69%) and severity (6), and Northern Corn Leaf Spot Disease; lowest incidence (0%), Severity (0) and highest incidence (75%) and severity (5.67). This information is key for germplasm conservation and use for improvement and cultivation. More characteristics of economic importance need be evaluated.*

**Keywords:** Landraces, Germplasm, Open Pollinated Varieties (OPV), Silking and Anthesis

# Determinants of Smallholder Rice Farmers' Market Outlet Selection in Mbarali and Mvomero Districts, Tanzania

**C. Mauki[1]*, J. Jeckoniah[1] and G. Massawe[2]**

[1]Department of Development and Strategic Studies, Sokoine University of Agriculture, P.O. Box 3024, Morogoro, Tanzania
[2]Department of Policy, Planning and Management, Sokoine University of Agriculture, P.O. Box 3035, Morogoro, Tanzania

*Corresponding author's email: maukicons@gmail.com

*Understanding smallholder farmers' market outlets have the potential to improve the productivity and incomes of smallholder farmers engaged in rice farming. Tanzania rice farmers select market outlets from a diverse spectrum. There is a paucity in the literature on the drivers of farmers' decision-making associated with these market outlets in the context of Agricultural Marketing Co-operative Societies' marketing initiatives. This paper explores the drivers for the selection of market outlets. A cross-sectional research design was used in the research. A sample of 382 smallholder rice farmers was selected from three co-operative societies selected from two districts in Morogoro and Mbeya Regions. Multinomial Logit regression was applied to examine the determinants of market outlet selection decisions. It was found that the outlets were wholesale, retail, millers, middlemen and private buyer. The majority (65.71%) of farmers sold to more than one outlet. The quantity of paddy sold, access to market information, smartphone ownership, access to credit, the amount of rice sold and frequency of extension visits were the important determinants of the selection of market outlets ($p<0.05$). It is concluded that; access to profitable market outlets contributes to livelihood improvement. To promote livelihood through agricultural transformation in Tanzania, policymakers should prioritize increasing smallholder rice farmers' access to market outlets through initiatives such as building rural infrastructures, improving market information systems, and promoting public-private partnerships.*
***Keywords:*** Market outlets, smallholder farmers, decision, co-operative societies

# A Review of Post-harvest Milk Losses in Tanzania's Milk Sector: Lessons from Production to Consumption

**Charles B. Lugamara[1]*, Justin K. Urassa[2], and Goodluck D. Massawe[2]**

[1]Department of Development and Strategic Studies, Sokoine University of Agriculture,
P. O. Box 3024, Morogoro, Tanzania
[1]Department of Livestock Production and Marketing Development, Ministry of Livestock and Fisheries,
P.O. Box 2870, Dodoma, Tanzania
[2]Department of Policy, Planning and Management, Sokoine University of Agriculture,
P.O. Box 3035, Morogoro, Tanzania

*Corresponding author: charleslugamara@gmail.com

*Tanzania has engaged in various policies, strategies and programmes in order to increase production, processing and marketing infrastructure for milk and milk products and minimise animal product losses. However, not much is known in relation to post-harvest milk losses. Therefore, the review paper aims to establish from empirical literature the extent of Tanzania's post-harvest milk losses and efforts taken by the government to reduce or minimise the same. To achieve the above, the authors used various search engines to locate documents reporting on Tanzania's post-harvest milk losses whereby 844 documents were identified and screened resulting in 40 that were deemed relevant. Thereafter, an assessment of the 40 documents led to only 10 being included in the critical review with three being dropped due to either similarity or use of the same data. Therefore, in the end, only seven are captured in this paper. Generally, the review shows that there is insufficient empirical information on Tanzania's post-harvest milk losses with the most recent study having been conducted almost 19 years ago. In addition, the study's scope was quite limited covering a sample of 66 respondents and a narrow geographical coverage of only three regions (i.e. Coast, Dar es Salaam and Morogoro regions). Furthermore, the study used the rapid appraisal approach. Therefore, there is a need for disaggregated information on Tanzania's extent of post-harvest milk losses at various nodes of the milk value chain so as to inform policy makers and other stakeholders interested in curbing the same.*
***Keywords:*** Milk losses, milk supply chain, post-harvest losses

# Implementation of Agricultural Sector Development Programme's Priority Interventions: Are the Interactions among Agricultural Sector Lead Ministries Optimal?

**Emmanuel T. Malisa[1]*, Suzana S. Nyanda[2], Faith P. Mabiki[3] and Justin K. Urassa[2]**

[1]Institute of Continuing Education, Sokoine University of Agriculture, Tanzania
[2]Department of Policy, Planning and Management, Sokoine University of Agriculture, Tanzania
[3]Department of Physics and Chemistry, Sokoine University of Agriculture, Tanzania

*Corresponding author's email: malisaet@sua.ac.tz

*Tanzania's efforts to reduce poverty involve among others the implementation of Agricultural Sector Development Programme (ASDP) aimed at improving agricultural sector's performance. However, literature shows dismal performance of the sector despite implementation of ASDP since 2010. It was hypothesised that the interaction among the ASDP actors is not synergetic and hence has not optimally contributed to the execution of ASDP. Guided by Ostrom's institutional analysis and development framework and the social network theory (SNT), the study examined the interaction patterns among the ASDP actors and their influence on the implementation of ASDP's priority interventions. The QUAL-quan design was adopted whereby data collection methods employed included key informant interview, focus group discussion, and questionnaire survey. Through content analysis and descriptive statistics, it was observed that the implementation of ASDP involved a high level of multifaceted interactions among the key actors. Study participants acknowledged predominance of strong actors' interactions but did not consider this to be enhancing the ASDP implementation. This is because there were actor-specific issues which constrained execution of their roles to the network. For example, farmer groups were too weak to deliver the expected project results. Consistent with the SNT, actors could interact strongly but combined effect is subject to successful execution of roles that are based on their relationship with other actors in the network. For interactions to be synergetic—enhancing agricultural sector transformation through ASDP—the involved actors should have the necessary capacity and should play well their strategic role towards achieving the common good.*
***Keywords:*** Agricultural transformation, agricultural sector lead ministries, basket funding; budget allocation.

# A Comparative Analysis of Participatory Extension Approaches Implemented in Developing Countries

**Glory E. Mella* and Respikius Martin**

Department of Agricultural Extension and Community Development, P.O. Box 3002, Sokoine University of Agriculture, Tanzania

*glorymella97@gmail.com

*Numerous studies have compared the top-down and bottom-up approaches in extension systems, but there is limited research that compares different participatory approaches implemented in different countries. This dichotomy in comparison (i.e. top-down vis a vis bottom-up) has resulted in a dearth of knowledge in terms of how participatory extension approaches are similar but also different. Thus, the objective of this study was to compare and contrast the Farmer Field School (FFS) and Farming System Research and Extension (FSR/E) approaches, with a focus on their individual successes and how they can complement each other. The study aims to address four main questions: 1) To what extent are these two participatory extension approaches similar? 2) To what extent are the two extension approaches different? 3) In what ways can the two approaches complement each other? and 4) What factors influence the success of each approaches?A review of literature was conducted to answer these questions. The review found that both approaches are participatory, demand-driven, and client-centered, with a focus on putting farmers first. However, FSR/E lacks a curriculum and facilitation. Also, FSR/E emphasizes a strong linkage between researcher, farmers and extension agents. Ineffective link between research and extension impedes development and dissemination of appropriate technologies to small-scale and resource-poor farmers. Thus, this is among the areas where FSR/E can complement FFS. Generally, the success of both approaches depends on the context and moving away from one-way technology transfer. The paper concludes that although FFS and FSR/E are participatory, they are also distinct. The aspects which differentiate the two approaches are potential areas for their complementarity.*
***Keywords:*** participatory, extension, approaches, success factors

# Competences of Extension Officers of Using Value Chain Approach in Advising Farmers in Tanzania

**Vituce J. Kalungwizi, Respikius Martin and Innocent M. Busindeli**

Department of Agricultural Extension and Community Development
P.O.Box 3002, Sokoine University of Agriculture, Tanzania
vitucekalungwizi@yahoo.com

*Recently, value chain approach in agriculture has been promoted in order to cope with market challenges which smallholder farmers face. This has necessitated changes in roles of extension agents who are supposed to advice farmers beyond the production node. However, most of the extension agents have assumed the new roles without being equipped necessary knowledge and skills to enable them discharge their roles effectively. In this context, extension agents' competences in advising farmers along the entire value chain and its implication are not fully investigated and understood. The, purpose of this study is to investigate the competences of extension agents in advising farmers along agricultural value chain in Tanzania. Specifically, the study seeks to answer three overarching questions; 1) to what extend do extension agent support farmers along the entire value chain 2) which aspects of the value chain are well supported and which ones are not well supported 3) what are the perceived obstacles that limit extension agents advise farmers beyond the production node. To answer these questions a convenient sample of 183 field extension agents was used. Descriptive statistics was used to compare the variations of competence across selected demographic variables. Findings show that the performance of extension agents along the entire value chain is good at the production node post-harvest and marketing nodes. . Limited access to retooling training was the major obstacle limiting extension agents perform their roles effectively. For farmers to become competitive in the global market, the study recommends retooling training on marketing and market linkage to be offered to frontline extension agents.*
***Keywords:*** Value chain, extension agents, perception, Tanzania, competence.

# Progressive Initiatives and the Transformation of Tanzania's Agricultural Sector: Experiences From ASPD I and ASDP II

**Suzana S. Nyanda[1]*, Emmanuel T. Malisa[2], Faith P. Mabiki[3] and Justin K. Urassa[1]**

[1]Department of Policy, Planning and Management, Sokoine University of Agriculture, Tanzania
[2]Institute of Continuing Education, Sokoine University of Agriculture, Tanzania
[3]Department of Physics and Chemistry, Sokoine University of Agriculture, Tanzania

*Corresponding author's email: suzy_nyanda@sua.ac.tz

*Tanzania's struggle to transform its agricultural sector for poverty reduction through various initiatives has shown limited achievements since independence. The present study assessed the progressive implementation of Agricultural Sector Development Programmes (ASDP I and ASDP II) in the transformation of the sector. Data were collected through desk review of ASDPs related documents, survey (n=68), key informant interviews (n=24) and focus group discussions (n=4). Quantitative data was analysed using SPSS whereby descriptive statistic were determined. Content analysis was used for qualitative data. On the one hand, the Tanzanian government in collaboration with Development Partners, made significant investments in irrigation, storage, marketing, livestock dipping and transport infrastructures, and improved research, capacity building and extension services during ASDP I. Additionally, basket funding coupled with financial decentralization facilitated the implementation of agricultural interventions at the grassroots level though some misallocation of funds was experienced. On the other hand, while the Government allocated funds for the already ended phase I of ASDP II it nonetheless faced limited disbursement; hence limited achievements on value addition interventions of the improved production due to ASDP I. Nevertheless, the annual budgetary allocation to agriculture was below the recommended 10% of total expenditure required to significantly contribute to poverty reduction. The study concludes that ASDP I and ASDP II had limited progression hence limited contribution to transformation of Tanzania's agriculture. Therefore, the Ministry of Finance and Planning should ensure disbursement of funds to enable progressive implementation of agricultural transformation initiatives for a greater impact on poverty reduction.*
***Keywords:*** ASDP, Agricultural transformation, agricultural sector lead ministries, basket funding; budget allocation.

# Sub-Theme 4:
# Climate change, Natural Resource and Environment

# Heavy metal pollution in soil, water and vegetables in Dar es salaam, Tanzania

**Meserecordias Wilfred Lema**

Department of Environmental Engineering and Management, University of Dodoma, P. O. Box 11090, Dodoma, Tanzania

Corresponding author e-mail: drlemaofficial@gmail.com

*In this study, heavy metals (Cu, Cr, Cd and Pb) in soil and vegetables (Amaranthus blitum, Ipomea batata and Cucurbita maxima) were determined in small farms along Msimbazi River, in Dar es Salaam – Tanzania. Atomic Absorption Spectrophotometer was used for the analysis of all samples, and results obtained were compared with standard limits. The trends for heavy metal concentrations in soil, water and vegetables, for the past 20 years, for the same study site, were also established. The concentrations of heavy metals in soils were all below maximum allowable limits. Vegetable samples were found to contain copper concentrations below standard limits. The concentrations of Cadmium, Lead and Chromium were between 0.309 ± 0.01 mg/Kg and 0.331 ± 0.01 mg/Kg, 2.526 ± 0.01 mg/Kg and 9.143 ± 0.11 mg/Kg, and 1.118 ± 0.01 mg/Kg and 13.981± 0.87 mg/Kg, respectively, that exceeded maximum standard limits of 0.02, 2 and 1.3 mg/kg, respectively. The presence of such elevated levels of dangerous heavy metals in edible vegetables indicates a potential health risks to urban consumers of vegetables grown along Msimbazi River, through long-term dietary intake. The trend for average concentrations of heavy metals in soils and vegetables showed average increases from year 2000 to 2010, and decreases from 2010 to 2020. On the contrary, concentrations of heavy metals in water showed an increase from year 2000 through 2020, except for chromium that decreased from 2010 to 2014. This information is vital for policy makers and other concerned stakeholders in monitoring urban vegetable farming activities in major cities especially Dar es Salaam.*
***Keywords:*** Heavy metal, soil, vegetable, pollution, urban farming, Msimbazi River

# Restoring Copper Mine Tailing Landscapes in Zambia: Revegetation and Lime Treatment as Ecological Strategies

**Leonce Dusengemungu[1,2]*, Cousins Gwanama[3], Benjamin Mubemba[3]**

[1]School of Mathematics and Natural Sciences, the Copperbelt University, Kitwe, Zambia,
[2]The Copperbelt University, Africa Centre of Excellence for Sustainable Mining, Kitwe, Zambia
[3]School of Natural Resources, the Copperbelt University, Kitwe, Zambia

*dusengeleonce@gmail.com

*This article examines the progress in the remediation of tailing dams (TD25,TD26 and TD10) which resulted from copper and cobalt mining activities in Zambia. Despite restoration efforts that have been underway for decades, there has been little follow-up research on the long-term effectiveness of these methods. The study aims to evaluate the heavy metal content in partially restored and bare soil at tailing dams and to identify the most successful plant species for revegetation. The study found that there were differences in soil copper and cobalt content at the tailing dams compared to control soil from Mwekera conserved natural forest. Acacia erioloba and Curatella Americana trees were found to be thriving around the tailing dams, while Cyperus rotundus was found to colonize large parts of the unrestored areas. The mean concentrations of heavy metals decreased in order of Fe > Cu > Co > Mn > Pb > Zn across all sites, with lime treatment being effective at reducing pollution load to 0.18 at TD10. In addition, the study identified 32 native tree species belonging to 13 different families as potential candidates for phytoremediation. The article concludes that novel functional ecosystems that support biodiversity preservation and natural ecosystems associated with water and soil protection could be developed by combining species from traits exclusive to primary habitats with species chosen for phytoremediation from features present in secondary metalliferous habitats. The findings of this study have significant implications for the future management of metal-rich soils and the development of sustainable ecological restoration systems in mining areas.*
***Keywords:*** Tailing dams, Heavy metals, Revegetation, Ecological restoration, Zambia

# Impacts of Climate Change on Traditional Irrigation Farming Systems and Adaptation Strategies in West Usambara Highlands, Tanzania

**Maro, F.L[1]* and Tenge, A.J[2]**

[1]Department of Geography and Environmental Studies, The University of Dodoma, P.O. Box 395 Dodoma, Tanzania
[2]Institute of Development Studies, The University of Dodoma, P.O.Box 395 Dodoma, Tanzania

*Correspondence author; E-Mail: fredymaro@ yahoo.com; Phone: +255-713-803-084

*Climate change is among the challenges to sustainable development due to its effects on major sectors of economy worldwide. However, its impacts differ from one system to another depending on the magnitude of the climate change, vulnerability and adaptive capacity of the system. This study assessed the the impacts of climate change on crop yields in two traditional irrigation farming systems (Ndiwa and Chamazi) and the adaptation strategies. A cross-sectional research design was adopted for this study. Purposive and systematic random sampling was used to select 380 respondents for this study. Data was collected through household survey, Focus Group Discussion, interviews, observation and documentary reviews. Descriptive statistics such as mean were computed to establish the trends of climate change variables. Cross tabulation was used to analyse the impact of climate change on crop yields. Participatory pairwise ranking and Analytic Hierarchy Process (AHP) were performed to identify feasible adaptation strategies. The results showed that, within 30 years, climate change has caused yield decline of major crops (maize, beans and irish-potatoes) by 12-51% Maize being the mostly affected. This was due to decreased amount of water for irrigation and outbreak of crop diseases. Major adaptation strategies include cultivation closer to water sources (93.8%), early planting (86.9%), crop diversification (72.6%) and digging of shallow wells (58.7%). However, some adaptation strategies are detrimental to the environment. Adaptive capacity of farmers is low to medium. We recommend to improve adaptive capacity of farmers through access to climate information, financial resources, agricultural extension services and improved irrigation infrastructures.*
***Keywords:*** Chamazi, Ndiwa, Traditional irrigation farming system, adaptation strategies, adaptive capacity.

# Hydrogeophysical Characterization of Aquifers around Ngerengere River Sub-Catchment, Morogoro, Tanzania

**Edikafubeni Edson Makoba[1]*, Antony Daniel Funga[2], Eliapenda Elisante Mariki[3] and Fares John Bignagwa[2]**

[1]Sokoine University of Agriculture, Department of Geography and Environmental Studies,
P .O. Box 3038, Morogoro, Tanzania
[2]Sokoine University of Agriculture, Department of Biosciences, P. O. Box 3038, Morogoro, Tanzania
3Sokoine University of Agriculture, Department of Physics and Chemistry, P .O. Box 3038, Morogoro, Tanzania

*edikafubeni.makoba@sua.ac.tz

*The demand for groundwater worldwide is on increase due to rapid population growth and climate change. On the other hand, availability of sufficient clean and safe groundwater is uncertain due to the natural processes. This calls for hydrogeological studies to assess availability of quality groundwater in limited water supply areas. Detailed hydrogeophysical study was conducted to assess groundwater potentiality, characterize aquifers, and establish potential areas for siting boreholes in Ngerengere river sub-catchment, Tanzania. Integrated geophysical methods (1D Vertical Electrical sounding (42 VES), 2D Electrical Resistivity Tomography (7 ERT) supported with 13 water samples) were employed. The obtained findings have been used to develop groundwater potential index map (GPIM) which is a guide for further groundwater development. Results indicated that most of the aquifers are slightly saline with salinity resulting from both rock dissolution and evaporation-crystallization circles. Based on the aquifer characteristics, there are at least 5 major distinct zones. Alluvial sediments and weathered metamorphic formation form potential zone one aquifer (40-150 Ωm) while sediments (~5 Ωm) form shallow saline water aquifer (<10 m) with salinity (~ 5 ppt) resulting from evaporation-crystallization circles. Zone three is the hard formation (>1000 Ωm) low potential zone. Zone four is characterized by a potential deep aquifers (~200 Ωm) while zone five is an intermediate groundwater potential aquifer (10 and 100 Ωm) where aquifers are largely controlled by structures. It is recommended to conduct detailed 2D resistivity survey at closely spaced distance and drill at least three deep boreholes (~200 m) in different aquifers.*
***Keywords:*** aquifer resistivity, resistivity tomography, sounding curve, Ngerengere river, Tanzania (max 5 key words)

# Assessment of Soil Erosion Hotspots by Rusle Model using Remote Sensing and GIS in Mvomero and Morogoro Rural and Urban Districts, Tanzania

**Proches Hieronimo[1]*, TUYISABE Jean Bosco[2]**

[1]Department of Agricultural Engineering, Sokoine University of Agriculture (SUA),
P.O. Box 3003, Chuo Kikuu, Morogoro, Tanzania,
[2]Department of Civil and Water Resources Engineering, Sokoine University of Agriculture (SUA),
P.O. Box 3003, Chuo Kikuu, Morogoro, Tanzania.

Corresponding author email: phmusigula@gmail.com

*Soil erosion by water seems to be the greatest factor limiting soil productivity and impeding agricultural enterprise in many regions of Africa, mainly in the humid and sub-humid zones of Sub-Saharan Africa including the Tanzania. As the economic activities of people within the Morogoro urban and Mvomero districts are primarily dominated by agriculture, and the importance of key water bodies like Mindu dam, currently being threatened by siltation, with its catchment areas located in Morogoro urban and Mvomero districts, entail managing land and water resources critical. Sustainable land management practices are needed to avoid land degradation including soil erosion and this requires identification of soil erosion hotspots in order to prioritize resources. Sustainable land management will improve both land productivity for agricultural purposes and improve water quality. The objective of this study was to assess trends of soil erosion, identification of spatial distribution and magnitude of soil erosion risks hotspots to guide land management interventions. A GIS based analysis using the Revised Universal Soil Erosion (RUSLE) Model was applied to estimate potential soil loss risk by water for any location within the Morogoro urban and rural and Mvomero districts. The analysis provides spatial pattern of the potential soil loss risks caused by rainfall in the three districts. This study showed that soil loss magnitudes ranges from from Very slight (< 2 Tons/Ha/Year) to Very severe/Catastrophic (> 100 Ton/Ha/Year) with high erosion hotspots located on mountainous areas. The results show that Mvomero district has the highest proportion (42%) of land potentially susceptible to risks of unacceptable soil losses (> 5 Tons/Ha/Year) for tropical soils/and or shallow highland soils if no support/conservation practices applied when undertaking a number of land uses including agriculture. On the other hand, Morogoro rural and urban have 38 % and 35% of the lands areas respectively has potential risk of experiencing unacceptable soil loss for tropical soils/and or shallow highland soils (> 5 Ton/Ha/Year) if no support/conservation practices applied when undertaking a number of land uses including agriculture. The study shows that soil erosion in the study area vary spatially in terms of the degree of severity at various scales and therefore different management strategies in the three districts should be prioritized according to varying degrees of erosion hazards established in this study.*

***Keywords:*** Soil erosion hotspot, RUSLE, land management, acceptable soil loss

# Status of Soil Physicochemical Properties under Selected Avocado Cultivars in Agroforestry System of Central South Ethiopia

**Hadia Seid1*, Sigrun Dahlin2, Zebene Asfaw3, John Kessy1**

1 Sokoine University of Agriculture, Department of Ecosystem and Conservation, P.O.Box, 3000, Morogoro, Tanzania.
2 Swedish University of Agricultural Sciences, Department of Soil and Environment,
P.O.Box 7014, SE-75007 Uppsala, Sweden
3 Hawasa University, Wondo Genet College of Forestry and Natural Resource, Wondo Genet,
P.O. Box 128, Shashemene, Ethiopia

*Corresponding Authors: E-mail: hadi04seid@gmail.com

*Soil physical properties and chemical parameters influence the availability and accessibility of nutrients. This study investigated the impact of three preferred avocado cultivars on selected soil physicochemical properties in the Lemo district, Central South, Ethiopia. The soil samples were collected from the three avocado cultivars, at three radial distances (1m, 2m away from the tree trunk, and 5m away from the canopy in the open area), at two soil depths (0-20cm and 20-40cm) using a factorial arrangement in randomized complete block design. The result demonstrated that the soil moisture content, bulk density, pH, organic carbon electric conductivity, total nitrogen, and available phosphorus under the canopy of avocado cultivars was significantly different than the open control area (P< 0.05). In addition, soil organic carbon, total nitrogen and available phosphorus decreased with increasing soil depth in the avocado soil. The studied avocado cultivars are ideal for soil nutrient cycling, especially, cultivar Hass made a significant contribution, followed by Nabal, and Ettinger. Thus, the integration of cultivar Hass and Nabal in the Agroforestry system can improve the soil physicochemical properties and*

*supplement the organic source of nutrients in the study area. However, for optimal agricultural soil health and sustainable avocado production, it is necessary to take into account cultivar and site-specific soil management practices.*
***Keywords:*** Agroforestry system, avocado, Hass, Nabal, Ettinger.

# Optimization of Goat Manure against Use of N-Minjingu Nafaka Plus Fertilizer for Improved Lablab Growth and Yield in Semi - Arid Areas of Northern Tanzania

**Barnaba Mhagama[1,2]*, Mashamba Philipo[1] and Ernest Mbega[1]**

*[1]School of Life Science and Bioengineering - LiSBE, Nelson Mandela African Institution of Science and Technology, Arusha Tanzania.
*[2]Department of Research and Innovation, Tanzania Agricultural Research Institute, TARI – Selian.

*Corresponding author; mhagamab@nm-aist.ac.tz

*Lablab (Lablab purpureus (L.) Sweet) field experiment was conducted in 2022 in two different locations at Tanzania Agricultural Research Institute - TARI Selian Centre and Saweni site respectively, situated at Arusha and Same districts. The objective of the experiment was to determine the effect of goat manure against use of Minjingu Nafaka Plus fertilizers on the yield of lablab under two tillage practices (conventional and zero tillage). The experiment was laid out in a split–plot design with three treatments and two replications. Two sites were planted with improved lablab variety (NM-D19) originating from local Eldoret black originated in Kenya. Furthermore, three treatments were prepared and applied with; OF = Organic fertilizer (dry goat manure 250g per hole, equivalent to 25 tons ha$^{-1}$); IF = In-organic fertilizer (Minjingu Nafaka Plus 5gms per hole equivalent to 245kg ha$^{-1}$) and NF = No fertilizer as a (control). The parameters recorded from experimental plots were; the Germination percent (%), days at 50% flowering, number of pods per plant, plant height (cm), number of seeds per pod, lablab grain yield in kilogram per ha, and weight of 100 lablab seeds in (kg). The overall results from different location showed that Minjingu Nafaka Plus fertilizer, followed by goat manure uptake by a plant highly affected lablab plant growth and yield component. In brief, the application of goat manure is mostly recommended for increased lablab yield production since has a high net benefit on the cost of production compared to Minjingu Nafaka Plus fertilizer at sites.*
***Keywords:*** Goat manure, Minjingu Fertilizer, Lablab, Yield, Tillage.

# Large-Scale Prediction of Growing Stock Volume in Small-Scale Forest Plantations using Sentinel 2 Remotely Sensed Data

**[1]Ernest William Mauya, [1]Sami D. Madundo, [1]Diana L. Tesha and [2]Benadol J. Manyanda**

[1]Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture, Tanzania
[2]Department of Forest Resources Assessment and Management, Tanzania

*mauya@sua.ac.tz

*Growing stock volume (GSV) is one of the important stand parameters needed for sustainable forest management. In this study, we demonstrated the potential of integrating field inventory and remotely sensed data for large-scale predictions of growing stock volume (GSV), in small-scale forest plantations of Mufindi district, Tanzania. A total of 32 small-scale forest plantation stands were selected, circular plot of 10 m radius were established on each stand, making a total of 63 field plots within the area of interest. GSV was then computed for each of the field plots. Sentinel 2 remotely sensed data covering the area of interest were downloaded and processed using google earth engine platform. Three sets of predictor variables including band values, vegetation indices and texture variables were extracted. Statistical models relating GSV and remotely sensed predictor variables were developed using ordinary least square (OLS) and random forest regression. The results showed that, the OLS linear model fitted using texture-based variables turned out to be the best among the parametric models with relative root mean square error (RMSEr) of 41.28%. Likewise, the random forest model fitted using the combination of all predictor variables turned out to be best among the non-parametric models with the RMSEr of 37.8%. The mean average value of GSV for the entire AOI predicted using random forest was 152 m$^3$/ha and the standard deviation was 54.7 m$^3$/ha. The obtained mean GSV was close to the field measured mean GSV which was 160.7 m3/ha. The standard deviation was relatively lower as compared to the field-based value, which was 76.47 m3/ha. Therefore, our study had demonstrated that, Sentinel 2 remotely sensed data can be used to develop cost-effective method for GSV estimation in the small-scale plantations of Tanzania.*
***Keywords:*** volume, plantation, remotely sensed, OLS, random forest

# Community Based Forest Management as a Tool to Sustain Dry Afromontane Forest and its Potential for REDD+ in Ethiopia

**Lemma Tiki[ab]*, Jumanneh M. Abdallah[b], Motuma Tolera[c] and Kristina Marquardt[d]**

[a]Ambo University, college of Agriculture and Veterinary science, Ethiopia
[b]Sokoine University of Agriculture, college of forestry, wildlife and tourism, Tanzania
[c]Hawassa University, Wondo Genet College of forestry and natural resources, Ethiopia
[d]Swedish University of Agricultural Science, department of urban & rural development, Sweden
*obsansi@gmail.com

*Forest ecosystems are a multifunctional production system worthy to be managed. Some experiences from around the world shows shifting forest management from state-centered to community-centered resulted better forest management. Therefore, the study was to examine the role of community based forest managment for sustainable managment of dry Afromontane forest in Adaba-Dodola, Ethiopia. A total of 89 concentric circular quadrats of 20, 14, 4 and 2m were laid with a distance of 500m. Tree DBH, tree height, number of saplings, number of seedlings, species name and stem density were recorded. Woody species diversity was computed with diversity indices while aboveground biomass was done by allometric equation. Statistical difference between PFM and the adjacent NPFM forests were separated by using t-test at P < 0.05). A total of 29 and 23 woody species were recorded in PFM and NPFM forests, respectively. Woody species structure of both forest management units showed an inverted J-shape and there is statistically significant difference between PFM and NPFM in terms of seedlings, sapling and adult density. There is significant difference at (P = 0.026) between the mean total living biomass carbon stock of PFM (225.50±26.54 t/ha) and the adjacent NPFM (156.24±15.72 t/ha). Hence, forest areas managed under PFM play a prominent role in conservation and improvement of carbon sequestration potential of forests.*
***Keywords:*** Biomass carbon stock, PFM, REDD+, Woody species, Non-PFM, Forest management

# The Extent of Milk Losses in Rain and Dry Seasons along the Milk Value Chain in Tanzania

**Charles B. Lugamara[1]*, Justin K. Urassa[2], and Goodluck D. Massawe[2]**

[1]Department of Development and Strategic Studies, Sokoine University of Agriculture,
P. O. Box 3024, Morogoro, Tanzania
[1]Department of Livestock Production and Marketing Development, Ministry of Livestock and Fisheries,
P.O. Box 2870, Dodoma, Tanzania
[2]Department of Policy, Planning and Management, Sokoine University of Agriculture,
P.O. Box 3035, Morogoro, Tanzania

*Corresponding author: charleslugamara@gmail.com

*Globally, about one-eighth of food lost at post-harvest stage is for meat and other animal products. In sub-Saharan Africa, the extent of milk losses and waste per year is estimated to be 17% during post-harvest handling. Despite the Tanzanian government's policies, strategies and programmes which aim to ensure a stable market for milk and milk products in order to minimise losses, little is known on the current situation of the extent of post-harvest milk losses in the country. The above necessitated this paper to determine the extent of milk losses at the various nodes of the milk value chain in both dry and wet/rain seasons and between regions. A cross-sectional research design was used to collect data in both the dry and wet seasons (between June 2021 and September 2022) from milk producers, milk collectors, milk processors, retailers and hotels/ restaurants/milk bars. Paired sample t-test as well as Wilcoxon signed-rank test results showed significant differences in milk losses between dry and wet seasons (p<0.05). In addition, one way - ANOVA showed a variation of milk losses across the regions in the area of study (p<0.05). Furthermore, at the regional level, milk loss was significant at the household and retailer levels. Therefore, the Tanzanian government should create awareness to the milk value chain actors on the magnitude of the losses and the possible consequences. Also, the government should come up with policies and strategies or actions to minimise post-harvest milk losses along the whole milk value chain.*
***Keywords:*** Milk losses, post-harvest, value chain, season, Tanzania

# Public Perception of Climate Risk and Adaptation in Tanzania: A Systematic Review

**Nyinondi, P.S.[1]* and M.E. Sospeter[2]**

[1]Sokoine University of Agriculture. Department of Informatics and Information Technology.
P. O. Box 3038. Morogoro. Tanzania
[2]Mbeya University of Science and Technology. Department of Information and Records Studies.
P. O. Box 131. Mbeya. Tanzania.

*Corresponding author Email: martinuss530@gmail.com

*Climate change is a pressing global challenge of the 21st century, with impacts including global warming, drought, famine, floods, tropical storms, and cyclones. One of the biggest challenges to mitigating climate change is people's perception of its risks. This study provides valuable insights on the public perception of climate risk and adaptation in Tanzania through a systematic review of peer-reviewed papers. The search was conducted using keywords related to climate change awareness, knowledge, perception, attitude, and risk adaptation from the Sokoine University of Agriculture Institutional repository (SUAIR) for publications between 2000 and 2022. The review found that there is a high level of awareness (84%) of climate change, with many (74%) recognizing its impacts on their daily lives in terms of economic activities and gender roles. However, the perception of climate risk varies depending on factors such as gender, location, and socioeconomic status. For example, people living in rural areas perceived climate risks such as floods and drought more than those in urban areas did. Attitudes towards climate change adaptation also vary among different groups, with some people such as farmers more resilient and willing to adopt than pastoralists, people living in urban areas than people living in rural areas. The review identifies knowledge gaps in understanding the causes and impacts of climate change. Overall, this systematic review provides a comprehensive picture of current knowledge and understanding of the public perception of risk adaptation in Tanzania, highlighting areas for further research and policy action.*
***Keywords:*** Climate Change awareness, Climate change, extreme weather, climate change adoption

# Modelling Ecological Niches of Marula Tree, Sclerocarya birrea (A. Rich.) Horchst, subspecies in Tanzania under the Current and Future Climates

**Abubakari H. Munna[1]*, Nyambilila A. Amuri[1], Proches Hieronimo[2] and Dino A. Woiso[3]**

[1]Department of Soil and Geological Sciences, Sokoine University of Agriculture, P.O. Box 3008, Morogoro, Tanzania
[2]Department of Agricultural Engineering, Sokoine University of Agriculture, P.O. Box 3003 Morogoro, Tanzania
[3]Department of Biosciences, Sokoine University of Agriculture, P.O. Box 3038 Morogoro, Tanzania

*Corresponding author e-mail: amabmunna81@gmail.com

*The information on ecological niches of the Marula tree, Sclerocarya birrea, (S. birrea) (A. Rich.) Horchst, subspecies is needed for sustainable management of this tree, considering its nutritional, economic, ecological benefits, and a decline of its population. However, despite Tanzania is regarded as a global genetic center of diversity of S. birrea, information on the subspecies ecological niches is lacking. We aimed to model, predict and quantify ecological niches of the S. birrea subspecies in Tanzania under the current and future climates. Modeling was done by using the MaxEnt algorithm using climatic, edaphic, and topographical variables, and occurrence data from Morogoro, Iringa, Rombo, and Serengeti districts in Tanzania. Future predictions were done under 4.5 and 8.5 representative concentration pathways (RCPs) for 2050 and 2080 by using Hadley Climate Center and National Center for Atmospheric Research's Earth Systems Models. The accuracy of models was assessed by using the receiver operating characteristic (ROC)'s area under the curve (AUC). The results show that the predictive power of the models was robust, with AUCs of 0.85-0.95. The ecological niche models of the S. birrea subspecies were mostly influenced by precipitation, elevation, and soil cation exchange. The ecological niches cover 28,446-184,814 km2 of Tanzania's landmass, occurring in 21-30 regions, and will contract by 0.4-44% under future climates. Currently, 31-51% of ecological niches are under the protected areas network. Tanzania harbors and will continue to harbor ecological niches of S. birrea subspecies under future climates hence should be the epicentre of research, domestication, and conservation efforts.*
***Keywords:*** domestication, climate change, conservation, MaxEnt, protected areas network

# Modelling and Predicting Tree Richness and Species Diversity using Sentinel-2 Data in Sub-Tropical Montane Forests of Tanzania

**Nandera Lolila[1]*, Ernest William Mauya[1] and Deo Shirima[2]**

[1]Department of Forest Engineering and Wood Sciences, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O.Box 3012, Chuo kikuu, Morogoro, Tanzania.
[2]Department of Ecosystems and Conservation, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O.Box 3010, Chuo kikuu, Morogoro, Tanzania.

*nandera.lolila@sua.ac.tz

*Spatial scale monitoring and assessment of indicators of tree species richness and diversity is crucial for developing large scale effective adaptation and mitigation strategies for conservation of biodiversity of the Tropical forests. This study assessed the potential of Sentinel-2 data remotely sensed in predicting tree species richness and Shannon diversity index. Based on spectral features, indices, and texture separately and their combination, a generalized linear model (GLM) for predicting tree richness and Shannon diversity index were created. Moreover, to test the effect of elevation on prediction accuracy, the best richness and Shannon diversity index models were enhanced with elevation. The results showed that combining texture and band data for both Shannon diversity and richness enhanced the variability described by independent models (pseudoR2). This was further corroborated by the Shannon diversity prediction cross-validation results. On the other hand, Sentinel-2 vegetation indices, specifically the red-edge chlorophyll index (CLRE) and the green normalized difference vegetation index (GNDVI), accurately (rRMSE = 27.7 and rMAE = 21.1) predicted species richness. The elevation component of the best model had no significant effect (P > 0.05) on prediction of richness and Shannon diversity. The findings revealed that tree species diversity measurements in Tanzania's subtropical montane forests might be predicted and modelled using Sentinel-2 data. Even while the multi-temporal Sentinel-2 images offer sufficient precision for distinguishing tree species, future studies should take into account fusion with other remote sensing data, including the hyper-spectral dataset that might increase the prediction accuracy.*
***Keywords:*** Richness, Shannon diversity index, GLM, texture, tropical forest

# Performance Evaluation of Mkula Irrigation Scheme in Kilombero, Tanzania

**Mary Sauga[1] and Festo Richard Silungwe[2]***

[1]Ministry of Water; Dodoma, Tanzania: saugamary@gmail.com
[2]Sokoine University of Agriculture, P.O.Box 3000 - Morogoro,Tanzania, festosilungwe@sua.ac.tz,

*Corresponding author Email: festosilungwe@sua.ac.tz,

*Many irrigation systems indicate failures with respect to their anticipated benefits. However, improvement of these schemes can be achieved through performance evaluation and rehabilitation to meet the performance indicators. The aim of this study was to evaluate the performance of Mkula Irrigation scheme. The performance indicators evaluated were efficiency, dependability, sustainability, adequacy of water supplied, equity and productivity of the scheme. The availability of institutional and support services were also investigated through a questionnaire administered to beneficiary farmers and other stakeholders. The results obtained showed that the main and tertiary canal conveyance efficiencies were 88% and 65%, respectively. Though loses and seepage was also observed, most of the secondary and tertiary canals are poorly maintained and most of the structures are dysfunctional. Dependability of the scheme evaluated in terms of duration and irrigation interval showed that the scheme is performing below the intended level while many farmers complained to have unfair distribution of water due to water shortages. It was further reported that intrusions of elephants in the scheme destroy infrastructures and it endangers farmer's lives hence threatening the scheme's sustainable use. The scheme productivity is low; about 84% of farmers harvest less than 3tones ha-1 of paddy and only the remaining 16% produces more than 3.0 tones/ha. There is an urgent need of improving scheme operation and management, and conduct maintenance of scheme's canals so as to improve efficiencies, adequacy and equity.*
***Keywords:*** Irrigation, Performance, Sustainability, Productivity, efficiency

# Evaluating the Diversity of Knowledge about Medicinal Plants among Three Ethnic Groups in South-Central Ethiopia

**Sintayehu Tamene[1], Fortunatus B.S. Makonda[2], Mesele Negash,[1] and Linley Chiwona[3]**

1Wondo Genet College of Forestry and Natural Resources, Hawassa University, Ethiopia.
[2]College of Forestry, Wildlife, and Tourism, Sokoine University of Agriculture, Tanzania.
[3]Department of Urban & Rural Development, Swedish University of Agricultural Sciences, Sweden.

Corresponding author E-mail, sintebeye@gmail.com

*More than 60% of the global population, including 80% in developing countries, rely almost entirely on traditional medicine for primary healthcare. However, the majority of previous studies have focused on rural areas, and the topic of traditional medicinal plant knowledge in urban and periurban settings has been marginalized and understudied. The objective of this study was to document and evaluate the use of traditional medicinal plant knowledge by three different ethnic groups, namely Sidama, Oromo, and Gedeo, living in peri-urban areas of south-central Ethiopia. Semi-structured questionnaires, in-depth interviews, field observations, and group discussions with 189 traditional healers were employed to collect data. Several ethnobotanical indices such as the informant consensus factor, cultural importance, use value, the relative frequency of citation, and the relative importance index, were used to analyze and express the relevance of medicinal plants. 189 medicinal plant species used to treat 100 ailments were documented. Of these, 47 (25%) medicinal plants collected so far overlapped between the three ethnic groups and are commonly used. The Sidama, Gedeo, and Oromo ethnic groups reported 28, 34, and 38 percent of therapeutic plants, respectively. Species Albizia gummifera, Aloe macrocarpa, Croton macrostachyus, Ruta chalepensis, Vernonia amygdalina, and Zingiber officinale received the highest rank to treat various ailments. The highest informant consent value was found for circulatory system disorders (0.68), followed by reproductive organ disorders (0.66), and spirituality disorders (0.66). Age was found to be a major factor influencing respondents' local ethnobotanical knowledge ($R^2$ = 0.34, p value = 2.2e16). The present study found that traditional medicinal plant treatment is still prevalent in the study area. Documenting ethnomedicinal species and their therapeutic applications will encourage more phytochemical and pharmacological research, potentially leading to the development of new drugs and, at the very least, preventing the loss of indigenous knowledge associated with the local flora.*

***Keywords:*** Ethiopia, Ethnobotanical knowledge, Peri urban, South central Ethiopia, Traditional medicinal plant

# Rodent Abundance, Diversity and Community Structure in a Bubonic Plague Endemic Area, Northern Tanzania

**Stella T. Kessy[1,2]*, Rhodes H. Makundi[2,3], Christopher Sabuni[3], Apia W. Massawe[2,3] and Alfan A. Rija[1]**

[1]Department of Wildlife Management, Sokoine University of Agriculture, P.O. Box 3073, Chuo Kikuu, Morogoro, Tanzania
[2]The African Centre of Excellence for Innovative Rodent Pest Management and Biosensor Technology Development (ACE IRPM&BTD)
[3]Institute of Pest Management, Sokoine University of Agriculture, P.O. Box 3110, Morogoro, Tanzania

*Corresponding Author: E-mail: kessystella78@gmail.com

*Rodent-borne diseases, including bubonic plague, remain a significant threat to public health in tropical countries. In plague-endemic areas, little information exists on factors triggering periodic bursts. The study assessed how species richness, diversity, and community structure of rodents in Mbulu District, Tanzania, are associated with plague persistence. Rodents were captured using the removal trapping technique. A total of 610 rodents belonging to 12 species were capatured, with Mastomys natalensis being the most abundant (10.89%). Within foci, persistent plague had significantly higher abundance, species richness, and diversity compared to non-persistent localities ($p< 0.05$). Forest habitats had significantly higher species richness compared to domestic premises ($p= 0.01$). Plague persistent localities were found to be significantly positively associated with high rodent abundance (mean= 2.34, ±1.10SE, $p= 0.03$) and species richness (mean= 0.73, ±0.16SE, $p< 0.001$). Additionally, three broad rodent community structures ($R= 0.98$, $p= 0.01\%$) were found, that varied significantly between studied habitat types ($R= 1$, $p< 0.8\%$), suggesting high population interaction at fine-scale resource abundance. The high abundance and diversity of plague-susceptible rodent reservoirs are among the possible factors contributing to plague persistence in the foci. The information may be useful to develop preparedness strategies in these areas to control plague outbreaks.*

***Keywords:*** Bubonic plague, plague persistence, rodent abundance and diversity

# Aquatic Ecological Risk of Metal(loid) Pollution Associated with Degraded Mining Landscapes of the Southern Africa River Basins: A Review

**Ouma, K.O.[1,3]*, Shane, A.[2], and Syampungani, S.[1]**

[1]School of Natural Resources, The Copperbelt University, P.O. Box 21692, Kitwe, Zambia
[2]School of Mines & Mineral Sciences, The Copperbelt University, P.O. Box 21692, Kitwe, Zambia
[3]Copperbelt University Centre of Excellence for Sustainable Mining (CBU-ACESM), P. O. Box 21692, Kitwe, Zambia

*Corresponding author e-mail: kennedy.ouma@cbu.ac.zm

*Africa accounts for nearly 30% of the discovered world's mineral reserves, with half of the world's platinum group metals, 36% of gold, and 20% of cobalt deposits in Southern Africa (SA). The intensification of metal(loid) production in SA has exacerbated negative human and environmental health impacts. Mining waste generated from industrial and artisanal mining has significantly affected the ecological integrity of SA aquatic ecosystems. However, the extent to which metal(loid) pollution associated with mining has impacted the aquatic ecosystems has not been adequately documented. We explored the current aquatic ecological impacts on the heavily-mined river basins of SA. We also discussed the approaches to assessing the aquatic ecological risks, inherent challenges, and potential for developing nature-based integrated ecological risk assessment protocols for terrestrial-aquatic systems in SA. Six mining-intensified and highly populated river basins in SA were evaluated for the historical impacts of metal mining on aquatic ecosystems. Cross-cutting impacts were disaggregated and analysed to establish trends and spatial aquatic ecological risks of metal(loid) mining and processing. Risk assessment approaches were employed to characterise the threats. Acid-mine drainage, siltation, effluent discharge and riparian habitat degradation negatively impacted stream water quality, quantity, and aquatic biocoenosis. Nevertheless, there is progress in developing eco-friendly green-based rapid bioassessment schemes (RBS) for SA aquatic ecosystems. However, method integration, including biomonitoring and molecular technology, will overcome the current challenges towards the standardisation of RBS. Also, citizen science will encourage community and stakeholder involvement for sustainable environmental management of the agroindustrial landscapes of SA.*

***Keywords:*** aquatic ecosystems; ecological risk assessment; heavy-metal pollution; Southern Africa; rapid bioassessment schemes.

# Simulation Modelling of the Impact of Nature-based Solutions on the Hydrology of the Mbarali River Catchment

**Nyemo A. Chilagane[1]*, Japhet J. Kashaigili[2], Winfred Mbungu, Festo Silungwe[3], Papilon Mkome[4]**

[1]Tanzania Research and Conservation Organization, P.O. Box 6873, Morogoro, Tanzania.
[2]Department of Forest Resources Assessment and Management, Sokoine University of Agriculture, P.O. Box 3013, Morogoro, Tanzania.
[3]Department of Civil and Water Resource Engineering, Sokoine University of Agriculture, P.O. Box 3003, Morogoro, Tanzania
[4]National Environment Management Council, Southern Highlands Zone, P.O. Box 1562, Mbeya, Tanzania

Corresponding author's email: nchilagane@yahoo.com

*Despite substantial increases in the scope and magnitude of biodiversity conservation and ecological restoration, there remains ongoing degradation of natural resources that adversely affects both biodiversity and human wellbeing. Nature-based Solutions (NbS) can be the effective framework for reversing this trend, by increasing the alignment between conservation and sustainable development objectives. This study was conducted to evaluate the effects of NbS on watershed hydrology. Remote sensing and GIS techniques were used to prepare model inputs data and the Soil and Water Assessment Tool (SWAT) used to simulate the impact of NbS on hydrology under different NbS counterfactual scenarios. Simulation results were compared with the baseline scenario to estimate the effects of NbS on the hydrology. Simulation results indicate that when nature-based solutions are implemented in Mbarali River catchment, the sediment yield reduced by 13.5% while the soil water content increased by 3% with an increase in average dry season (June – October)) river flows of 1%. The results indicate that adopting NbS in Mbarali River catchment can mitigate the impacts of extreme drought conditions and contribute toward building long-term water security.*

***Keywords:*** Counterfactual scenarios, Nature based Solutions, Sediment yield, Soil water content

# Land-Use and Land-Cover (LULC) Change Detection in Wami River Basin, Tanzania

**Sekela Twisa[1,2,3*] and Manfred F. Buchroithner[3]**

[1]Water Resource Centre of Excellence, Ministry of Water, P.O. Box 456, Dodoma, Tanzania;
[2]Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES), United Nations University, Ammonstrasse 74, 01067 Dresden, Germany
[3]Institute for Cartography, Technische Universität Dresden, 01062 Dresden, Germany

.*Corresponding author email: sekela.twisa@maji.go.tz/sekelat@yahoo.co.uk

*Anthropogenic activities have substantially changed natural landscapes, especially in regions which are extremely affected by population growth and climate change such as East African countries. Understanding the patterns of land-use and land-cover (LULC) change is important for efficient environmental management, including effective water management practice. Using remote sensing techniques and geographic information systems (GIS), this study focused on changes in LULC patterns of the upstream and downstream Wami River Basin over 16 years. Multitemporal satellite imagery of the Landsat series was used to map LULC changes and was divided into three stages (2000–2006, 2006–2011, and 2011–2016). The results for the change-detection analysis and the change matrix table from 2000 to 2016 show the extent of LULC changes occurring in different LULC classes, while most of the grassland, bushland, and woodland were intensively changed to cultivated land both upstream and downstream. These changes indicate that the increase of cultivated land was the result of population growth, especially downstream, while the primary socioeconomic activity remains agriculture both upstream and downstream. In general, net gain and net loss were observed downstream, which indicate that it was more affected compared to upstream. Hence, proper management of the basin, including land use planning, is required to avoid resources-use conflict between upstream and downstream users.*

***Keywords:*** LULC; RS and GIS, remote sensing; geographical information system; change detection; upstream and downstream

# POSTER PRESENTATION

## Sub-Theme 1:
## Transformation Technologies and Innovations

# Evaluation of Sunflower Farmers Knowledge on Varietal Selection and Agronomic Practices in Tanzania: A case Study of Simiyu and Singida regions

**Hekima Boniface Mliga[1]*, Mwajuma Zinga[1], and Respicius Martin[2]**

[1]Department of Crop Science and Horticulture, P.O. Box 3005, Chuo Kikuu Morogoro, Tanzania.
[2]Department of Agricultural Extension and Community Development , P.O. Box 3002, Chuo Kikuu Morogoro, Tanzania.

*Corresponding author's email: hekima.mliga@sua.ac.tz

*Sunflower is an ideal oilseed crop produced in Tanzania. Its oil is considered a premium oil due to its high oleic acid and oil content, being a main source of polyunsaturated oil and vitamin E. Despite its vast potential in oilseed production, Tanzania imports 60% of its national edible oil demand. This study aims to increase the productivity and oil content of sunflower in Tanzania by assessing the farmers' awareness on best agronomic practices, current available production technologies, and comparing the performance of different sunflower varieties. A field survey was conducted in sunflower growing areas of Singida and Simiyu regions to determine the level of farmers' awareness of sunflower varieties and agronomic practices. Face-to-face interview using a semi-structured questionnaire was conducted to gather primary data from 60 farmers in each district.Data on farmers' demographics, agronomic practices, challenges and experience were collected. Low yield was reported as a predominant problem by majority (100%) of farmers. Most (70%) farmers do not use fertilizers and do not know the varieties of sunflower grown in their farms. Unavailability of seeds, high cost of fertilizers and pesticides were reported as major challenges. Majority (80%) of respondents reported yield of less than 1 ton per hectare. Lack of knowledge on suitable types of seeds and fertilizer especially Sulphur fertilizer which increases oil content are the main limiting factors. To improve yield, it is suggested that appropriate agronomic practices, suitable varieties and right fertilizer to be used.*
***Keywords:*** Sunflower, oil content, fertilizer, Singida, Simiyu

# Digital Tuberculosis Treatment Monitoring Platform in Tanzania

**Joan Jonathan* and Alcardo Barakabitze**

[1]AI4D Research Group, Department of Informatics and Information Technology, Sokoine University of Agriculture, Morogoro, P.O Box 3038, Tanzania.

*joanjonathan@sua.ac.tz

*Tuberculosis (TB) is known as one of the death leading diseases in Tanzania. However, the disease can be cured and prevented using medications. TB treatment lasts for a long period of time and a patient is required to visit healthcare clinic for medication procedures. It is invaluable to observe the procedures of treatment for a successful outcome. In Tanzania, TB treatment is provided freely in order to reduce TB transmission and prevent drug resistance. Conversely, TB patients frequently stop treatment because they forget to go to the clinic on the scheduled dates. To address this issue, we have developed an innovative digital data-driven TB treatment monitoring platform called SmartTB that reminds patients of their treatment schedules and provides real-time reporting. This study used agile methodology to gather requirements from three Tanzanian hospitals and to develop the system. The system was validated using user acceptance testing to confirm the system's performance. Despite the validation findings showing that SmartTB can support monitoring of TB patients' treatment and data management, the system has not been launched for operational use. Therefore, the implementation of SmartTB requires the effective cooperation of stakeholders, including healthcare providers, and policymakers, to ensure that the system is utilized and integrated into the country's healthcare system.*
***Keywords:*** Data management, Tuberculosis, Treatment, Monitoring, Healthcare

# Unlocking the Potential of Technology-Driven Agricultural Marketing Co-operatives for Agricultural Transformation in Tanzania

**ALex J. Ngowi**

Department of Co-operative Development and Management, Moshi Co-operative University- Tanzania

E-mail: ngowi.alex@yahoo.com

*The main objective of this study was to find out how Technology-driven Agricultural Marketing Co-operative Societies (TAMCoS) can contribute to Tanzania's agricultural transformation. In particular, it determined the various technology interventions and how they were perceived to contribute. The results of this study provide guidance to stakeholders in the agricultural sector, policymakers, and development professionals about the advantages of utilising technology-driven initiatives to support agricultural transformation. Utilising a survey, focus groups, and key informant interviews, information was gathered from 201 respondents. While qualitative data were arranged in accordance with the study themes, quantitative data were computed as percentages and frequencies. Despite co-operatives still being behind in adopting technology, more than three quarters (78.6%) of study participants felt that TAMCoS is an engine for agricultural transformation. The study found numerous technology innovations that, if used, may contribute to agricultral transformation. This includes mobile applications, digital platforms, and data analytics. It was perceived to have opportunities in the following areas: post-harvest management, disease and pest control, soil research, weather forecasts, disaster/risk preparedness and alerts, disease and pest detection pest controls. The study conclude that adoptions to technology has the potential to improve agriculture since they offer crucial agricultural services and information to different actors throughout the value chain. Therefore, the study recommends co-operatives to abandon raditionsal methods in favor of utilising technology potentials. However, enabling successful and effective adoptions of these potentials can call for institutional support, access to technological and digital infrastructures, and funds among other things.*

***Keywords:*** technology Potentials, Technology-Driven Agricultural Marketing Co-operatives, Agricultural Transformation in Tanzania

# Molecular Characterization And Antimicrobial Susceptibility Status of *Mycoplasma Capricolum* Subsp. *Capripneumoniae* Isolated from Goats in Manyara Region

**Jevenary N. Lukeye[1]*, Alexanda Mzula[1], Elisa Mwega[1], Andrew C. Chota[2] and Philemon N. Wambura[1]**

[1]College of veterinary medicine and Biomedical Sciences, Department of Microbiology, Parasitology and Biotechnology. P.O. Box 3019, Chuo Kikuu, Morogoro, Tanzania

[2]Tanzania Livestock Research Institute (TALIRI) Address: P.O. Box 834, Dodoma- Tanzania

*Corresponding author. Email: jevenaryrwiza@gmail.com

*Contagious caprine pleural pneumonia (CCPP) causes approximately 60-80% morbidities and 100% mortalities in naive goat flocks. According to estimates, the morbidities, mortalities, and overall costs associated with preventing and treating this disease over the world result in losses of 507 million US dollars whereas in Tanzania, this disease results in around 2,273,281 TZS losses per household every year. This study aimed to characterize and determine the antimicrobial susceptibility status of the etiological agent for CCPP, Mycoplasma capricolum subsp. Capripneumoniae isolated from goats in Manyara region. A cross-sectional study was employed where 217 goats were sampled via purposive and snowball techniques in Kiteto, Simanjiro, Babati, and Mbulu districts. A total of 210 swabs and 7 lung samples were collected from goats demonstrating clinical manifestations of the surveyed infection and transported to the microbiology laboratory for bacteriological examination. Each sample was inoculated into PPLO broth, then into PPLO agar, and observed under the stereo microscope from the 3rd to the 14th-day post-inoculation. The results showed that 15 (6.9%) of the 217 samples collected tested positive for Mycoplasma spp. Ten of these samples came from Babati, two from Kiteto, and three from Simanjiro district. However, these samples which were initially identified via colonial microscopic observation are currently preserved to wait for antimicrobial susceptibility testing as well as molecular assays including PCR and sequencing to allow a more resolved identification of the pathogen. The results are anticipated to be useful in designing better control strategies against the disease after the conclusion of this study.*

***Keywords:*** Contagious caprine pleural pneumonia, Mycoplasma capricolum subsp. Capripneumoniae, antimicrobials.

# Bamboo Value Chain Development and Commercialization: A Case Study of Southern Highlands of Tanzania

**Paulo J. Lyimo[1]*, Japhet S. Japhet[2], Gladness E. Kaaya[2], Frank M. Ntenga[2], Kosei Masaka[3], Gimbage Mbeyale[4] and Suzana Nyefwe[5]**

[1]Department of Ecosystems and Conservation, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3010, Chuo Kikuu, Morogoro, Tanzania.
[2]Bamboo and Rattan Association of Tanzania (BARATA), P.O. Box 3100, Morogoro, Tanzania.
[3]Department of Forest and Environmental Economics, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3011, Chuo Kikuu, Morogoro, Tanzania.
[4]Department of Forest Resources Assessment and Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3013, Chuo Kikuu, Morogoro, Tanzania.
[5]Nelson Mandela African Institution of Science and Technology (NM-AIST), P.O. Box 447, Arusha, Tanzania.

*Corresponding author Email: paulo.lyimo@sua.ac.tz

*Bamboo resources have high potential economic benefits in domestic and industries uses. Despite the chief contribution of bamboo resources to the industrial development and domestic uses, value chain and commercialization of the manufactured bamboo products, market system analysis, business environment and challenges from the bamboo production to consumption systems is less investigated. This study aimed to investigate the bamboo value chain development and commercialization in Iringa, Njombe and Mbeya regions of Tanzania. The main data collection method was surveys of main value chain actors complemented by expert interviews. Both qualitative and quantitative techniques including inferential statistics were used for analysis. Bamboo products identified during study were baskets, bamboo juice, carrying baskets, dustbins, tables and chairs. Simple tools have been used during bamboo processing. Bamboos are consumed and utilized differentially due to their different purposes by temporary buyers, commercial farmers, local farmers and furniture uses. The results show that management practices are less taken during bamboo production. Rates of commercialization are found different among regions where areas with a better access to consumer markets reportedly engage more in commercial extraction and earn a correspondingly higher income from bamboo than regions far from centres of consumption. The bamboo value chain faces several challenges including markets and financial factors and technical skills especially education concerning bamboo production. The study suggests the need for training and education, market improvement, effective support from other stakeholders such as loan institutions and good governance for improvement of bamboo value chain development and commercialization.*
***Keywords:*** Bamboo, Value chain, Commercialization, Management, Tanzania

# Indigenous Knowledge, Innovation and Utilization Technologies of Bamboo as an Instrument of Livelihood Provision to the Local Communities: A Case Study of Southern Highlands of Tanzania

**Paulo J. Lyimo[1]*, Japhet S. Japhet[2], Gladness E. Kaaya[2], Frank M. Ntenga[2], Kosei Masaka[3], Gimbage Mbeyale[4] and Suzana Nyefwe[5]**

[1]Department of Ecosystems and Conservation, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3010, Chuo Kikuu, Morogoro, Tanzania.
[2]Bamboo and Rattan Association of Tanzania (BARATA), P.O. Box 3100, Morogoro, Tanzania.
[3]Department of Forest and Environmental Economics, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3011, Chuo Kikuu, Morogoro, Tanzania.
[4]Department of Forest Resources Assessment and Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3013, Chuo Kikuu, Morogoro, Tanzania.
[5]Nelson Mandela African Institution of Science and Technology (NM-AIST), P.O. Box 447, Arusha, Tanzania.

*Corresponding Author Email: paulo.lyimo@sua.ac.tz

*Bamboo is a potential source of climate-smart income generation. However, bamboo has not gained significant influence on the farming-production lands, furniture and construction industries, thereby missing the substantial contribution it could make to local community development. This study aimed to fill the information gap concerning indigenous knowledge, innovation and utilization of technologies performed by the local communities in the Iringa, Njombe and Mbeya regions of the Sothern Highlands of Tanzania. Systematic random sampling using a sampling frame generated with the help of village leaders*

*was employed. Focus group discussion, household survey and key informant interview were used to obtain information from consumers, bamboo producers and enterprises. Then, the data collected were analysed using descriptive statistics. Findings on innovation technologies demonstrate that indigenous knowledge (42.27%) and personal technical skills (30.2%) are main sources of knowledge for product innovation. Majority of traditional bamboo enterprises gain the necessary skills, knowledge and creativity via local competitors, mass media and internet. Information exchange (80%), joint buying of inputs and selling of products (73.3%), experience sharing (73.3%), and group works (26.67%) are most tactics that aid improvement and spread of innovation technologies. The study reveals that local communities use bamboo for various purposes. The frequently mentioned uses are food and drinks (bamboo juice and ulanzi), basketry, miscellaneous crafts, house construction, furniture, medicine and fuel use. Therefore, local community's indigenous technologies promote innovation through use of bamboo as nature-based solution to guarantee sustainable food security and improved environmental conservation.*
***Keywords:*** Bamboo, innovation, technology, climate-smart and livelihood.

# Detection and Classification of Bean leaf Diseases using Image Processing and CNN-based Deep Learning Strategy

**Michael P.J. Mahenge[1]*, Hussein Mkwazu[1], Camilius A. Sanga[1], Caroline Maro[2], Beatrace Mwaipopo[2], and Richard Madege[2]**

[1]Department of Informatics and Information Technology, College of Natural and Applied Sciences, Sokoine University of Agriculture
[2]Department of Crop Science and Horticulture, College of Agriculture, Sokoine University of Agriculture

*Corresponding author Email: mahenge@sua.ac.tz

*Management of plant diseases is a challenging task due to lack or inadequate tools for efficient surveillance, detection, prediction as well as prevention. Early and accurate detection of plant disease is potential for effective disease management to minimize yield loss and production costs, and hence improving food security. Bean is a potential grain legume used as food as well as the key source of important micronutrients needed by millions of people worldwide, including in sub-Saharan Africa. In Tanzania, consumption of common bean dry seeds with cereal-based food guarantees access to a balanced diet and supplementary nutrients that help alleviate malnutrition and prevent various diseases such as cardiovascular, certain types of cancer, and diabetes. Moreover, beans are considered as a source of income, more than 90% are produced by small-scale farmers. The purpose of this study is to enhance early detection and classification of bean leaf diseases using a cost-efficient approach based on artificial intelligence and deep learning techniques. In this paper, experiment were configured in a cloud-based environment referred to as Google Colaboratory or "Google Colab." A dataset of 2228 samples of bean leaf images captured using digital cameras from the field in Songwe and Morogoro regions in Tanzania were used. Three (3) Convolutional Neural Network (CNN) models including ResNet152, Inceptionv3 and EffientNet were used. Initially a novel deep Residual Convolutional Neural Network (ResNet152) was used to extract multiple features from bean leaf images and Adaptive moment estimation (Adam) optimizer were applied to enhance classification performance of bean leaf diseases. The experimental results illustrate that the proposed ResNet-based deep learning strategy performs better (Average accuracy = 94.78%) in terms of classification performance followed by InceptionV3 (93.18%). These findings provide understanding into the development of automated tools for early plant disease detection to improve early notifications and management of plant diseases.*
***Keywords:*** Deep learning, Image processing, Crop disease classification, ResNet, Artificial Intelligence.

# Artificial Intelligence and Deep Learning based Technologies for Emerging Disease Recognition and Pest Prediction in Beans (*Phaseolus Vulgaris* L.): A Systematic Review

**Michael P.J. Mahenge[1]*, Hussein Mkwazu[1], Camilius A. Sanga[1], Caroline Maro[2], Beatrace Mwaipopo[2] and Richard Madege[2]**

[1]Department of Informatics and Information Technology, College of Natural and Applied Sciences, Sokoine University of Agriculture
[2]Department of Crop Science and Horticulture, College of Agriculture, Sokoine University of Agriculture

*Corresponding author Email: mahenge@sua.ac.tz

*Artificial Intelligence (AI) and deep learning have the capacity to reduce losses in crop production, such as low crop yields, food insecurity, and the negative impacts on a country's economy caused by crop infections. This study aims to find the knowledge and technological gaps associated with the application of AI-based technologies for plant disease detection and pest prediction at an early stage and recommend suitable curative measures. An evidence-based framework known as the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) methodology was used to conduct systematic reviews of the state-of-the-art of AI and deep learning techniques for crop disease identification and pest prediction in developing countries. The results demonstrate that conventional methods for plant disease management such as cultural, physical, chemical, and biological controls, face some challenges, such as being costly in terms of labour, having low detection and prediction accuracy, and some are not environmentally friendly. Also, the rapid increase in data-intensive and computational-intensive tasks needed for plant disease classification using traditional machine learning methods poses challenges such as high processing time and storage capacity. Consequently, this paper recommends a deep learning and AI-based strategy to enhance the detection, prediction, and prevention of crop diseases. These recommendations will be the starting point for future research.*

***Keywords:*** Plant diseases detection, pest prediction, pesticide recommendation, artificial intelligence, machine learning.

# Artificial Intelligence based Smart Livestock Farming to Improve Animal Health and Production in Tanzania

**Mabula M. Marko[1] and Alcardo Barakabitze[2]**

[1]Department of Veterinary Medicine and Public Health, P.O.Box3021, Sokoine University Of Agriculture, Morogoro, Tanzania
[2]AI4D Research Group, Department of Informatics and Information Technology, Sokoine University of Agriculture, Morogoro, P.O Box 3038, Tanzania,

Corresponding author: mabulamarkoe@gmail.com

*This study aimed to investigate the potential of artificial intelligence (AI) in improving animal health and production in Tanzania through smart livestock farming. A systematic literature search was conducted to identify relevant studies from various databases using prisma guideline. A total of 200 articles were identified, out of which only 35 met the inclusion criteria. Additionally, 10 studies were identified from Tanzania, and only three of them were included in the review. The selected studies were analyzed to extract information on the use of AI in livestock farming. The data collected from the eligible articles were analyzed using a thematic analysis approach. The main themes identified were the current state of AI-based smart farming in Tanzania, its impact on animal health and production and opportunities for its implementation. The findings of the study revealed that AI-based smart farming has the potential to improve animal health and productionin Tanzania by providing real-time monitoring and early detection of diseases, optimizing feed and water management, and enhancing breeding programs. The study also identified opportunities for the implementation of AI-based smart farming in Tanzania, such as government support and partnerships with private sector organizations. AI-based smart farming has a pontential to revolutinalize livestock farming in Tanzania by improving animal heath and production. however to fully realize its pontential threre is need for increased investment in technology and infractructure as well as awareness and trainning among farmers.*

# Sub-Theme 2:
# Vector and Pest Management, Animal and Public Health Management

# Organophosphorous Pesticides Residues in Tomatoes from Morogoro: A case Study of Mlali and Doma Divisions in Mvomero district

***Alex Wenaty and Beatha Mkojera**

Department of Food Science and Agro- processing, School of Engineering and Technology,
Sokoine University of Agriculture, P.O. Box 3006, Chuo Kikuu, Morogoro

*Corresponding author Email: wenatyalex@sua.ac.tz

*Extensive use of pesticides is mentioned to challenge the horticulture industry in Tanzania. Morogoro region is the largest producer of tomatoes in the country and the farmers involved can hardly escape the risks of applying pesticides. This study evaluated organophosphorous pesticide residues in tomatoes grown at Mlali and Doma divisions of Mvomero district in Morogoro. Samples were collected from farms and markets of the study sites. Analyses of cleaned – up extracts were performed by using a gas chromatography equipped with mass spectrometry (GC – MS). Six organophoshorous pesticides such as; pirimiphos methyl > diazinon > fenitrothion > dimethoate > profenofos > chlorpyrifos were detected in that order of concentrations. The levels of pirimiphos methyl ranged between 9.53±0.05 and 3.32±0.03 µg/kg on samples from Mlali and 6.33±0.03 - 0.20±0.01 µg/kg on samples from Doma. Chlorpyrifos were detected in least concentrations to all samples compared to other organophosphorous pesticides. Higher levels of pesticides were detected in samples collected from the market compared to those from the farms in both sampling sites. This indicates a possible misuse of the pesticides on tomatoes after harvesting and during distribution which may result into hazardous effects to the consumers of affected tomatoes.*
***Keywords:*** Tomatoes, organophosphorous pesticides, analytes, gas chromatography, hazardous effects.

# Antibacterial and Antifungal Properties of Green Silver Nanoparticles Synthesized using Phytochemicals from *Zanthoxylum piperitum* Leaves

**Alinanuswe J. Mwakalesi[1]* and Magori Nyangi[2]**

[1]Department of Chemistry and Physics, College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O. Box 3038, Tanzania
[2]Department of Water Resources, Water Institute, P.O Box 35059, Dar es Salaam, Tanzania

*mwakalesi@sua.ac.tz

*Application of silver nanoparticles is one of the recently emerging potential solutions for the treatment of diseases caused by multidrug-resistant microorganisms due to their high performance caused by a high surface area-to-volume ratio. Thus, the use of silver nanoparticles (AgNPs) for antibacterial and antifungal effects has been recently capturing significant attention. The current study intends to develop green AgNPs with antimicrobial properties using phytochemicals from Zanthoxylum piperitum leaves collected from Morogoro region. Ag-NPs were synthesized through a chemical method and the formation was indicated by the appearance of a maximal absorption peak at 420 nm in the UV-Vis spectrum. The findings indicated that the synthesized silver nanoparticles (Ag-NPs) were effective against both gram-negative and gram-positive bacteria. The antibacterial effectiveness was indicated by minimum inhibitory concentrations (MIC) of 0.07 and 0.13 mg/L for Staphylococcus aureus and Escherichia coli, respectively. The nanoparticles act by killing bacteria with minimum bactericidal concentrations (MBC) of 0.53 and 0.13 mg/L for Staphylococcus aureus and Escherichia coli, respectively. Similarly, the Ag-NPs were effective antifungal agent against Candida albicans and Aspergillus niger with MIC values of 1.06 and 0.13 mg/L, respectively. The MBC values exhibited for Candida albicans and Aspergillus niger were 1.06 and 0.53 mg/L, respectively. The preliminary results from the current study suggest that the synthesized Ag-NPs contain potential antimicrobial properties and can be useful for the treatment of infectious diseases.*
***Keywords:*** silver nanoparticles, Zanthoxylum piperitum leaves, antibacterial and antifungal

# Improving Food Security and Alleviating Nutritional Deficiencies in Tanzania through Bean Leaves Consumption

**Caroline N. Maro*, Mary R. Marcel, Joyce D. Mwakatoga, Mwajuma K. Zinga, James Chacha and Joseph O. Ruboha**

*Corresponding Author: caroline.maro@sua.ac.tz

*Nutritional disorders caused by dietary nutrient deficiency in Tanzania are still prevalent causing poor growth in children and low productivity in adults. Despite leafy vegetables being a potential source of micronutrients and mineral contents, farmers normally utilize grain legume including common bean which is highly preferred. In some Tanzanian communities especially southern highlands, tender and dry bean leaves are consumed as a leafy vegetable when dry grains are scarce. However, the nutritional content of these preferred varieties is undocumented. In this study, we aimed to analyse the key micronutrients and mineral contents of highly consumed bean leaves. We conducted a screen house experiment using the 10 most preferred bean varieties laid in Completely Randomized Design (CRD) with three replication each. After 21 days tender leaves were harvested and submitted to Human Nutrition laboratories at Sokoine University Agriculture (SUA) for nutritional analysis. Vitamin A, C, iron, and Zinc were analysed. We found a significant difference in Vitamin A, C, and Zinc among the 10 varieties tested ($p \leq 0.05$). Iron content differed slightly among the 10 varieties suggesting that one can receive nearly similar amount of iron by consuming any of the 10 varieties. It was revealed that the levels of micronutrients and mineral contents were significantly higher in leaves than in grains (3.95 mg/100g of Zinc and 67.64 mg/100g of Iron in leaves compared to 1.7-2 mg/100g of Zinc and 5-8 mg/100g of Iron in grains respectively). This study provides new insights into bean leaf consumption and breeding for high nutritional bean leaf varieties. Future research should focus on analysing the nutritional content of commonly consumed leafy vegetables across Tanzania to increase food security and alleviate nutrient disorders.*
***Keywords:*** Bean leaves, nutritional disorders, micro nutrients, mineral contents.

# Ticks and Tick-borne Disease Control Practices and Commonly used Acaracides in Eastern Tanzania

**Mwita Marwa Wambura and Eliakunda Mafie**

Department of Microbiology, Parasitology and Biotechnology, Sokoine University of Agriculture, P. O. Box 3019, Morogoro, Tanzania

*Corresponding author Email: eliakunda.mafie@sua.ac.tz

*Ticks are blood feeding arthropods that transmit disease pathogens of public and veterinary importance such as protozoa and bacteria. Chemical ticks control is simple and feasible generally used method. However some tick species has been reported to develop resistance against some commonly used acaricides. Acaricides malpractices which include choice of acaricides, their dilution rates, methods of application and frequency of application might result into failure of tick and TBDs control programmes including resistance development. This study was conducted to investigate on ticks and tick-borne disease control practices and commonly used acaricides where structured questionnaires were administered to 129 respondents in Morogoro and Chalinze districts. The results indicate that hand spray of acaracides was the most application method used by majority of respondents 115 (89.1%). About 16 chemical tradenames were commonly used in the study areas and majority of respondent 63 (48.8%) applied the acaricide at the interval of once per week followed by 51 (39.6%) who were not considering any interval (uncontrolled interval). However, most of respondents 90 (69.8%) had poor knowledge on acaricide solution preparation as most of them were deciding on concentration to use basing on their own experience and in most cases, they were exceeding the manufacturers recommended concentration. In addition, a number of respondents 44 (34.1%) reported to use single drug for more than ten years while others were purposively interchanging acaricides 63 (48.8%) due to resistance suspicion in certain acaricides. This study has revealed that acaricide malpractices including use of wrong dilution rates, use of single acaricide over prolonged time and uncontrolled application intervals are some of factors which might contribute to acaricide failure including resistance development. Further studies should be conducted to investigate the resistance status of commonly used acaricides in the study areas.*
***Keywords:*** Acaricide, Ticks, Tickborne diseases.

# Epidemiological Survey of Feline Immunodeficiency Virus (FIV) Infection in Morogoro, Tanzania: a Pilot Study

**Isaac Makundi*and George Sanga**

[1]Department of Microbiology, Parasitology and Biotechnology, CVMBS, P.O Box 3019, SUA, Morogoro, Tanzania

*isaac.makundi@sua.ac.tz

*Feline Immunodeficiency Virus (FIV) is an immunosuppressive virus in cats which is related to HIV. In domestic cats the disease is manifested with immunodeficiency syndrome characterized by gingivitis-stomatitis, wasting, neuropathology and increased incidence of tumor development. Reports of the epidemiology of FIV worldwide are numerous, but information is scarce for most regions of Africa including no studies in Tanzania. We conducted this study in order to provide baseline information about the status and epidemiology of this disease in domestic cats. In Tanzania, vaccination against FIV is largely uncommon probably due to unavailability of data about the type of virus strains circulating in the country. This abstract is submitted to the 3rd SUA Scientific Conference under the sub-theme 2 titled, Vector and Pest Management, Animal and Public Health Management under the section of epidemiology and control of endemic and emerging diseases. The current study aimed at investigating FIV sero-prevalence, assess the potential risk factors associated with infection in domestic cats and to develop further recommendations. A cross-sectional study was conducted at selected urban regions of Morogoro, between March and December 2022, in 120 apparently health domestic cats. From each of cats, 1.0 ml of blood were collected by jugular puncture for detection of antibodies to FIV in whole blood using a commercial test kit, FeLV/FIV Immunochromatographic assay. FIV antibodies was not detected in any of the 120 cats tested (95% CI: 0% – 0.03%). In the present study, we found no evidence of FIV infection among the sampled cats. A further study with a much larger sample size employing multiple detection methods such as PCR is warranted.*

***Keywords:*** Feline Immunodeficiency Virus; Retrovirus; Sero-surveillance; Morogoro; Tanzania

# The Potential use of Traditional Maize Germplasms in Reducing Maize Loss due to Maize Storage Pest, Maize Weevils (*Sitophilus Zea*)in Katavi Region

**Mpeguzi Masunga Hinile[1]*, Novartus Massawe Mark[2], Elisha Masudi Rutha[3], Joseph Osward Ruboha[4] and Anna Sikira[5]**

Sokoine University of Agriculture, Department of Agricultural Science, P.O. BOX 82, Mpanda, Tanzania

*Corresponding author's mmpeguzi@gmail.com

*Maize storage for small scale farmers is highly challenged by the storage pest maize weevil (Sitophilus zeamais). This study was conducted in three districts of Katavi region leading in maize production namely Mlele, Nsimbo and Tanganyika to identify the potential use of resistant varieties in reducing loss caused by maize weevils. 30 maize germplasms (traditional and improved) were collected and screened for maize weevil resistance potential using the phenotypic screening. During sample collection, assessment of maize production, storage and loss encountered by farmers due to maize weevils in Katavi were also conducted. According to the results obtained, it was shown that the loss due to maize weevils in Katavi region begin at farm when maize is harvested late and can reach up to 100 % if no control measures applied. It was also revealed that only 45.6 % of all farmers protect their maize against weevils while 54.4 % do not apply any method due to lack of knowledge, financial difficulties and lack of storage facilities. Screening of maize genotypes shows that the collected genotypes differ in their level of resistance to maize weevils. The analysis of variance (ANOVA) shows that there was a significant difference at $P \geq 0.05$ with the P value of 0.01 whereby the most susceptible variety was HB 515 with the highest weight loss while the highly resistant variety was tradition variety labelled KLVN7 collected from Nsimbo district. Although high resistance was observed in traditional varieties but most farmers (73.4 %) grow improved varieties due to their high yield compared to the traditional varieties (26.6 %), therefore, this work suggests the use of traditional germplasm as a sources of resistant gene(s)/QTL in the breeding program to improve the resistance of high yielding maize varieties toward the storage pest maize weevil.*

***Keywords:*** Maize Weevils, Katavi, Traditional variety

# Recent Research on Occurrence and Management of Fusarium Mycotoxins in Maize (*Zea mays* L) - Sub Saharan Africa: A review

**Richard Raphael Madege**

Department of crop Science and Horticulture, Sokoine University of Agriculture, Tanzania

*richmadege@gmail.com

*Maize (Zea mays L.) is one of the most vulnerable crops to infections of pathogenic fungi, particularly Fusarium species. The tropical, warm, and humid conditions, typical climates of sub-Saharan Africa are favorable to the growth and development of the fungi. Apart from deteriorating the physical quality of the grain, the fungi produce secondary metabolites, mycotoxins that are not only phytotoxic, but also harmful to humans and animals. The toxins can cause acute or chronic illnesses. There are numerous fusarium mycotoxin groups that have been detected in maize grains Further, despite the increase in the understanding of mycotoxigenic fungi and mycotoxins in the country, very limited knowledge exists on practices and measures that control both the fungi and the toxins. The European Union member states and the United states apply standards and legal regulations on the permissible levels of mycotoxins in food and feed. Enforcement of same has not been possible to African context for various reasons. Hence, in these countries, the use of preventive measures during crop cultivation and after become the most important strategy to limit contamination of Fusarium fungi and their mycotoxins This review summarizes the most recent knowledge on the occurrence of toxic secondary metabolites of Fusarium in maize, and the development of methods for limiting and/or eliminating the contamination of Fusarium mycotoxins in maize-based food and feed chain.*

***Keywords:*** Fusarium species, mycotoxins, preharvest management

# Sub-Theme 3:
# Policy and Good Governance for Agriculture Transformation

# Spatial Spillover Effect of Neighbors' Herd Size on the incidence of Farmer-Herder Conflicts: A Case of Kilosa, Tanzania

**Tumaini Allan[1], Edwin Ngowi[2], Ng'winamila Kasongi[3], Justin Urassa[1] and John Jeckoniah[2]**

[1]Department Department of Policy Planning and Management, Sokoine University of Agriculture, Tanzania.
[2]Department of Development and Strategic Studies, Sokoine University of Agriculture, Tanzania.
[3]Department of Geography and Environmental Studies, The University of Dodoma, Tanzania.

*Corresponding author Email: nkasongi@gmail.com

*Farmer-herder conflicts have been widely studied in the Sub-Saharan region. The existing literature puts more emphasis on understanding causes and effects of farmer-herder conflict in the origin locations of conflict. Also, the increase of herd size has been framed as one of major causes of these conflicts. Nevertheless, there is little empirical evidence on the extent to which neighbors' herd size tends to influence farmer-herder conflicts. This study used ward-level data of Kilosa District to fill this knowledge gap. To estimate spatial spillover effect of neighbors' herd size, the study used Geographically Weighted Logistic Regression Model (GWLRM) which was implemented in R software (V 4.2.1). The results indicate that farmer-herd conflict is still a major challenge in the study area because more than 50% of all wards had encountered farmer-herd conflicts in the past twelve months. The results of GWLRM show that neighbors' herd size is a good predictor of farmer-herder conflict, but the spatial spillover effect tends to be significant to specific locations in the study area. This suggests that the effect of neighbors' herd size on farmer-herder conflict is heterogenous, and it should not be spatially generalized. Based on our findings, the narrative that the increase of herd size influences the conflict is not always true. Our result shed light on the usefulness of using spatial modeling in understanding better the context of farmer-herder conflict. Therefore, we recommend that analysis of and implementations of strategies to combat farmer-herd conflict should consider the neighborhood context.*
***Keywords:*** Farmer-herder conflict, herd size, spillover effect, Geographical weighted regression, Kilosa

# Assessment of the Quality of Rain Water Harvested from Different Types of Rooftops in Morogoro Municipality

**Chaliga, S. Warda[1]* and Silungwe, R. Festor[2]**

[1]Ministry of Agriculture Food Security and Cooperatives, National Irrigation Commission,
Regional Irrigation Office, Mbeya, Tanzania
[2]Sokoine University of Agriculture, Department of Civil and Water Resources Engineering,
P.O.Box 3003, Morogoro, Tanzania

*Corresponding author Email: festosilungwe@sua.ac.tz

*Contamination of the harvested rainwater makes it unsafe for human consumption. While contamination may occur at any stage in the rain water harvesting (RWH) system's components, the contaminations from roofs which are the most common catchments used must be understood clearly. Therefore, this study assessed the quality of rain water harvested using different rooftops materials of different ages from four different places (SUA Edward Moringe Campus, Mazimbu, Jordan University and Pangawe). These study areas were chosen randomly to provide wide spatial coverage of Morogoro Municipality. From each study area, rainwater samples were collected for different roofing materials with two age limits of less than 10 years (new) and more than 10 years (old). The samples were then taken to the laboratory for analysis of quality parameters which are the PH, total dissolved solids (TDS), fluoride, colour and faecal coliforms. The study found that the types of roofing materials did not affect water quality parameters. The age of roof affected the influenced the harvested water quality parameters, with old aged roofing having quality parameters which were out of the standard ranges or near limits. This indicates that the harvested rainwater must be treated prior to its use. Water from aged corrugated iron sheet rooftop is highly not recommended for certain activities such as drinking and cooking.*
***Keywords:*** water quality, rainwater harvesting, roofs, roofing materials, contaminants.

# Propagation Practices and Quality of Seedlings against the Proposed Minimum Certification Standards for Mango Seedlings in Tanzania

**Bahati Fungameza, Richard Madege and Yasinta Nzogela**

Department of Crop Science and Horticulture, Morogoro, Tanzania

Corresponding author: fungamezab@gmail.com

*Mango production in Tanzania is steadily growing and its sustainability depends on the production of quality mango seedling (MS). This growing demand has called for a need to have government regulatory controls for certification of MS. However, the compliance of MS propagation practices to the recently proposed MS certification standards (TOSCI) is not known. A survey conducted in three regions (Morogoro, Tanga and Pwani) using semi-structured questionnaire with 70 MS nursery sample reveled that, Morogoro 25%, Tanga 17.4% and Pwani 5.3 sterilize working tools before and during grafting activities. Morogoro, Tanga and Pwani only 57.1%, 8.7% and 42.1% respectively sources scion from health and active growing mother plant. pesticides use is by 67.9%, 56.5%, and 78.9% in Morogoro, Tanga and Pwani respectively. 64.3%, 65.2% and 73.7% of the observed seedlings in Morogoro, Tanga and Pwani complies minimum rootstock diameter (0.6 cm). 85.7%, 65.2% and 42.1 % of observed MS in Morogoro, Tanga and Pwani complies minimum height of grafting point (20cm). minimum diameter of polythene bags (15cm) is conformed to by (39.1%), (39.1%) and (26.3%) in Morogoro, Tanga and Pwani.*

***Keywords:*** Mango seedlings (MS), Certification, Nursery.

# Smallholders Farmers Access to Agricultural Information: A Case of Lushoto and Korogwe Districts, Tanzania

**Joyce James[1]*, Justin Kalisti Urassa[2] and Justin Job Ringo[3]**

[1,2]Department of Policy, Planning and Management, College of Social Sciences and Humanities (CSSH), Sokoine University of Agriculture (SUA), P. O. Box 3035, Morogoro, Tanzania.
[2]Department of Development and Strategic Studies, CSSH, SUA, P. O. Box 3024, Morogoro, Tanzania.

*Corresponding Author: email: joycebakunda10@gmail.com

*Smallholder farmers' access to agricultural extension is critical for high productivity. Therefore, the paper assesses smallholder farmer's access to agricultural information in Lushoto and Korogwe Districts, Tanga Region. Specifically, it identifies types of information accessed and the respective sources. A cross-sectional research design was used whereby data were collected from 200 randomly selected smallholder farmers using a structured questionnaire, interviews and focus group discussions. Quantitative data were analysed using (SPSS) version 26, and content analysis was used for qualitative data. The findings show that more than a half of the surveyed farmers accessed their agricultural information through their relatives/ neighbours, radio, agricultural officers, and Television and only a minority (18.5%) accessed the same through social media and the internet. In addition, Pearson chi-square analysis results show that improved seed varieties, market information, best farming methods, pest management and manure were the highly searched types of agricultural information from social media and the internet ($P \leq 0.05$). Furthermore, binary regression analysis results show that smallholder farmers' likelihood of using social media and the internet was significant ($P \leq 0.05$) in relation to information (fertilizer, improved seeds and agricultural incentives). Therefore, it is concluded that despite the challenges which smallholder farmers face in accessing agricultural extension services their use of ICT to curb the shortfall is still limited. Thus, the Government, agricultural sector stakeholders and development partners are urged to promote farmers' digital literacy so that they can use ICT in meeting their agricultural information needs.*

***Keywords:*** Agricultural information, ICT, Smallholder farmers, Tanzania

# Soils around Ruvu Water Treatment Plant have Excess Chloride that Impairs Growth and Taste of Irrigated Vegetable

**Festo R. Silungwe[1]* and Majid M. Nassor[2]**

[1]Department of Civil and Water Resources, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Watercom(T) Ltd, Dar es Salaam, Tanzania

*Corresponding author Email: festosilungwe@sua.ac.tz; abdulmajidnassor11@gmail.com

*The use of inadequately treated effluent for irrigation may results to poor plant growth and destruction of soil properties. At Ruvu Water Treatment plant located at Coast Region, the use of effluent for irrigation of vegetable has grown over time. However, there are complaints of the impaired growth of vegetables and poor taste. So far, it has not been clear whether the reason is due to soils or the use of effluent for irrigation. This study assessed the cause of inadequate growth of vegetables and poor taste of its leafy vegetables. Effluent water samples were taken for three consecutive weeks from the irrigated fields and analysed for total alkalinity, chloride, pH, EC (Electrical conductivity), salinity, TDS (Total dissolved solids) and temperature. Also, soil samples were taken randomly from three locations around the area to analyses the physical and chemical properties. The results show that most of the effluent parameters values were within the available standards, however, the effluent quality fluctuated on different days and few parameters exceeded the acceptable limits. Further, soil parameters such as soil pH (7.2), Electrical Conductivity (173.2), Cu, Zn, Mn and Fe (5.13, 11.4 and 1.95, respectively) and exchangeable bases Ca, Mg, Na, and K (4.9, 2.05, 0.03, 0.06 mg/L, respectively) were within the acceptable limits, except for chloride which was the only parameters that exceed the limits (58.9 mg/l). The excess soil chloride was a verified reason for poor growth and taste of vegetables. It is recommended to check the effluent conformity on chloride levels before it is released for irrigation.*
***Keywords:*** Vegetables, Effluent, Chloride, Irrigation, Soils

# The Potential of Some Selected Cereal and Legume Crops for Hydroponic Fodder Production for Improving Smallholder Livestock Farming Systems of Tanzania

**David D. Maleko[1]*, Marco K. Laizer[1], Doreen I. Lyatuu[2] Nelson R. Makange[3] and Denis O. Kiobia[4]**

[1]Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Kiteto District Council, Manyara, Tanzania
[3]Department of Agricultural Engineering, Sokoine University of Agriculture, Morogoro, Tanzania
[4]Department of Food Sciences and Agro-processing, Sokoine University of Agriculture, Morogoro, Tanzania

*maleko@sua.ac.tz

*Hydroponic fodder (HP) is a livestock feed produced in water or a nutrient-rich solution in absence of soil as the growth media. This study examined the potential of cowpea (Vigna unguiculata), mung-bean (Vigna radiata), sorghum (Sorghum bicolar) and maize (Zea mays) seeds for HP production. This experiment was conducted in a greenhouse whereby the selected crops were grown in plastic trays inside a greenhouse under controlled randomized design. Organic nutrient solution (panchagavya) was prepared using cow urine, cow dung, milk and curd, and used to fertilize the crops. Crude protein content was 33.4, 29.86, 16.4, and 12.8% for mung-bean, cowpea, sorghum and maize, respectively. The dry matter content of up to 32.31, 20.62, 17.20 and 10.17% were observed for maize, cowpea, sorghum and mung-bean fodder respectively. Water productivity for cowpea (196.38 kg/m³), sorghum (127.49 kg/m³) and maize (98.28 kg/m³) was high while for mung bean was the lowest (58.11 kg/m³). It is concluded that the mung-bean HP was the best because of its high protein content and low water productivity potential. However, based on the seed pricings the mung-bean was more expensive than the rest of the selected crops. It is suggested that further research should be conducted to assess the aspects of anti-nutritional factors and toxicity, mineral, vitamins and fatty acid profiles contents of these selected HP crops. Additionally, it is important to undertake animal acceptability and productivity studies of these HPs for various livestock including dairy goats, cattle, pig and poultry under smallholder farming environments.*
***Keywords:*** Cowpea, sorghum, maize, mung bean, livestock feed

# Factors Influencing Rural Farmers Access to Agricultural Extension Services Provided by Private Organizations in Kibondo District

**Iman Masanja*, Gosbert Shausi and Vituce Kalungwizi**

Department of Agricultural Extension and community Development, Sokoine University of Agriculture, Morogoro, Tanzania

*Corresponding author Email: imanmasanja766@gmail.com

*Through agricultural extension services farmers acquire useful information to minimize agricultural production challenges. Though farmers in many countries including Tanzania still rely on public extension services, the governments in many countries have started to open doors for non-governmental organizations (NGOs), farmer-based organizations, and private agribusiness firms to provide services to farmers. Regardless of their existence still access to extension services provided by the private organizations has remained a main question. Studies have consistently pointed out that only few farmers in rural areas get access to extension services provided by private organizations. Low access to extension services by rural farmers has contributed to low agricultural production in rural areas and has remained the main factor for persistent poverty. This study therefore determined factors influencing rural farmers' access to agricultural extension services provided by private organizations in Kibondo district. The study used cross-sectional research design and data were collected by interviewing 120 farmers sampled from four villages. Data analysis involved descriptive statistics and a binary logistic regression model. The study found that only 18.3%% of farmers had access to extension services. Gender, marital status, education level, farmers' income and group membership had a positive and statistically significant association with access to extension services. The study concluded that only a small proportion rural farmers had access to extension services. It is recommended that production of extension services by private organizations should consider the identified factors.*
***Keywords:*** Agricultural extension, binary model, rural farmers, access, Kibondo

# A Hidden Potential of Pigeon Peas to Curb Household Food Insecurity in Rural Areas of Eastern Southern Tanzania

**Hadijah A. Mbwana[1]*, Jacob Kaingo[2] and Constance Rybak[3]**

[1]Sokoine University of Agriculture, Department of Human Nutrition and Consumer Sciences, P.O. Box 3006, Morogoro-Tanzania
[2]Mountain of the Moon University, Department of Crop and Animal Production, Fort Portal, Uganda
[3]Humboldt University of Berlin, Urban Plant Ecophysiology, Berlin, Germany

*hadijah.mbwana@sua.ac.tz

*Pigeon pea is a tropical grain legume that can curb the hunger gap in being itself an excellent source of protein and other nutrients such as iron starch, calcium, manganese, crude fibre, fat, trace elements and minerals. It has a vast unexploited potential for improving food and nutrition security. This study examined the trails through which different means of growing pigeon peas affect numerous measures of household food security and well-being. Two semi-arid villages of Mibure and Mitumbati districts of Lindi region were reached. Data included 300 farming households the main respondent was the household head. Two major types of models were approximated: (i) the direct effects of the pigeon pea know-hows on five measures of household wellbeing (adequate household food availability, household dietary diversity, disposable crop income, and calorie and protein production), and (ii) the effects of disposable crop income and calorie production on adequate food availability and household dietary diversity. Results indicated that that about 72% of maize-growing smallholders grew pigeon peas and other legume crops such as beans and cow peas. The most common way that legumes are integrated into the agriculture system was intercropping with cereals which is practiced by over 50% of households. Crop rotation was an infrequent practice, with less than 10% of households using this technique. Cereal-legume intercropping was significantly associated with households' months of adequate food availability and increased household dietary diversity. Conclusively, implementation of intercropping of both crops increased both crop income and protein and calorie production, contributing to higher household dietary diversity scores and additional months with adequate household food availability. The work of policymakers and extension workers is informed to empower knowledge and information to smallholder farmers.*
***Keywords:*** Pigeon pea, food security, small holder farmers

# Influence of low intensity education program on maize farmers' perceptions and willing to use owl for rodent control in Iringa Region

**Nicholaus Mwalukasa and Anna Kimaro**

[1,2]Sokoine University of Agriculture, Department of Information and Information technology, Morogoro, Tanzania

*Corresponding author Email: nmwalukasa@sua.ac.tz

*Owl appears to be a more attractive means to control rodent pests in agricultural ecosystems. Despite its potential as means to control rodents, their uptake by smallholder farmers is low. Therefore, this study assessed influence of low intensity education program on maize farmers' perceptions and willing to use the owl for rodent control. A Longitudinal research design was used to collect data from 200 randomly selected maize farmers. Semi-structured questionnaires were used for data collection in eight selected villages in two districts of Iringa and Mufindi in Iringa Region, Tanzania. Quantitative data was coded and analyzed using SPSS McNemar test was used compare the farmers' attitudes before and after low intensity education program. The findings of the study show that low education program improved farmers' attitude and knowledge towards use of owl for rodents' control Revealed that most of the respondents attended low education training developed the willing and intention to use owl for rodents control changed after three month training. The study recommends use of low education program to enhance maize farmers' adoption on the use of biological rodents' control.*
***Keywords:*** Rodents, Owl, Low intensity education, Iringa

# Agricultural Mechanization and Gender Equality in Rice Production in Mbarali Tanzania

**Neema Mwalyagile*, John N. Jeckoniah and Raymond J. Salanga**

Department of Development and Strategic Studies, Sokoine University of Agriculture, Morogoro, Tanzania

*Corresponding author: nmwalyagile@gmail.com

*Agricultural mechanization is considered among the strategies for improving livelihood outcome in agri-food system transformation. However, the impact of agricultural mechanization has gendered outcome where women does not enjoy equal benefits as men. Despite a steady growth of mechanization in Tanzania, there is inequitable access and utilization of mechanized farm implements among smallholder's farmers. This paper explored the socio-economic factors for gender differences in the access and uses of mechanized farm implements in rice production. The study adopted a cross-sectional research design to collect data from 397 farmers in small-scale rice irrigation schemes at Mbarali District. The study found that power tillers and combine harvesters are the main mechanized farm implements used in rice production with a larger proportion of male farmers using power tillers (64.5%) and combine harvesters (72.3%) compared to women. The binary logistic regression revealed a significant association between second occupation (participation in non-agricultural activities) ($p<0.05$), scheme membership associations, and sex ($p<0.01$) whereby male use of mechanised farm implements was relatively higher than their female counterpart. It is concluded that gender differences in utilization of mechanised farm implements contribute to livelihood improvements differently for men and women. Participation in non-agricultural activities and membership in the scheme associations influencing the use of mechanized farm implements. Therefore, local government authorities in the area, NGOs and development partners should adopt a gender sensitive and inclusive approaches to create enabling environment for the enhancement of both male and female utilization of mechanised farm implements.*
***Keywords:*** Agricultural mechanization, gender, livelihood, farm implements, participation

# Impact of Training and Extension Services on the Adoption of Commercial Rabbit Production in Hai District

**Orestes Medard Rugarabamu*, Joshua Samwel Kidudu and Gosbert Lukenku Shausi**

Department of Agricultural Extension and Community Development, Sokoine University of Agriculture, Morogoro Tanzania

Corresponding Author's email: orestesmr14@gmail.com

*Rabbit researchers have documented on the potentials of rabbit production in poverty alleviation and food security. Rabbits can be kept for food, decoration and commercial purposes. Commercial rabbit production has numerous advantages such that all the products and by-products are of commercial value. Rabbit production is common in Tanzania especially in Hai district. Despite its numerous benefits and efforts made by Saore Company Limited to promote commercial rabbit production in Hai district, only about 0.1% of the population is engaged in commercial rabbit production. Several studies have associated adoption of innovations with training and extension services. Taking commercialization of rabbit production as an innovation, this study determined the influence of training and extension services on the adoption of commercial rabbit production in Hai District. The study adopted a survey research design to collect data from 85 commercial and 85 non-commercial rabbit producers using a questionnaire and through key informant interviews. Both descriptive and inferential statistics were used to analyse the data whereby the binary logistic regression was fitted. The study found that, awareness creation on importance of commercial rabbit production, physical form of extension, farmers group, contract farming and application of latest ICT technologies such as use of smart phones and mass media influenced adoption of commercial rabbit production in the study area. It is therefore recommended that to improve adoption of commercial rabbit production in the study area, special attention should be paid to the identified factors.*

***Keywords:*** Extension services, training, adoption, Hai

# A Review of Cultural Beliefs and Attitudes towards Owls in Africa

**Philbert S. Nyinondi**

Sokoine University of Agriculture, P.O. Box 3038, Morogoro, Tanzania

*Corresponding Email: pnyinondi@sua.ac.tz

*Owls are nocturnal birds of prey that may usually be located in a particular area that suits their demands. Because of their nocturnal habits and silent flight, their world-view across the globe is debatable. This study assessed the cultural beliefs and attitudes toward owls in Africa. The systematic review adopted PRISMA protocol. The Keywords and phrases, such as "owls," "perception," "Africa," "cultural beliefs," and attitudes," were searched using the Google Scholar search engine to identify relevant journal articles. A total of 276 articles from 2000 to 2022 were downloaded and screened. After screening, 21 full text journal articles were selected for in-depth review. The collected data were thematically analyzed in the context of the study's focus. The results shows that most studies on owls' belief and altitude were conducted in South Africa, Kenya, Zimbabwe, Botswana and Nigeria. Owls are symbols of death or omens related to evil in the studied countries. They represent a group of undesirable birds across Africa. The results further suggests that people change their attitudes towards owls when made aware of their potential benefits. Therefore, the introduction of outcomes-based education principles can be used to create positive worldviews about owls in Africa.*

***Keywords:*** owls, perception, Africa, cultural beliefs, attitudes

# Edible Miombo Wild Mushrooms and its Potential for Improving Livelihoods of People in Songea and Tabora Districts, Tanzania

**Greyson Zabron Nyamoga**

Sokoine University of Agriculture, College of Forestry, Wildlife and Tourism, Department of Forest and Environmental Economics, Morogoro, Tanzania

*Corresponding author Email: gnyamoga@sua.ac.tz

*Edible wild mushrooms are among Non-Timber Forest Products (NTFPs) from miombo woodlands in Tanzania. However, miombo are subjected to different anthropogenic activities leading to deforestation and forest degradation. This study assessed the engagement of people in collecting miombo woodland wild edible mushroom species for domestic and commercial uses for generating and diversifying income of to the people. Specifically, the study aimed to identify the main species collected by local communities, examine extent of mushroom collection and identify key stakeholders engaged in collecting and selling mushrooms. Questionnaires, focus group discussion and key informant interviews were used in collecting data. Quantitative data were coded and processed using Statistical Package for Social Sciences (SPSS) version 22. Total scores, means, frequencies and percentages were used to describe key findings. Qualitative information were summarized using contents analysis. 152 respondents from fourteen villages were interviewed. Mushrooms collection were observed to be an important activity to 98% of the people in the villages with female dominating. Although about 28 different edible wild mushroom species were identified, the most preferred species were Amanita loosii, Cantharellus isabellinus, Clavulina wisoli, Lacturius edulis and Temitomyces microcarpus. Most of the respondents had a very good indigenous knowledge on edible and non-edible mushroom species using colour, smell, size and growing places. Edible wild mushrooms value chains involved community members, middlemen, wholesalers, retailers, truck drivers and mushroom collectors. Further research are recommended for promoting and commercializing edible wild mushrooms business in order to improve the livelihoods of people in Tanzania.*

***Keywords:*** Non-Timber Forest Products; Income Diversification; Poverty Alleviation; commercialization; Deforestation

# Sub-Theme 4:
# Climate change, Natural Resource and Environment

# Reduced Genetic Diversity and Effective Population Size of a Lake Salmon, *Opsaridium microlepis* in Degraded Habitats

**Alex Nehemia[1] and Alinanuswe J. Mwakalesi[2]**

[1]Department of Biological Sciences, College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O. Box 3038, Morogoro, Tanzania
[2]Department of Chemistry and Physics, College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O. Box 3038, Morogoro, Tanzania

*nehemiah@sua.ac.tz (AN)

*Opsaridium microlepis is one of the fish species that serve as the main source of income and proteins for people living near Lake Nyasa. However, the increased human activities such as agriculture, urbanization, and mining have been causing an extinction threat to the fish species. As a consequence, the species abundance has decreased and the International Union for Conservation of Nature (IUCN) has classified them as one of the threatened fish species. The current study used partial mitochondrial cytochrome oxidase subunit I (COI) sequences to evaluate the effects of potential human activities on the nucleotide and haplotype diversity of Opsaridium microlepis species. The findings indicated that reduced effective population size, nucleotide diversity, and haplotype diversity were more observed in degraded sites, in comparison to relatively pristine sites. This suggests that the genetic effective population size and diversity of Opsaridium microlepis found along Lake Nyasa were likely to be negatively affected by human activities taking place in the catchments. Thus, the findings from the current study can serve as a sign to conservationists to take quick action to manage the anthropogenic activities taking place in the area to protect/minimize effects that are likely to expose the fish species to extinction risks.*

***Keywords:*** Lake Nyasa, threatened, nucleotide and haplotype diversity, effective population size, Opsaridium microlepis

# Assessment of Knowledge, Attitude and Practices on the Influence of Land-use Change on Threats of Zoonoses in Katavi - Rukwa Ecosystem, Tanzania

***Moshiro, E.,[1] Biseko, B.,[1] Yona, C.[2] and Mdegela R.H.[3]**

[1]Department of Wildlife Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P. O. Box 3073, Morogoro, Tanzania
[2]Department of Biosciences, Solomon Mahlangu College of Natural and Applied Sciences, Sokoine University of Agriculture, P.O. Box 3019, Morogoro, Tanzania
[3]Department of Veterinary Medicine and Public Health, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture, P.O. Box 3021, Morogoro, Tanzania

*Corresponding author Email: eva.moshiro@sua.ac.tz

*Land-use change particularly adjacent to protected areas have a likelihood potential of spreading zoonotic diseases by mediating interaction between human, livestock and wildlife. A cross sectional study was conducted in four districts namely Mpanda, Mlele, Tanganyika and Mpimbwe to assess the knowledge, attitude and practices of different actors on factors for increasing prevalence of zoonoses in changing land-use. Household survey using structured questionnaires (Kobocollect), field observation, key informant interviews and focus group discussions were used to collect primary data. Additionally, secondary data were obtained from districts medical report, TANAPA and Rukwa game reserve reports. A total of 299 respondents were obtained through random sampling from nine purposely selected villages. Out of 299 involved respondents 157 (52.57%) were males and 142 (47.49%) were females. However, the study revealed a total of 223 (74.6%) respondents involved in the study were not aware of land-use change and how might influence the occurrence of zoonoses. Additionally, findings from this study revealed population increase as one of the key drivers of land-use change as (57.5%) of the respondents were immigrants involved in cultivation activities (90.64%) and livestock grazing (3.68%). Considering current increase of emergence and re-emergence of zoonotic diseases, the study proposes immediate intervention for prevention of such scenarios. A One Health approach is recommended for improvement of KAP for different actors for better land use and zoonoses prevention.*

***Keywords:*** Katavi-Rukwa ecosystem, Land-use, Zoonoses, One Health, Tanzania

# Building Enabling Environment for Creation of Youth-led Agricultural Enterprises: A Practical Model for Commercializing Research Findings and Leveraging Emerging Technologies to Drive Agricultural Transformation in Tanzania

**Kiko Kiwanga**

A Founder & Executive Director of TAOTIC and An Interim CEO of the National Advisory Board for Impact Investment in Tanzania

Corresponding author email: kiko.kiwanga@taotic.co.tz

*The agricultural sector in Tanzania has been identified as a key driver for economic growth and poverty reduction, particularly in creating employment and wealth for the youth who make up a significant portion of the population. However, the sector faces challenges in adopting emerging technologies and commercializing innovations to drive agricultural transformation. This paper aims to address these challenges. To achieve this objective, multiple case studies were examined to provide in-depth insights into successful programs. The data were collected using secondary data and documents review, resulting in findings showing some successful programs generating over 1,300 founders, creating 40,000 companies and 5.4 million employment opportunities, with a startup survival rate of up to 93%. Content and narrative analysis, process mapping, and grounded theory were used to identify key themes, patterns, and relationships. This analysis revealed that successful entrepreneurial universities significantly contribute to fostering supportive environments for innovation and commercialization through their commitment to research and education excellence, entrepreneurial culture, and close relationships with industry, including venture building partnerships. Our conclusion is that the venture building partnership model presents a practical approach that research universities in Tanzania can adapt to create an enabling environment for the translation of research findings into innovative solutions that benefit society, while engaging the youth in driving agricultural transformation, with a focus on leveraging emerging technologies to drive economic growth and development. A participatory action research is recommended to validate and refine the model, ensuring its relevance to the specific context of the agricultural sector in Tanzania.*

***Keywords:*** Commercializing research findings, youth-led agricultural enterprises, entrepreneurial universities, leveraging emerging technologies, venture building partnerships

# Long-term Households' Economic Implications of the Land use Shift from Pine to Avocado: the Case of Njombe Region, Tanzania

**Charles Peter Mgeni[1]*, Festo Richard Silungwe[2], Gody Jonathan Sanga[3] and Frank Firmat Mluge[1]**

[1]Department of Agricultural Economics and Agribusiness, College of Economics and Business Studies, Sokoine University of Agriculture, Tanzania
[2]Department of Civil and Water Resources Engineering, Sokoine University of Agriculture, Tanzania
[3]Department of Trade and Investment, College of Economics and Business Studies, Sokoine University of Agriculture, Tanzania

*chrlsmgeni099@sua.ac.tz

*Farmers in Njombe region, Tanzania are increasingly shifting land use from pine and other crops to avocado production. The major species of avocado that are grown by many smallholder farmers are Hass, Fuerte, and Waisal. The increase in avocado production among farmers is aggravated by the increase in export demand particularly for the Hass variety. Consequently, the shift in land use not only affects pine timber production but also other land uses for production of food crops. However, economic benefits of avocado production, its effects on other crops are not known. Therefore, this study examines the effects of major land uses (e.g. crop, pine, and avocado production) in Njombe district. The study uses system analysis approach that allows assessing the impact of different policy scenarios on land use trade-offs. Findings from this study reveals that farmers are making more profits by shifting from pine trees production to avocado productions. The reasons highlighted by farmers as to why opt for avocado production are: avocado trees take few years (two to three years) to start production fruits while pines tree talks many years to economical harvesting (10 to 15 years). Therefore, policymakers and other stakeholders should advocate an integrated production system that would consider other food crops in the avocado production system so that food security is not compromised in the area. Also is imperative for the government to strategize on developing transport and energy infrastructure in support to both internal transportation and exportation of avocado from the study area.*

***Keywords:*** Avocado, Pine, land use shift, export, Tanzania

# Home Range and Survival Probability of Two Dominant Rodent Species on Slopes of Mount Kilimanjaro

**Suzana M. Thomas[1,2,3],*, Geofrey E. Soka[2] and Loth S. Mulungu[4]†**

[1]The African Centre of Excellence for Innovative Rodent Pest Management and Biosensor Technology Development, Sokoine University of Agriculture, Morogoro, Tanzania.
[2]Department of Wildlife Management, Sokoine University of Agriculture, Morogoro, Tanzania.
[3]Department of Biology, University of Dodoma, Dodoma, Tanzania.
[4]Institute of Pest Management, Sokoine University of Agriculture, Morogoro, Tanzania.

*Corresponding Author: meydancan@gmail.com
† Deceased

*This study was aimed to determine the home range and survival probabilities of the two dominant rodent species (Lophuromys aquilus and Rhabdomys dilectus) found in western slopes of Mount Kilimanjaro, Tanzania. Trapping was done in both dry and wet seasons using medium sized Sherman live traps in four Capture-mark-recapture (CMR) grids for a period of two years from April 2020 to March 2022. The traps were baited with peanut butter and set for three nights in each month. Home range size of Rhabdomys dilectus was significantly higher in moorland than in fallow. Lophuromys aquilu's home range was influenced by the variations in habitat, season and sex whereby, it was significantly higher in Moorland than in fallow land ($p < 0.05$). Moreover, there were significant differences in survival of the two rodent species. Whereby, survival of L. aquilus was higher than that of R. dilectus, indicating that L. aquilus could be more adapted to live on Mt. Kilimanjaro than R. dilectus, this was evident from lower capture probability due to trap shy behaviour which serve as a mechanism of predator avoidance as compared to R.dilectus which is a trap lover. For both species female's survival was higher than that of males ($p < 0.05$ suggesting that females spend most of their time in the nests during breeding season hence reduces predation risk. This study concludes that habitat quality and sex influences home range size and survival probability of rodents due to variations in food resources availability, mating behavior and reproductive fitness.*
***Keywords:*** Home range, survival, sex, capture, reproductive

# Zero-valent Iron-aluminium Co-corrosion: A potential Low Cost Method for Water Defluoridation

**Emmy Solomon Lema[1]*, Hezron Timothy Mwakabona[1,2]**

Department of Chemistry and Physics, Sokoine University of Agriculture, P.O. Box 3038, Morogoro, Tanzania.
Department of Earth Sciences, Mbeya University of Science and Technology, P.O. Box 131, Mbeya, Tanzania.

*emmy@sua.ac.tz

*Climate change coupled with population increase has forced communities in fluoride rich areas to rely on fluoride contaminated groundwater to fill in the deficit created by drying of water sources. The (hydr)oxides of aluminium and iron and their composites have been explored for water defluoridation, however, the preparation step present an additional cost to end users, hence, limiting their wide application in the field. This study investigated the effect of simultaneous corrosion of zero-valent aluminium (ZVA) and iron (ZVI) on their fluoride removal properties. The fluoride removal properties of these materials were studied by mixing such materials with fluoride solutions in controlled conditions. The effect of time, dose, concentration and pH were established by varying one parameter while controlling others. Findings reveal that, the two materials in their metallic state have the same synergistic effect on their fluoride removal properties as their corresponding (hydr)oxides. Whereas in their pure metallic states, iron and aluminium lowered the concentration of fluoride from 15 - 13.09 mg/L and 15 - 14.9 mg/L respectively, their mixture lowered from 15 - 7.74 mg/L in the period of seven (7) days. Spiking the fluoride solution with Fe3+ ions was found to enhance fluoride removal by lowering F level from 15 - 0.8 mg/L in the same period implying a mechanism involving precipitation of fluoro-complexes of iron rather than aluminium. These findings, therefore, suggest that a step involving conversion of ZVA and ZVI into their (hydr)oxides can be skipped without significantly affecting their fluoride removal capacities.*
***Keywords:*** co-precipitation, zero-valent aluminium, zero-valent iron, defluoridation.

# The Right Tree in the Right Place: Mapping and Predicting Global-scale Suitable Areas for Marula tree, *Sclerocarya birrea*, (A. Rich.) Horchst, subspecies Cultivation, Conservation, and Use in Restoring Global Drylands

**Abubakari H. Munna[1]*, Proches Hieronimo[2], Nyambilila A. Amuri[1], and Dino A. Woiso[3]**

[1]Department of Soil and Geological Sciences, Sokoine University of Agriculture, P.O. Box 3008, Morogoro, Tanzania
[2]Department of Agricultural Engineering, Sokoine University of Agriculture, P.O. Box 3003 Morogoro, Tanzania
[3]Department of Biosciences, Sokoine University of Agriculture, P.O. Box 3038 Morogoro, Tanzania

*Corresponding author e-mail: amabmunna81@gmail.com

*Marula, Sclerocarya birrea (S. birrea) (A. Rich.) Horchst, is a drought-tolerant and multipurpose tree native to Africa which its population is currently declining. The S. birrea subspecies have been used to restore drylands and introduced outside Africa as a pilot towards commercial cultivation. However, there is a global paucity of information regarding where subspecies can establish themselves beyond Africa. We aimed to predict and quantify global-scale suitable areas for S. birrea and its subspecies under the current and future climates. We used MaxEnt algorithm and occurrence data from Africa, climatic and topographical variables and, climate data from Max Planck Institute and Hadley Climate Center's global Earth Systems Models under shared socio-economic pathways (SSPs) greenhouse gas concentrations, SSP3-7.0, for 2050 and 2080. The results revealed that the predictive power of models was excellent with areas under the curves (AUCs) of 0.90-0.98. Potential evapotranspiration, continentality, temperature, and precipitation seasonality contributed the most to the ecological niche models of S. birrea and its subspecies. Suitable areas for S. birrea and its subspecies exist in all continents except Europe and Antarctica, occupying 3,751,057 km2-24,632,452 km2 of earth's terrestrial area in 54-107 countries predominantly in global biomes with climatic conditions ranging from desert tropical to temperate humid. The suitable areas will retract by 64-100%, shift to high latitudes, and be limited to desert-to-desert temperate and Mediterranean warm global biomes, and parts of Eastern Europe will become suitable under future climates. Suitable areas for S. birrea subspecies exist and will continue to exist beyond Africa.*

***Keywords:*** drylands, climate change, global scale, MaxEnt, Sclerocarya birrea

# Gender Dynamics and Climate Resilience in Small-Scale Fish Business: A Case of Mwanza Region, Tanzania

**Advera M. Gibe[1]*, John N. Jeckoniah[2] and Fatihiya A. Massawe[3]**

[1]Department of Development and Strategic Studies, College of Social Sciences and Humanities, Sokoine University of Agriculture, P.O. Box 3024, Morogoro, Tanzania
[2]Department of Development and Strategic Studies, College of Social Sciences and Humanities, Sokoine University of Agriculture, P.O. Box 3035, Morogoro, Tanzania
[3]Institute of Judicial Administration Lushoto, P.O. Box 20, Lushoto, Tanzania

*Corresponding author Email: adveraroche@gmail.com

*Small-scale fish businesses are vital to the local economy of Mwanza region in Tanzania, providing livelihoods and ensuring food security for many communities. However, gender dynamics within this sector often result in the marginalization of women, who face specific challenges due to prevailing gender norms and power relations. This study explored the interplay between gender dynamics, climate variability, and the resilience of small-scale fish businesses in Mwanza. The study was guided by three research questions: How does climate variability affect gender dynamics within small-scale fish businesses in Mwanza? What strategies do women employ to adapt to climate change in this context? And, how can gender-sensitive interventions enhance the resilience of small-scale fish businesses in the face of climate change? The study adopts a feminist theory framework, emphasizing the importance of understanding gender roles and power dynamics and their influence on various social, economic, and political outcomes. The social-ecological systems framework was utilized to analyse the complex interactions between human societies and the natural environment over time. Qualitative research methods, including interviews, focus groups, and participant observation, were employed to collect data. Thematic and discourse analysis was conducted with the aid of NVivo software. The study found that effective and equitable climate adaptation mechanisms when incorporated in strategies from the government and development agencies enables women's to acquire assets and improve*

*their participation in decision making especially in addressing challenges that impacts on their roles due to changes in climate for sustainable fish business. Therefore, it is crucial to invest in women's social capital, such as networks that provide financial buffers, information and market access by women. The findings of this study has contributes to the development and or engender policies and interventions in addressing the challenges that women faces in fish business.*
***Keywords:*** Gender dynamics, climate resilience, small-scale fish business, Tanzania

# The Influence of Farming Practices on Okra Yield at Farms in Kilombero, Tanzania

**Sergio G. Milheiras[1], Joseph A. Magwira[2], Deo Shirima[2] and Marion Pfeifer[1]**

[1]School of Natural and Environmental Sciences, Ridley Building 2, Room 5.38, Newcastle University, United Kingdom
[2]Department of Ecosystems and conservation, Sokoine University of Agriculture, P.O. Box 3000, Morogoro, Tanzania

*Corresponding author email: dshirima@sua.ac.tz

*The long-term sustainability of agricultural systems highly dependent on synthetic inputs is sometimes contested, as well as the suitability of that production model to smallholders in the rural tropics. Farming practices that rely on ecological processes and services to maintain a resilient agricultural system have been advocated as an alternative model that is better fitted to protect smallholder livelihoods against system instability generated by external factors, such as market fluctuations or climate change. However, more empirical evidence is needed to assess if the trade-offs and synergies generated by a higher implementation of agro-ecological practices are beneficial to smallholder farmers. Here, we use data from a survey applied to smallholder okra farmers (n=58) in Kilombero, Tanzania, to assess how different farming practices affected estimated annual okra yield. We found three farming practices that significantly affected okra yield levels, namely, the number of agro-ecological practices at farm level, whether weather conditions influence when the okra is sowed, and the number of seeds that are sown together. The first two were positively linked to okra yield, while sowing more seeds together lead to lower okra yields. Results only aim to be exploratory and will require further investigation to be confirmed. This study contributes to the discussion on what agricultural practices are most beneficial for smallholder okra farmers in rural Tanzania.*
***Keywords:*** agricultural systems, farming practices, okra yield

# Potential of Remote Sensing Techniques in Estimating and Mapping Indicators of Forests Biodiversity in the West Usambara Mountains

**Diana L. Tesha[1]*, Ernest W. Mauya[2], Sami D. Madundo[2] and Cosmas J. Emily[1]**

[1]Department of Ecosystems and Conservation, Sokoine University of Agriculture
[2]Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture

*Correspondence: teshaldiana@gmail.com

*Assessing and managing forest biodiversity is vital for effective ecosystem conservation, and remote sensing technology has shown promise in estimating and mapping biodiversity indicators at larger scales. Open access high-resolution remote sensing data has the potential to enhance conservation and management of forest ecosystems through informed decision-making and policy implementation, enabling accurate tree species modelling and large-scale forest management. This study aimed at evaluating the utility of Sentinel-2 and PlanetScope remote sensing data for estimating and mapping indicators of forest biodiversity in West Usambara, Tanzania's dense tropical mountain forests. Two modelling techniques, semi-parametric Generalized Additive Model (GAM) and non-parametric Extreme Gradient Boosting model (XGBoost) were compared for their effectiveness in estimating forest biodiversity indicators. Tree species diversity estimation models were developed and validated using k-fold cross-validation (k = 10), and their accuracy was evaluated using Mean Absolute Error (MAE), relative Root-Mean-Square Error, and Coefficient of Determination (R2). Results indicated that XGBoost models using PlanetScope data produced the most precise estimates for diversity, richness, and evenness. Combining various predictor variables (bands, vegetation indices, and textures) improved model performance. Scatter plots of predicted versus observed tree species diversity values demonstrated good model performance in predicting forest biodiversity indicators in the study area. These findings highlight that integrating remote sensing techniques and ground-based inventory enables accurate estimation of forest biodiversity indicators in dense tropical forests, promoting the conservation of these endangered ecosystems. Further*

*research is needed to enhance the models' predictive power, including the utilization of higher spatial resolution sensors like hyperspectral, SAR, and LiDAR data, along with increased sampling efforts.*
***Keywords:*** Remote Sensing; Forest Biodiversity Indicators; Diversity Mapping; GAM; XGBoost

# Model Development for Prediction of Soil ECe based on Values of $EC_{1:2.5}$ for Effective Laboratory Soil Salinity Assessment in Tanzania

**Daniel Porkalpo Isdory* and Boniface Hussein Massawe**

Department of Soil and Geological Sciences, College of Agriculture, Sokoine University of Agriculture, P.O. Box 3008, Morogoro, Tanzania

*Corresponding author Email: danielisdory@sua.ac.tz or danielisdory@gmail.com

*Electrical conductivity of saturated soil paste extracts (ECe) is a standard laboratory soil salinity measurement. However, due to difficulty of ECe measurement, electrical conductivity of soil to water suspensions (ECsoil:water) such as EC1:2.5 in Tanzanian soil laboratories are used and must be converted to ECe for salinity interpretation in crop production. This study was conducted to develop texture specific regression models for predicting ECe values from EC1:2.5 for Tanzanian soils. A total of 198 composite soil samples at 0 – 30 cm depth were collected from Kiwere, Dakawa, Sakalilo and Mwamapuli irrigation schemes in Iringa, Morogoro, Rukwa and Katavi Regions respectively and analyzed for soil texture, EC1:2.5 and ECe. The dominant soil textural classes were clay, sandy clay loam, sandy clay and clay loam. There were significant differences ($P<0.05$) between mean values of EC1:2.5 and ECe (dS m-1) in all textural classes. The regression models indicated significantly strong linear relationships between values of EC1:2.5 and ECe for all textural classes with $R2 >0.90$ and $P<0.001$ for both regression models with and without intercept. The regression models without intercept performed better in predicting soil ECe from EC1:2.5 than regression models with intercept by having higher P-values, slope value closer to 1.0 and lower RMSE values between measured and predicted ECe. The study recommends regression models expressed as ECe = 2.0963EC1:2.5 for clay; ECe = 2.7714EC1:2.5 for sandy clay loam; ECe = 2.3519EC1:2.5 for sandy clay and ECe = 2.0811EC1:2.5 for clay loam soils for predicting soil ECe from EC1:2.5 in Tanzania.*
***Keywords:*** Soil salinity, prediction, EC1:2.5, ECe, Tanzania

# Community Structure of Endemic Fish Species in the Kilombero Valley Floodplain

**Jackson L. Saiperaki[1]*, Silvia F. Materu[1], Prisila A. Mkenda[1], Elly J. Ligate[1], and Cyrus Rumisha[2]**

[1]Department of Biosciences, Sokoine University of Agriculture, P. O. Box 3038, Morogoro, Tanzania.
[2]Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture, P.O. Box 3004, Morogoro, Tanzania

*Corresponding author:jacksonlendoya89@gmail.com

*The Kilombero Valley Floodplain (KVFP) in East Africa supports diverse endemic fish species that are important for local livelihoods and food systems. Unsustainable fishing practices are widespread, and declines and extinctions can occur undetected if efforts are not taken to assess changes in the community structure of endemic fishes in the KVFP. This study used fishers, and the key informants interviews, Focus Group Discussion (FGDs) and fishery surveys to assess historical and contemporary distribution of endemic fishes within KVFP. Of the 38 reported fish species, 60.5% (23 species) were endemic whereas 21.7% of the endemic species were identified as highly fished. About 15.8% (6 species) were not verified during fishery surveys, which could mean that they are either, no longer present or are present in very low numbers. Simpson's diversity indices (D) at Ngalimila, Kivukoni and Mofu landing sites were 0.34, 0.28 and 0.25 whereas species richness were 0.99, 0.72 and 0.63 respectively. The local identification techniques used in fish identification by fishers at KVFP were fish morphology including the size of the fish and number or structure of fins. This identification knowledge was obtained from village elders and the more experienced fishermen. However, these local techniques were not accurate as the same fish species may have different size and appearance at different stage of their growth, hence named differently. The findings reveal the existence of a significant number of endemic fish species at KVFP which require more conservation efforts for their continued existence. The study further calls for a need to go for DNA barcoding to verify the accuracy of the local fish identification techniques.*
***Keywords;*** Fish conservation, fish identification, diversity indices

# Volume Estimation of Offcuts Left During Timber Harvesting in Natural Forests in Tanzania. A Case of Nyera Kipelele Forest Reserve

**Malima, T.M*, Mugasha, W.A., and J.Z. Katani**

Department of Forest Resources Assessment and Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3013, Chuo Kikuu, Morogoro, Tanzania.

* Corresponding Author's email; malimathomas@gmail.com

*Supply of woody products in a sustainable way depends among other things on reducing the wastage of forest resources during harvesting and processing. Yet, in Tanzania, there is little information on wood wastes from harvesting to utilization sites. Most studies have focused on the rate of recovery during timber processing. This study carried out at Nyera Kipelele Forest Reserve (NKFR) provides the quantification of harvesting leftovers and their corresponding drivers. A total of 30 harvesting sites were selected where the stump height and diameter, mid-diameter and length of leftovers were measured. The leftover included the tree branches, stems, and excess stump. The possible reason was assessed via field observations and through Focus Group Discussion (FGD). The findings show that Pterocarpus angolensis is mostly harvested, accounting for more than 95% of the harvested volume. Although, P. angolensis has a low percentage (51.48±2.21%) of leftover left at tree level compared to Jubernardia globiflora (76.23±16.03%), due to its high exploitation contributes to a large leftover total volume. The wood left is mainly due to cracks and rot, which affect large-diameter trees. Additionally, the distance to the final destination of logs is another factor influencing the amount of logging residues. Leftovers contribute a significant amount of wood loss in the forest reserve (FR). Compliance with rules and regulations governing harvesting in natural forests for both loggers and governing bodies, integrated use of forest products for multiple uses and emphasis on utilization of lesser-known timber tree species are essential measures to reduce wood loss.*

***Keywords:*** Harvesting offcuts, leftovers, logging residue, wood loss, natural forests

# Aquatic Ecological Risk of Metal(loid) Pollution Associated with Degraded Mining Landscapes of the Southern Africa River Basins: A Review

**Ouma, K.O.[1,3]*., Shane, A.[2], and Syampungani, S.[1]**

[1]School of Natural Resources, The Copperbelt University, P. O. Box 21692, Kitwe, Zambia
[2]School of Mines & Mineral Sciences, The Copperbelt University, P. O. Box 21692, Kitwe, Zambia
[3]Copperbelt University Centre of Excellence for Sustainable Mining (CBU-ACESM), P. O. Box 21692, Kitwe, Zambia

*Corresponding author e-mail: kennedy.ouma@cbu.ac.zm

*Africa accounts for nearly 30% of the discovered world's mineral reserves, with half of the world's platinum group metals, 36% of gold, and 20% of cobalt deposits in Southern Africa (SA). The intensification of metal(loid) production in SA has exacerbated negative human and environmental health impacts. Mining waste generated from industrial and artisanal mining has significantly affected the ecological integrity of SA aquatic ecosystems. However, the extent to which metal(loid) pollution associated with mining has impacted the aquatic ecosystems has not been adequately documented. We explored the current aquatic ecological impacts on the heavily-mined river basins of SA. We also discussed the approaches to assessing the aquatic ecological risks, inherent challenges, and potential for developing nature-based integrated ecological risk assessment protocols for terrestrial-aquatic systems in SA. Six mining-intensified and highly populated river basins in SA were evaluated for the historical impacts of metal mining on aquatic ecosystems. Cross-cutting impacts were disaggregated and analysed to establish trends and spatial aquatic ecological risks of metal(loid) mining and processing. Risk assessment approaches were employed to characterise the threats. Acid-mine drainage, siltation, effluent discharge and riparian habitat degradation negatively impacted stream water quality, quantity, and aquatic biocoenosis. Nevertheless, there is progress in developing eco-friendly green-based rapid bioassessment schemes (RBS) for SA aquatic ecosystems. However, method integration, including biomonitoring and molecular technology, will overcome the current challenges towards the standardisation of RBS. Also, citizen science will encourage community and stakeholder involvement for sustainable environmental management of the agroindustrial landscapes of SA.*

***Keywords:*** aquatic ecosystems; ecological risk assessment; heavy-metal pollution; Southern Africa; rapid bioassessment schemes.

# The role of integrating Chololo pits and soil fertility management and its resultant implications on crop production in Dodoma, Tanzania

**Zubeir K. Ismail**

Department of Geography and Environmental Studies, The University of Dodoma (UDOM),
P.O. Box 259, Dodoma, Tanzania

Email: basahem@gmail.com

*Soil fertility decline is a challenge which resulted in a decline in agriculture yields as well as a poor natural resource base for the majority of the chololo pits practices farmers in the dry land areas of Dodoma. Integrating the Chololo pits practice with soil management has been identified as a potential solution to low soil fertility and its importance in increasing crop production in the semi-arid Chamwino District, Dodoma Region in Tanzania. Data were collected through documentary review, household interviews, focus group discussions, key informant interviews and field observations. The findings indicate that the farmer combined chololo pits with manure (24%, n=337), Chololo pits in combination with green manure (14.8% %, n=337), combine Chololo pits with animal manure and fertilizer (7.3%, n=337). The remaining farmers reported having not used any input at all on Chololo pits (6.4%,n=337). The study indicated the farmers who combine chololo pits with green manure, animal manure and fertilizer their production almost doubled those who do not use manure( from 1.6 to 3.8 tonnes per hectare).To enhance crop production through soil fertility management the stakeholders suggested that; the increased availability of organic fertilizers (75.7%), the use of domestic compost manure (65.5%), farmer's capacity building (47.1%) and up-scaling the practice (24.8%). the study concluded that the use of manure enables the farmers to get a high yield.*
***Keywords:*** cholololo pits, fertility management, implications, crop production

# Epidemiological Survey of Feline Immunodeficiency Virus (FIV) Infection in Morogoro, Tanzania: a Pilot Study

**Isaac Makundi*and George Sanga**

Department of Microbiology, Parasitology and Biotechnology, CVMBS, P.O Box 3019, SUA, Morogoro, Tanzania

*isaac.makundi@sua.ac.tz

*Feline Immunodeficiency Virus (FIV) is an immunosuppressive virus in cats which is related to HIV. In domestic cats the disease is manifested with immunodeficiency syndrome characterized by gingivitis-stomatitis, wasting, neuropathology and increased incidence of tumor development. Reports of the epidemiology of FIV worldwide are numerous, but information is scarce for most regions of Africa including no studies in Tanzania. We conducted this study in order to provide baseline information about the status and epidemiology of this disease in domestic cats. In Tanzania, vaccination against FIV is largely uncommon probably due to unavailability of data about the type of virus strains circulating in the country. This abstract is submitted to the 3rd SUA Scientific Conference under the sub-theme 2 titled, Vector and Pest Management, Animal and Public Health Management under the section of epidemiology and control of endemic and emerging diseases. The current study aimed at investigating FIV sero-prevalence, assess the potential risk factors associated with infection in domestic cats and to develop further recommendations. A cross-sectional study was conducted at selected urban regions of Morogoro, between March and December 2022, in 120 apparently health domestic cats. From each of cats, 1.0 ml of blood were collected by jugular puncture for detection of antibodies to FIV in whole blood using a commercial test kit, FeLV/FIV Immunochromatographic assay. FIV antibodies was not detected in any of the 120 cats tested (95% CI: 0% – 0.03%). In the present study, we found no evidence of FIV infection among the sampled cats. A further study with a much larger sample size employing multiple detection methods such as PCR is warranted.*
***Keywords:*** Feline Immunodeficiency Virus; Retrovirus; Sero-surveillance; Morogoro; Tanzania

# In the Midst of Global Anti-Tobacco Farming and Smoking Campaigns: How Resilient and Sustainable are the Tobacco Farming Co-operatives in Southern Africa?

**Mikidadi Muhanga[1]* and Mangasini Katundu[2]**

[1]Department of Development and Strategic Studies, College of Social Sciences and Humanities, Sokoine University of Agriculture, P.o.Box 3024, Morogoro -Tanzania
[2]Department of Community Development and Gender, Moshi Co-operative University (MoCU), P.O. Box 474, Moshi-Tanzania

*Corresponding author Email: mikidadi@sua.ac.tz

*Cognizant of the harms registered through tobacco farming and consequently smoking on the environment and human health, the world is witnessing campaigns against both tobacco farming and smoking. These campaigns are expected to affect the tobacco sub-sector, which contributes to the economies of the leading tobacco-producing countries, namely Zimbabwe, Zambia, Tanzania, Malawi, and Mozambique. The campaigns have in some countries been followed by governments' partial engagement or total disengagement from providing inputs, credit, extension services, and price support. To protect this subsector, tobacco farmers, inter alia, had to engage agricultural and marketing cooperative societies (AMCOS). However, the extent to which AMCOS engagement by farmers has been realized is empirically unknown. Amid these campaigns, understanding how resilient and sustainable tobacco cooperatives have been, remains imperative. Resilience building supports people and institutions in adapting to new circumstances, hence sustainability. This article analyses the resilience and sustainability of Tobacco co-operatives using a documentary research method. In this article, resilience has been analyzed based on (i) networks, (ii) innovation, and, (iii) the role of the state. Varied degrees of government support to the tobacco sub-sector have been identified. Contract farming has been exploited to fill the gap where the minimal role of the state has been registered. Despite the global anti-smoking campaigns, tobacco production is on the increase in southern Africa. Resilience and sustainability have been observed to vary country-wise. Due to tobacco's economic value in these countries, the campaigns can bear significant positive results in the presence of alternatives to tobacco farming.*
***Keywords:*** Resilience, Sustainability, Tobacco co-operatives, Southern Africa, Contract Farming

# Socio-Economics of Zoonotic Diseases at the Interface of Humans, Animals and the Environment: The Known, Unknown, and Should Be Known

**Mikidadi Muhanga[1]*, Liness Shasha[2], Million Phiri[2,3] Sibongile Namayawa[2], Milika Sikaluzwe[2], Chola Nakazwe[4,5] and Musonda Lemba[2]**

[1]Department of Development and Strategic Studies, College of Social Sciences and Humanities, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Department of Population Studies, School of Humanities and Social Sciences, The University of Zambia, Lusaka, Zambia
[3]Demography and Population Studies Programme, School of Public Health and Social Sciences, University of the Witwatersrand, Johannesburg, South Africa
[4]Zambia Statistics Agency, Lusaka, Zambia
[5]School of Public Health, University of Zambia, Lusaka, Zambia

*Corresponding author Email: mikidadi@sua.ac.tz

*Zoonotic diseases have been connected to numerous impacts on socio-economic well-being. However, scanty information exists on such impact found in the body of literature for the sub-Saharan Africa (SSA) region, particularly for countries such as Tanzania and Zambia. This article reviewed the socio-economics of zoonotic diseases with a focus on brucellosis, a zoonotic disease with a reported major impact on public health in the SSA. The review identified the gaps in knowledge in the selected countries. A systematic review and documentary analysis were employed in this study, the search strategy included keywords such as "zoonotic diseases, the impact of zoonotic diseases, effects of brucellosis, knowledge on brucellosis, socio-economics of brucellosis". A systematic literature review was employed employing innumerable search engines and databases to acquire 38 articles from Tanzania and Zambia published between 2000 and 2020 focusing on the socio-economics of zoonotic diseases particularly brucellosis, the impact of zoonotic diseases, effects of brucellosis, knowledge on brucellosis, and were peer-reviewed empirical studies. Zoonotic diseases are connected to a negative impact on socioeconomic well-being and are significantly associated with poverty. However, quantifications of such impact are rarely found in the body of literature, particularly for Tanzania and Zambia. The literature reviewed indicated a low level of knowledge existing both in Tanzania*

*and Zambia. Little is found in the literature on the socio-economics of zoonotic diseases. There is a need to further research on the socioeconomic impacts of zoonotic to further inform governments in these countries on the way to deal with zoonoses.*

# Perceptions of Tanzanian Livestock Dependent Communities on Climate-Related Changes: A Case of the Maasai Pastoralists in Longido District, Northern Tanzania

**Raymond Salanga**

Department of Development and Strategic Studies, College of Social Sciences and Humanities,
Sokoine University of Agriculture, Morogoro-Tanzania

*Corresponding author Email: salanga@sua.ac.tz

*This study was carried out in eight villages of Longido District, northern Tanzania to understand how the Maasai pastoralists perceive and interpret changes in climate and variability issues and determine their traditional livelihood strategies or responses deployed to cope with climate variability and change following a devastating drought in 2009/2010. Both primary and secondary data on the Maasai pastoralists' perception of climate change and variability were used. Primary data were obtained using household questionnaires and different Participatory Research Approaches (PRA) including key informant interviews and focus group discussions. The perception of climate change and variability was supported with a time-series analysis of rainfall and temperature data. This study presents empirical evidence that demonstrates how pastoralists have been using their local knowledge to cope with climate-related adversities. The results show that the Maasai pastoralists are aware of the current variations and changes in climate, which they admitted having become increasingly difficult to predict using their traditional knowledge. Furthermore, the study identified indicators of climate change and variability and the associated adversities as perceived by the Maasai pastoralists in the study area. The statistical analysis of 30 years of climatic data produced results that are in agreement with the Maasai pastoralists' perception of climate change and variability. It is imperative to understand people's perceptions to understand their responses to climate-related impacts in the future. Since some of the pastoralists' old ways to cope with climate-related adversities are failing, new means or techniques have certainly emerged. The study recommends examining and up-scaling the present techniques in designing alternative adaptive strategies for pastoralism, which is the most productive form of land use for patchy and scattered range land resources.*
***Keywords:*** Perception, Interpretation, Climate change and variability, Maasai Pastoralists

# Effect of Cutting Type and Plant Growth Regulators on Root and Shoot Development of Synadenium Glaucescens (Pax) and Commiphora swynnertonii (Burrt)

**Richard Madege[1], Faith Mabiki[2]**

[1]Department of Crop Science and Horticulture, Sokoine University of Agriculture, Tanzania
[2]Department of Physics and Chemistry, Sokoine University of Agriculture, Tanzania

Correspondance: richmadege@sua.ac.tz

*The vegetative propagation of majority mmedicinal and pesticidal plant hindered by low establishment potential of used propagules. This study aimed investigated the effect cutting type and growth regulators on shoot and root development of Synadenium glaucescens (Sg) and Commiphora swynnertonii (Cs) under screenhouse conditions. A three factor experiment in a Randomized complete block design with four replication was established to evaluate type of plant (Sg and Cs) , cutting type (Hard wood, semi hardwood and softwood) and growth regulators (Naphthalene Acetic Acid and indole-3-acetic acid) on shoot and root development. Findings revealed that plant type had significant ($p < .0001$) influence on days to sprouting, shoot length, number of leaves per cutting, number of roots per cutting, rooting percent and plant survival. All of these parameters were significant ($p < 0.05$) influenced of cutting type except number of leaves ($p = 0.7737$) and roots per cutting ($p = 0.2282$). Also, growth regulators had significant influence on all measured parameters except number sprouts ($p = 0.8642$) and roots ($p = 0.0659$) per cutting. A two-way interaction of plant and cutting type had significant effects ($p < 0.05$) in all measured parameters except number of days to sprout ($p = 0.0817$) number of leaves per cutting ($p = 0.4460$). A three-way interaction of plant type, cutting type and growth regulators had significant influence on number of roots per cutting ($p = 0.0071$) alone. These results are useful in propagation of medicinal and pesticidal plants especially Synadenium glaucescens and Commiphora swynnertonii*
***Keywords:*** Synadenium glaucescens Commiphora swynnertonii, cutting type, growth regulators, sprouting

# Influence of Storage Temperature, Moisture Content and Duration on Viability and Vigour of Sunflower Seeds

**Siwajali Selemani, Richard Madege and Yasinta Nzogela**

Department of Crop science and Horticulture, Sokoine University of Agriculture, Morogoro, Tanzania

*Corresponding author: selemanisiwajali@gmail.com

*A storage experiment was conducted at the Department of Crop Science,Sokoine University of Agriculture-Tanzania,December,2022-March,2023 to examine the effects of storage temperature, moisture content(MC) and duration on viability and vigour of Sunflower Seeds. In this study Certified OPV of sunflower seeds were stored in three different temperatures (5,20,350C) with different MCs (6, 8 and 10%). The seed samples were drawn at interval of 15days constituting six storage durations (15,30,45,60,75 and 90days) and evaluated for seed germination and seed health test on fungal infection. The experiment was a 3x3x6 factorial laid out in Completely Randomized Design (CRD) in four replications. Before storage the initial seed germination capacity (GC) was determined and used as control. The highest GC (94%), vigour index and poor fungal incidence was found at seeds tested before storage (0DAS) while the lowest GC (67.0%) was recorded in the seeds stored at temperature of 350C, MC of 10% at 90DAS. Among the storage conditions, the temperature of 5 and 200C and MCs of 6 and 8% were found to be the beneficial storage conditions for sunflower compared to the temperature of 350C and MC of 10%, the temperature of 350C was the worst storage temperature in all levels of MCs for sunflower seeds. Lastly, our results discovered that, the optimum and ideal storage conditions i.e. temperature of 5% and 20% with MC of 6 and 8% and shortest storage duration have the greatest advantage on the viability and vigour of sunflower seeds.*
***Keywords:*** sunflower, storage conditions, fungi.

# Environmental Flow Assessment for Sustainable Water Resource Management in Tanzania's Lower Rufiji River Basin: A Scoping Review

**Offoro N. Kimambo[1]; Winfred Mbungu[2]; Goodluck D. Massawe[3]; Amina A. Hamad[1] and Elly J. Ligate[4]**

[1]Department of Geography and Environmental Studies, Sokoine University of Agriculture (SUA)
[2]Department of Engineering Sciences and Technology, Sokoine University of Agriculture
[3]Department of Policy, Planning and Management, Sokoine University of Agriculture
[4]Department of Bioscience, Sokoine University of Agriculture

*Corresponding author Email: Offoro@sua.ac.tz

*Environmental flow (e-Flow) assessment is a widely adopted approach to facilitate informed decision-making concerning sustainable management and utilization of water and its resources in river systems. The Lower Rufiji River Basin (LRRB) faces various developmental pressures from several sectors, including hydropower, mining, agriculture, livestock, fishing, and tourism, necessitating effective management of the sub-catchment area to prevent significant environmental impacts. The study aimed to document and synthesize the catchment's characteristic, including climate and non-climate conditions. A scoping review was conducted to determine the status of environmental flow in the lower Rufiji river basin followed by batch (for the available data) flow analysis of the available data at Stiegler's Gorge using the global environmental flow calculator. The findings suggest that, while there has been progress in understanding eFlow estimation, yet there is need for more data on ecological and hydrological processes. This review found that hydrological and holistic methodologies are commonly employed in Tanzania to estimate e-Flow; however, uncertainties remain, raising questions concerning trust between decision-making tools and water resource utilization by the public. Climate variability influences e-Flow in the Rufiji River Basin, and the projections under various scenarios indicates increased temperatures with varying rainfall and humidity levels. Further, literature suggest that the Lower Rufiji river basin is among the vulnerability "hotspots" where communities face greater climate stressor risks. With the existing and planned developmental projects in the basin, including hydroelectric dams, mining, agriculture, livestock, and fisheries, it is critical to assess e-Flow in the LRRB to ensure resource sustainability. Advocating for preserving a dynamic environmental flow regime in rivers is recommended, considering the Rufiji River Basin's habitat connectivity. Championing the use of modern and high-level methods, including artificial intelligence techniques for the estimation of e-Flow. Quantifying the contribution of base flow to the surface flow, and salinity dynamics in the LRRB, which can affect the delta's biodiversity should be the future research direction.*
***Keywords:*** eFlow; Review; Water Resources; Sustainability; and Lower-Rufiji River Basin

# Assessment of knowledge, attitude and practices on the influence of land use change on threats of zoonoses in Katavi Rukwa ecosystem, Tanzania

**Moshiro, E.,[1]* Biseko, B.,[1] Yona, C.[2] and Mdegela R.H.[3]**

[1]Department of Wildlife Management, College of Forestry, Wildlife and Tourism,
Sokoine University of Agriculture, P. O. Box 3073, Morogoro, Tanzania
[2]Department of Biosciences, Solomon Mahlangu College of Natural and Applied Sciences,
Sokoine University of Agriculture, P.O. Box 3019, Morogoro, Tanzania
[3]Department of Veterinary Medicine and Public Health, College of Veterinary Medicine and Biomedical
Sciences, Sokoine University of Agriculture, P.O. Box 3021, Morogoro, Tanzania

*Corresponding author Email: eva.moshiro@sua.ac.tz

*Land use change particularly adjacent to protected areas has a likelihood potential of spreading zoonotic diseases by mediating interaction between humans , livestock and wildlife. A cross sectional study was conducted in four districts namely Mpanda, Mlele, Tanganyika and Mpimbwe to assess the knowledge, attitude and practices of different actors on factors for the increasing prevalence of zoonoses in changing land us e . Household surveys using structured questionnaires (Kobocollect), field observation, key informant interviews and focus group discussions were used to collect primary data. Additionally, secondary data were obtained from the districts medical report, TANAPA and Rukwa game reserve reports. A total of 299 respondents were obtained through random sampling from nine purposely selected villages. Out of 299 involved respondents 157 (52.57%) were males and 142 (47.49%) were females. However, the study revealed a total of 223 (74.6%) respondents involved in the study were not aware of land use change and how might influence the occurrence of zoonoses. Additionally, findings from this study revealed population increase as one o f the key drivers of land use change as (57.5%) of the respondents were immigrants involved in cultivation activities (90.64%) and livestock grazing (3.68%). Considering the current increase in the emergence and re emergence of zoonotic diseases, the study proposes immediate intervention for the prevention of such scenarios. A One Health approach is recommended for the improvement of KAP for different actors for better land use and zoonoses prevention.*

***Keywords:*** Katavi-Rukwa ecosystem, Land-use, Zoonoses, One Health, Tanzania

# Farmer's Knowledge and Practices on the Proper Use of Pesticides in Tomatoes Production in Mvomero District, Morogoro Region

**Fundikira, S.S.[1]*, Selestine, E.[1] and Msollo, S.S.[2]**

[1]Department of Food Science and Agro-processing, Sokoine University of Agriculture,
P.O. Box 3006, Morogoro, Tanzania
[2]Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture,
P.O. Box 3006, Morogoro, Tanzania

*Corresponding author: sambwe.fundikira@sua.ac.tz

Farmer's knowledge and practices on the proper use of pesticide in vegetables is very crucial to reduce the associated health risks among consumers. This study aimed at assessing the knowledge and practices of the famers on the proper use of pesticides. A cross sectional study was done in Mvomero district Morogoro region. A total of 120 randomly selected tomato farmers were face to face interviewed using a structured questionnaire. Descriptive statistics were done by using SPSSTM version 20. Results showed that, (100%) of farmers were using pesticides to control pests and diseases of which 53% preferred Snow tiger (Chlorofenapyr) and Dudumetrin (Emamectin +Acetameprid). Majority (84.3 %) apply pesticides after every one week but depending on the disease attack. Majority of the farmers (85%) reported to be reading the pesticide instructions before applying but (45.8%) were not following because it is not effective. Hence, (80.8%) of them decide to mix different pesticides during application to increase efficiency. About 57% of the farmers leave their tomatoes before harvesting for 7 days after application of pesticides to protect consumers while the rest harvest at any time when they get customers. Majority of the farmers (91.7%) know the effects of improper use of pesticide on health however, most of them are not sure of the specific health effect. Generally, there is a high improper use of pesticides in production of tomatoes, which create a need of training to farmers and public on proper use of pesticides.

***Keywords:*** Farmers, Knowledge, Practices, Pesticides use

# Short Biography for the Keynote speakers with their topic

**Dr. Anna A. Temu Senior Lecturer, researcher, Advisor/Consultant, Sokoine University of Agriculture, Tanzania**

Dr. Anna A. Temu holds a BSc. Agriculture (1986) (Sokoine University of Agriculture), a MSc Agricultural Economics (1991) (University of Guelph, Ontario Canada) and a PhD. Agricultural Economics (1999) (University of Illinois, Urbana-Champaign, USA). She is an Agricultural Economist and Agribusiness Development trainer, researcher and advisor/consultant, and her specialities include marketing and trade, institutional economics, agribusiness value chain development and social enterprise management. She is the founder of Sokoine University Graduate Entrepreneurs Cooperative (SUGECO). As a technical advisor of SUGECO, has conducted research on how to nurture and grow innovative and knowledge intensive entrepreneurs; she is researching and developing student entrepreneur value chain for the development of agribusiness value chain in Tanzania. She is involved agricultural technology transfer programs and value addition fruits, vegetable, herbs and spices value chains for food and nutritional security. Emphases being macro and micro-nutrients for balance dietsfor all. Iron and Zinc reach beans, pro-vitamin A orange maize and super foods such as Moringa, Turmeric and other herbs to combat vitamins and mineral deficiencies in Tanzania. For these value chains she is pursuing primary production, post-harvest handing, value addition, product development, processing and distribution systems and development of effective and efficient supply chains through enterprise development. SUGECO business model was developed to support involvement of youth and women in agribusiness value chains. The vision she carried for the past 11 years.

***Keynote Paper Title:*** **"Translating Science into Business".**

**Henry Mahoo (PhD). Associate Professor & Teaching Consultant at Sokoine University of Agriculture, Tanzania.**

Prof. Henry Mahoo holds a BSc in Applied Hydrology (University of Dar es Salaam, Tanzania), MSc in Irrigation Engineering; (Univ. Newcastle, UK), and a PhD from Sokoine University of Agriculture, Tanzania. His areas of specialty include hydrology, irrigation, drainage, water harvesting and climate change. He has long experience in managing and implementing various research projects and has published extensively. Prof. Mahoo has served in various National Boards and is currently the Chairman of the National Irrigation Commission (NiRC) in the Ministry of Agriculture (MoA).

***Keynote Paper Title:*** **"Irrigation As An Opportunity For Agricultural Transformation In Tazania".**

**Prof. Richard Taylor, University College London**

Prof. Richard Taylor is a Professor of Hydrogeology at University College London in the United Kingdom and an Adjunct Professor of Hydrogeology at Makerere University, Uganda. For three decades, he has worked with researchers, practitioners and stakeholders in across tropical Africa including Tanzania to inform strategies to expand and sustain access to safe water for drinking and food production. Richard has recently led large transdisciplinary research consortia including GroFutures and AfriWatSan to address these challenges in tropical Africa. Richard has extensively with Sokoine University of Agriculture and the Ministry of Water in Tanzania with a strong focus on the renewability and resilience of groundwater resources to climate change and the growing recognition that groundwater and surface water constitute a single water resource. He is the recipient of a Senior Fellowship from The Royal Society and a Contributing Author to two chapters, Changing Water Cycle and Africa, of the 6th Assessment Report of the Inter-governmental Panel on Climate Change. His research is rooted in the development and analysis of observations as well as the strengthening of individual and institutional capacities.

***Keynote Paper Title:*** **Resilience of groundwater resources in drylands to climate change: evidence from Tanzania and globally**

SOKOINE UNIVERSITY OF AGRICULTURE
DIRECTORATE OF POSTGRADUATE STUDIES, RESEARCH,
TECHNOLOGY TRANSFER AND CONSULTANCY (DPRTC)