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

2ND SUA SCIENTIFIC CONFERENCE

FROM 25TH - 26TH MAY 2021
AT EDWARD MORINGE CAMPUS
SOKOINE UNIVERSITY OF AGRICULTURE
MOROGORO, TANZANIA

MAIN THEME:

RESEARCH AND TECHNOLOGICAL INNOVATIONS TOWARDS TRANSFORMATION OF LOWER MIDDLE INCOME COUNTRIES

Directorate of Postgraduate Studies, Research, Technology Transfer and Consultancy
Sokoine University of Agriculture
P.O. Box 3151, Chuo Kikuu
Morogoro, Tanzania

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SECOND SUA SCIENTIFIC CONFERENCE (25-26 MAY, 2021)

MAIN THEME: RESEARCH AND TECHNOLOGICAL INNOVATIONS TOWARDS TRANSFORMATION OF LOWER MIDDLE INCOME COUNTRIES

Day 1	***CONFERENCE PROGRAMME – 25 th MAY, 2021***
	ICE Main Hall, Edward Moringe Campus, Sokoine University of Agriculture
08:30-09:00	**Registration**
Opening	**Session leads -** Chairperson Professor Japhet Kashaigili, Rapporteur Dr. Akwilina W. Mwanri
09:00-09:30	Welcome Remarks & Speeches– Prof. Esron Karimuribo, Director DPRTC, DVC-Ac. DVC A&F, VC, Guest of Honour
09:30-09:50	***Tanzania's Lower Middle Income Status: Implications for future economic growth strategies*** ***Dr. Florens M. Turuka*** , *Department of Agricultural Economics and Agribusiness, Sokoine University of Agriculture*
09:50-10:10	***Innovations for sustainable livestock production: improving nutrition and income of small-scale farmers in Tanzania*** ***Prof. Sebastian W. Chenyambuga,*** *Department of Animal, Aquaculture and Range Sciences, Sokoine University of Agriculture*
10:10-10:30	***Universities support to sustainable indistrialization*** ***Dr. Gerald Kafuku*** , *Tanzania Commission of Science and Technology (COSTECH)*
10:30-10:45	*Discussion*
10:45-11:15	**Health Break**
11:15-11:35	***Outsmarting Viruses through Genomics - a Case for SARS-CoV-2 Variants "Moving Target" and COVID-2019 Vaccines*** ***Prof. Gerald Misinzo*** , *SACIDS Foundation for One Health, Sokoine University of Agriculture*
11:35-11:55	***Focused groundwater recharge to the Makutapora Wellfield of central semi-arid Tanzania: empirical evidence to inform Managed Aquifer Recharge options*** ***Prof. Richard Taylor*** , *Department of Geography, University College London*
11:55-12:15	**Discussion**
12:15-12:25	**Group photo**
	PARALLEL SESSIONS **VENUE: ICE Main Hall**
Venue: ICE	***SUB-THEME 1: Agricultural innovations for enhanced food security and economic growth***
Session 1	**Session leads-** Chair: Dr. Heirinimo Proaches, Rapporteur: Dr. Devotha Mosha Kilave
12:25-12:35	***Identifying the Right Plants for Diverse Biocontrol Agents in Tropical Smallholder Bean Farming Systems*** *Mkenda, P.A , Department of Biosciences, Sokoine University of Agriculture*
12:35-12:45	***A simple Convolutional Neural Network Architecture for monitoring Tuta absoluta (Gelechiidae) infestation in tomato plants*** *Sixbert K. Mourice, Department of Crop Science and Horticulture, Sokoine University of Agriculture*
12:45-12:55	***CoolBot Coldroom Technology Enhance Postharvest Quality and Shelf-life of Tomato (Solanum lycopersicum) Fruits*** *Ramadhani O. Majubwa, Department of Crop Science and Horticulture, Sokoine University of Agriculture*
12:55-13:05	***Pedological characterization of the soils of Magozi Irrigation Scheme, Iringa, Tanzania*** *Daniel Porkalpo Isdory, Department of Soil and Geological Sciences, Sokoine University of Agriculture*
13:05-13:15	**Discussion**
Session 2	**Session leads-** Chair: Dr. Sixbert Mourice, Rapporteur: Daniel Porkalpo Isdory
13:15-13:25	***Safety of Traditional Leafy Vegetables Powders from Lindi in Tanzania*** *Chove, L.Department of Food Technology, Nutrition and Consumer Science, Sokoine University of Agriculture*
13:25-13:35	***Socio-economic determinants of Smallholder farmers Sisal Productivity: A Case of Korogwe District, Tanzania*** *Azizi H. Beleko, and Urassa, Department of Policy, Planning and management, Sokoine University of Agriculture*
13:35-13:45	***Soils of the Greenbelt Zone of South Sudan: Case of Sakure and Nginda Payams in Western Equatoria State*** *Isaac A. J. Bazugba, National Ministry of Agriculture and Food Security,The Republic of South Sudan*
13:45-13:55	***Trans fatty acids in Tanzania: Are consumers and processors aware of the associated health hazards ?: A case of morogoro*** *G. Nzunda,Department of Training, Research & Extension Services,Ministry of Agriculture , Dodoma -Tanzania*
13:55-14:05	***Discussion***
14:05-14:45	**LUNCH BREAK**
Session 3	**Session leads-** Chair: Dr. Chove, L, Rapporteur: Mkenda, P.A
14:45-14:55	***The Role of Agricultural Value Chain Incubation Programmes to Youth's Employment: A Case of the Sokoine Graduates Entrepreneurs Cooperative, Morogoro, Tanzania*** *Justin K. Urassa, Department of Policy, Planning and management, Sokoine University of Agriculture*
14:55-15:05	***Identification of resistant genotypes to rice leaf blast disease caused by pyricularia oryzae using rice blast differential lines and traditional varieties in Zanzibar*** *Ali Khatib Bakar, Department of Crop Science and Horticulture, Sokoine University of Agriculture*
15:05-15:15	***Assessment of rice yield losses caused by rice leaf blast disease (Pyricularia oryzae Cavara) in Zanzibar*** *Ali Khatib Bakar, Department of Crop Science and Horticulture, Sokoine University of Agriculture*
15:15-15:25	**Discussion**
Session 4	**Session leads-** Chair – Prof. Justine K. Urassa, Rapporteur: Ali Khatib Bakar
15:25-15:35	***Formulation and Sensory Evaluation of Complementary Foods Using Low-Cost, Locally-Available and Nutrient-Dense Ingredients by Linear Programming*** Tesha, A. P, Department of Food Technology, Nutrition and Consumer Sciences
15:35-15:45	***UAV-based multispectral imagery for improved nitrogen management in neglected horticultural species under tropical sub-humid conditions: A case of African eggplant (Solanum aethiopicum L)*** Paul Reuben Mwinuka, Department of Engineering Sciences and Technology, Sokoine University of Agriculture

Venue: ICE Main	***SUB-THEME 1: Agricultural innovations for enhanced food security and economic growth***
15:45-15:55	***Yield Losses Associated with Cylas sp. Infestation on Improved Sweetpotato Varieties in Tanzania*** Gration M. Rwegasira, Department of Biosciences, Sokoine University of Agriculture
15:55-16:05	***Effect of Shipping Packages on Postharvest Losses of Mandarin (Citrus reticulate Blanco.) Fruits along the Value Chain in Morogoro, Tanzania*** Ramadhani O. Majubwa, Department of Crop Science and Horticulture, Sokoine University of Agriculture
16:05-16:15	***Discussion***
Session 5	**Session leads-** Chair – Prof. Gratian M Rwegasira, Rapporteur: Tesha A.P
16:15-16:25	***The influence of farming practices on okra yield at farms in Kilombero, Tanzania*** Sergio G. Milheiras, Department of Ecosystems and conservation, Sokoine University of Agriculture
16:25-16:35	***Evaluation of groundwater recharge dynamics using the WetSpass Model in the Usangu Plains, Tanzania.*** Sahinkuye Thomas, Department of Engineering Sciences and Technology, Sokoine University of Agriculture
16:35-16:45	***Deep learning application on soil agricultural fertility via EC mapping system in precision farming*** Mohd Hudzari Haji Razali, Faculty of Plantation and Agrotechnology, Universiti Teknologi MARAMelaka, **Malaysia**
16:45-16:55	***Discussion***
16:55-17:15	**Evaluation of Day 1: All participants, speakers, Secretariat**
17:15-17:20	**Closing remarks & end of Day 1- Secretariat**

Day 1	**PARALLEL SESSIONS Venue: ICE Video Audio Hall**
	SUB-THEME 1: Agricultural innovations for enhanced food security and economic growth
Session 1	**Session leads-** Chair: Dr. Beda Mwang'onde, Rapporteur: Dr. Rashid Suleiman
12:25-12:35	***Impact of adjusting planting dates to reduce climate-related risk: evidence from an early maturing maize variety in semi-arid central Tanzania.*** Msongaleli, B, College of Humanities and Social Sciences, The University of Dodoma, Tanzania.
12:35-12:45	***Assessment of Farmers Handling Practices and Effectiveness of Different Post Harvest Technologies of Maize: A Case of Kilosa Region- Morogoro, Tanzania*** Constancia Laswai Henry, Department of Food Technology, Nutrition and Consumer Sciences, SUA
12:45-12:55	***Contribution of Fish in Improving Micronutrients Content in Complementary Foods for Children Aged 6 to 23 Months in Lindi Rural*** Hope Masanja, Department of Food Technology, Nutrition and Consumer Sciences, SUA
12:55-13:05	***Determination of Benzo(A)Pyrene and Heavy Metals Contamination in Smoked Lates niloticus and Oreochromis niloticus From Lake Victoria*** Donald B. Mkonyi, Department of Food Technology, Nutrition and Consumer Sciences, SUA
13:05-13:15	**Discussion**
Session 2	**Session leads-** Chair: Prof. Christopher Mahonge, Rapporteur: Donald Mkonyi
13:15-13:25	***Chickens Genetic Signatures Retained Long Historical Relationship Between Zanzibar and Oman*** Charles M. Lyimo and Badar Al-Qamashoui (SUA & Sultan Qaboos University respectively)
13:25-13:35	**Pre-storage and storage practices in relation to contamination of mycotoxins in two subsistence farming ecosystems in Tanzania** Richard, Raphael Madege, Department of Crop Science, SUA
13:35-13:45	***Smallholder Farmers' Storage Practices and Awareness of Aflatoxin Contamination of Cereals and Oilseeds in Chamwino, Dodoma, Tanzania*** Matrona E. Kimari, Department of Food Technology, Nutrition and Consumer Sciences, SUA
13:45-13:55	***The impact of Covid-19 on Food Safety in Developing Country*** Rashid Suleiman, Department of Food Technology, Nutrition and Consumer Sciences,SUA
13:55-14:05	***Discussion***
14:05-14:45	**LUNCH BREAK**
Session 3	**Session leads-** Chair: Prof. John N.Jeckoniah, Rapporteur: Matrona Kimari
14:45-14:55	***Sustainable Management Strategies for "Leaf Yellowing Syndrome" of Rice (Oryza Sativa L.) in Mvomero District*** Hekima Boniface Mliga
14:55-15:05	***The role of Conservation Agriculture in Bridging gender gaps in Tanzania: The case of Sustainable Agriculture Tanzania*** Elizabeth Msuya
15:05-15:15	***Understanding the Impact of Climate Smart Irrigation on Household Food Security: ACounterfactual Analysis of Southern Highland Zone of Tanzania*** Abiud J. Bongole,CSSH,SUA
15:15-15:25	**Discussion**
Session 4	**Session leads-** Chair – Dr. Barnabas Msongaleli, Rapporteur: Abiud Bongole
15:25-15:35	**Women Empowerment, Household Food Security and Dietary Diversity: Experience from Rice and Sunflower Commercialization in Tanzania** John Nshimba Jeckoniah, Department of Development Studies (DDS),SUA
15:35-15:45	***Water lifting devices in Tanzania: Farmer's knowledge and constraints for dry season vegetable irrigation*** Festo Richard Silungwe , Department of Engineering Sciences and Technology
15:45-15:55	***Assembling 'Mkulima Agricultural Knowledge Hub' For Up-Scaling the Adoption of Agricultural Innovations among Farmers in Tanzania*** Philibert S. Nyinondi, Department of Information and Records Studies, SUA
15:55-16:05	**2021 - The International Year of Fruits and Vegetables: Are we consumingenough Fruits? A Case of Chamwino, Dodoma** Ngawembela, M, Department of Food Technology, Nutrition and Consumer Sciences, SUA
16:05-16:15	***Discussion***
Session 5	**Session leads-** Chair – Dr. Richard Madege, Rapporteur: Dr. Festo Silungwe
16:15-16:25	***Innovative "Swahili based Agricultural Apps"- Underutilize Innovative Waysof Reaching Farmers and Disseminating Information in Tanzania*** Philibert S. Nyinondi, Department of Information and Records Studies, SUA
16:25-16:35	***Effects of plant part and storage conditions on occurrence of fungi and their mycotoxins in Synadenium glaucescens Extracts*** Faith Philemon Mabiki, Dapartment of Chemistry and Physics, SUA
16:35-16:45	**Discussion**
16:45-16:55	**Evaluation of Day 1: All participants, speakers, Secretariat**
16:55-17:15	**Closing remarks & end of Day 1- Secretariat**

	THEME 3: Policy Framework, Economic Transformation and Quality Livelihoods
Session 1	**Session leads-** Chair: Dr. Charles Lyimo, Rapporteur: Haji Ng'elenge
12:25-12:35	***Evolution of locally packed ready-to-eat cashewnuts in Tanzania: does their production follow food and environmental standards?*** Mushi, D. Department of Biosciences, Sokoine University of Agriculture
12:35-12:45	***Suitability of Pigeon Pea and Soybean flours as Extenders and Binders in Restructured Meat Product (Sausage)*** Gomezulu, A. D, Department of Food Technology, Nutrition and Consumer Sciences, Sokoine University of Agriculture
12:45-12:55	***Can maize smallholders in Southern and Northern highlands of Tanzania increase the net revenue from their storage facilities?*** Violeth J. Mwaijande, Department of Development Studies, Sokoine University of Agriculture
12:55-13:05	***Sorghum and Millet Value Chains for Food, Nutritional and Income Security in Semi-arid Lands of Tanzania: Investigation for missing*** Hella, J.P, Sokoine University of Agriculture
13:05-13:15	**Discussion**
Session 2	**Session leads-** Chair: Prof. Hella, J.P, Rapporteur: Violet J. Mwaijande
13:15-13:25	***Gas Extraction Operations and Changes in Livelihood Strategies: Experience from Mtwara District in Tanzania*** Beston Musa Musoma, Department of Policy Planning and Management, Sokoine University of Agriculture
13:25-13:35	***Influence of Social Capital on Adaptation to Climate Variability and Vulnerability in Farming System in Chamwino District, Tanzania*** Allan, T., Department of Policy Planning and Management, Sokoine University of Agriculture
13:35-13:45	***The Influence of financial literacy on relationship between access to finance and firm growth among agro processing firm in Tanzania*** Lekumok Kironyi, Department of Agricultural Economics and Business Studies, Sokoine University of Agriculture
13:45-13:55	**Scientific evidence for policy making: a missing link in higher learning institutions in Tanzania** Suzana S. Nyanda, Department of Policy, Planning and Management, Sokoine University of Agriculture
13:55-14:05	***Discussion***
14:05-14:45	**LUNCH BREAK**
Session 3	**Session leads-** Chair: Dr. Devotha B. Mosha, Rapporteur: Gomezulu A.D
14:45-14:55	***Competitiveness of different cotton production systems in maswa and meatu, tanzania*** Michael Raphael Baha, PhD Candidate - School of Agricultural Economics and Business Studies, Sokoine University of Agriculture
14:55-15:05	***Livestock, crop commercialisation and poverty reduction among rural households in Singida Region, Tanzania*** N.S.Y. Mdoe, SAEBS, Sokoine University of Agriculture
15:05-15:15	***Assessment of Socio-Economic factors on the Uptake of Modern Family Planning. A Case of Kishapu District*** Janeth Joseph Nandrie, Department of Policy Planning and Management, Sokoine University of Agriculture
15:15-15:25	**Discussion**
Session 4	**Session leads-** Chair: Prof. N.S.Y Mdoe, Rapporteur: Janeth J. Nandrie
15:25-15:35	***Examining gender differences in indigenous chicken commercialisation intent – Evidence from North-Western Zambia*** Moffat Chawala, School of Graduate Studies, The Copperbelt University-Kitwe, Zambia
15:35-15:45	***Determinants of Apicultural Practices in Sikonge Tabora, Tanzania*** Kalista Higini Peter, Department of Geography & Environmental Studies, Sokoine University of Agriculture
15:45-15:55	***Contribution of fisheries to household income in the Little Ruaha river catchments Iringa Tanzania*** Farida Mayowela, Department of Ecosystems and Conservation, Sokoine University of Agriculture
15:55-16:05	***The impact of rice commercialisation on livelihoods in Kilombero valley, Tanzania: Anybody left behind?*** Devotha B. Mosha, ICE, Sokoine University of Agriculture
16:05-16:15	***Discussion***
Session 5	**Session leads-** Chair: Dr. Suzana S. Nyanda, Rapporteur: Moffat Chawala
16:15-16:25	***Legal protection and promotion of livestock breeding in Tanzania*** Chana Mhembe, Resident Magistrate, Tarime District
16:25-16:35	***Sorghum and Millet Value Chains for Food, Nutritional and Income Security in Semi-arid Lands of Tanzania: Investigation for missing synergies*** Hella, J.P, SAEBS
16:35-16:45	***Structure And Dynamics of Tanzania Exports*** Turuka, Florens M, Department of Agricultural Economics and Agribusiness
16:45-16:55	***Performance, Success Factors and Challenges Facing Youth Agri-enterprises in Tanzania*** N.S.Y. Mdoe, SAEBS
16:55-17:05	***Discussion***
17:05-17:15	**Evaluation and closing of Day 1: All participants, speakers, Secretariat**
17:15-17:20	**Closing remarks & end of Day 1- Secretariat**

Day 1	**PARALLEL SESSIONS Venue: Extension 2**
	THEME 4: Contribution of Forestry, Wildlife Management and Tourism towards economic development
Session 1	**Session leads-** Dr. Lamtane, H.A, Rapporteur: Mwajabu Selemani
12:25-12:35	***Spatial and Temporal Abundance of Flower Visiting Flies Associated with Cultivating Cucurbit Crops in Morogoro, Eastern-Central Tanzania*** S.A. Kabota
12:35-12:45	***Functional diversity of bird communities correlates with local poaching and habitat degradation signals in a human dominated landscape of central Tanzania*** Shadia I. Kilwanila, Department of Wildlife Management
12:45-12:55	***Economic contribution of tourism to livelihood development and climate change adaptation in Lake Eyasi, Tanzania*** Nickson Peter Mkiramweni, Department of Tourism and recreation
12:55-13:05	***Geographic biases in cane rat research may impede broader wildlife utilization and conservation in Africa: a systematic review*** Shadia I. Kilwanila, Department of Wildlife Management
13:05-13:15	**Discussion**
Session 2	**Session leads-** Chair: Dr. Alfan Rija, Rapporteur: Shadia I. Kilwanila
13:15-13:25	***Lumber recovery and production rates of small-scale mobile sawmilling industries in Northern Tanzania*** Nandera Lolila Juma, Department of Wildlife Management
13:25-13:35	***Status and institutional mechanisms for mitigating human wildlife conflicts in Tanzania: A case of Swagaswaga game reserve in Kondoa*** Andrew Mushi , Mzumbe University

13:35-13:45	***Productivity analysis of conventional and integrated timber logging operations*** Ntalikwa, S. J., Department of Forest Engineering and Wood Sciences
13:45-14:00	***Discussion***
14:00-14:45	**LUNCH BREAK**
Session 3	**Session leads-** Chair: Lalika, M.C.S, Rapporteur: Nandera Lolila Juma
14:45-14:55	***1758)*** Mwajabu Selemani, Rhodes H. Makundi *et al*
14:55-15:05	***Morphometric analysis and sexual dimorphism of Artemia population in Tanzania*** Lamtane, H.A, SUA
15:05-15:15	***Habitat suitability and distribution shifts of 5 rubiaceae tree species under climate change in two eastern arc forests, Tanzania*** Alfred Kahanju Chitiki , Department of Ecosystems and Conservation
15:15-15:25	**Discussion**
Session 4	**Session leads-** Chair – Dr. Nickson Peter Mkiramweni, Rapporteur: Ntalikwa, S. J
15:25-15:35	***Uncovering the Potential of Neglected and Lesser Utilized Non-Wood Forest Products for Food and Nutrition Secutiry*** Lalika, M.C.S, Department of Geography and Environmental Studies
15:35-15:45	**Recent changes in river discharge in a tropical semi-arid lowland: climate versus people in the Great Ruaha River Sub-catchment of Tanzania** Japhet J. Kashaigili, Richard G. Taylor *et al*
15:45-15:55	***Discussion***
15:55-16:00 PM	**JOIN OTHER VENUES (1-3)**

SECOND SUA SCIENTIFIC CONFERENCE (25-26 MAY, 2021)
MAIN THEME: RESEARCH AND TECHNOLOGICAL INNOVATIONS TOWARDS TRANSFORMATION OF LOWER MIDDLE INCOME COUNTRIES

Day 2	***CONFERENCE PROGRAMME – 26 th MAY, 2021***
	PARALLEL SESSIONS Venue: ICE Main Hall
	THEME 2: Pests, diseases and innovative control strategies for improving food security and health
08:00-08:30	**Registration**
Session 1	**Session leads -** Chair: Prof Cornelio Nyaruhucha, Rapporteur: Suzan Machera
08:30-08:40	***Prospects and perspectives for the control of Taenia solium infections in Tanzania*** Mwemezi L. Kabululu, Tanzania Livestock Research Institute (TALIRI)
08:40-08:50	***The relevance of formal and informal institutions in local chicken genetic resource conservation: A case of Igunga District, Tanzania*** Lazaro E. Kapella, Department of Policy, Planning and Management, Sokoine University of Agriculture
08:50-09:00	***Understandingvulnerabilityand redefining adaptation strategies of agro-pastoral system to reduce climate-related risks: evidence from selected agro-ecological zones of Tanzania*** Mongi, H, Department of Information Systems and Technology, The University of Dodoma
9:00-9:10	***Intra-Household Decision Making on Production and Income Generation Among Women. in Mara Region, Tanzania*** Ndossi, M. J, Department of Economics and Rural Development
9:10-9:20	**Discussion**
Session 2	**Session leads-** Chair: Dr. Georgies Mgode, Rapporteur: Ndossi, M. J
09:20-09:30	***Morphology and molecular characterization of rice leaf blast pathogen (Pyricularia oryzae Cavara) collected in Zanzibar*** Ali Khatib Bakar, Department of crop science and horticulture, SUA
09:30-09:40	***Trade Development of Products of Medicinal Plants in Sub Sahara Africa: Overlooked Research Area?*** Eziacka Mpelangwa, Department of Agricultural Economics and Agribusiness, SUA
09:40-09:50	***Natural occurrence of moulds and mycotoxins in Synadenium glaucescens Extracts (SGE) from different plant parts under different storage conditions*** Faith Philemon Mabiki, Dapartment of Chemistry and Physics, SUA
09:50-10:00	***Farmers' perspectives on occurrence and management of rust and groundnut leaf spot diseases in different agro-ecological zones*** Kinanda R. I, Department of crop science and horticulture, SUA
10:00-10:10	***Effects of Foreign Direct Investment on Aggregate Cereal Yield in Tanzania: A Granger Causality Approach*** Furaha N Rashid, Department of Business Administration and Marketing Management, College of Business Education - Mbeya
10:10-10:20	***Relationship between plant parasitic nematode, arbuscular mycorrhizal fungi andsoil characteristics on clove (Syzygium aromaticum (l.) Merr and Perr) agroecosystem in East Usambara mountains-Tanzania*** Suzan Machera, Department of crop science and horticulture, SUA
10:20-10:40	**Discussion**
10:40-11:10	**Health Break**
Session 3	**Session leads-** Chair: Dr. Faith Philemon Mabiki, Rapporteur: Furaha N. Rashid
11:10-11:20	***Prevalence of Rickettsia typhi in rodent fleas from areas with and without previous history of plague in Mbulu district, Tanzania*** Claus A. Thomas, Department of Veterinary Microbiology, Parasitology and Biotechnology, Sokoine University of Agriculture
11:20-11:30	***Prevalence of haemoparasites in rodents and their zoonotic potential from Ruaha ward in Kilosa District, Tanzania*** A.M. Samiji, Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture
11:30-11:40	***Rodent and flea diversity on the influence of plague persistence in plague and non plague localities of Mbulu district, Northern Tanzania*** Stella T. Kessy, (ACE IRPM&BTD)
11:40-11:50	***Effects of medicinal plants harvesting on plants conservation: A Case of West Usambara, Tanga-Tanzania*** Mohamed Khamis Said, Department of Geography and Environmental Studies, Sokoine University of Agriculture
11.50-12.00	**Discussion**
Session 4	**Session leads-** Chair: Dr. Abdul Katakweba, Rapporteur: Mohamed Khamis Said
12:10-12:20	***Lymphatic filariasis, infection status in Culex quinquefasciatus and Anopheles species after six rounds of mass drug administration in Masasi District, Tanzania*** Eliza Lupenza, Department of Parasitology and Medical Entomology, School of Public,Health and Social Sciences, Muhimbili University of Health and Allied Sciences
12:20-12:30	***Seroprevalence and risk factors for Taenia solium infections in pigs in Kongwa and Songwe Districts, Tanzania*** Wilson, C, Department of Microbiology, Parasitology and Biotechnology, Sokoine University of Agriculture
12:30-12:40	***Porcine cysticercosis seroprevalence and potential transmission risk factors beforea digital educationinterventionin Iringa Rural District, Tanzania*** Flora F. Kajuna, Department of Veterinary Medicine and Public health, Sokoine University of Agriculture
12:40-12:50	***Challenges and opportunities in the diagnosis of Taenia solium cysticercosis and taeniosis in developing countries: Tanzania's*** Fredy Mlowe, Department of Veterinary Medicine and Public Health, Sokoine University of Agriculture
12:50-13:00	**Discussion**
13:00-14:00	**LUNCH BREAK**
Session 5	**Session leads-** Chair: Dr. Lupindu A., Rapporteur: Eliza Lupenza
14:00-14:10	***The Serological Survey for Human Cysticercosis Prevalence in Kongwa and Songwe Districts, Tanzania*** George Makingi et *al* ., College of Veterinary Medicine and Biomedical sciences, SUA
14:10-14:20	***Clinical and radiological presentations of NCC among PLHIV and HIV negative individuals in southern highlands of Tanzania*** Charles Elias Makasi, NIMR-Muhimbili Medical Research Centre
14:20-14:30	***Occurrence of Ventillicium Dahliae in African Eggplant*** Digna Swai, East-West Seed (Tanzania) Company Limited, Moshi, Kilimanjaro

14:30-14:40	***Whitefly resistance in African cassava genotypes*** C. Gwandu, Tanzania Agricultural Research Institute
14:40-14:50	***Knowledge, Attitudes and Practices in Relation to Taenia solium Cysticercosis and Taeniasis in Tanzania*** Nyangi C, Department of Veterinary Medicine and Public Health, SUA
14:50-15:00	**Porcine cysticercosis prevalence and potential transmission risk factors pre health education intervention in Iringa Rural District,** Flora Kajuna, Department of Veterinary Medicine and Public Health, SUA
15:00-15:20	***Discussion***
Session 6	**Session leads-** Chair: Dr. Emmanuel Malisa, Rapporteur: Catherine M. Philip
15:20-15:30	***Genome-wide association mapping of whitefly resistance in cassava genotypes*** C. Gwandu, Tanzania Agricultural Research Institute
15:30-15:40	***Examination of seasonal variations in levels and risks of organochlorine pesticides in fish: A case of Lates niloticus products from*** Alex Wenaty , Department of Food Technology, Nutrition and Consumer Sciences
15:40-15:50	***Development of Community-Based Health Education Package for the Control of T. solium, cysticercosis and taeniasis in Tanzania*** Nyangi C, Department of Veterinary Medicine and Public Health, SUA
15:50-16:00	***The occurrence of Plant-Parasitic Nematodes in different rice Agroecosystems in Morogoro and Mbeya regions, Tanzania*** Yasinta Beda Nzogela
16.00-16.10	***Discussion***
16:10-16:15	**Evaluation of Day 2: All participants, speakers, Secretariat**
16:15-16:30	**CONFERENCE CLOSING REMARKS**

Day 2	**PARALLEL SESSIONS** **Venue: ICE Audio Video Hall**
	THEME 4: Contribution of Forestry, Wildlife Management and Tourism towards Economic Development
08:00-08:30	**Registration**
Session 1	**Session leads** Chair: Dr. Felix Nandonde, Rapporteur: Aenea Saanya
08:30-08:40	***Patterns of Community Structure and Species Composition of Flower Visiting Flies Associated with Cultivated Cucurbit Crops in Morogoro, Eastern-Central Tanzania*** S.A. Kabota, Department of Crop Science and Horticulture, SUA
08:40-08:50	***The Potential for Ecosystem-based Management approach through Riparian forests Enhancement*** Antidius Raphael, Department of Forest and Environmental Economics, SUA
08:50-09:00	***Willingness to pay and accept compensation for conservation of Usangu Plains Mbarali District, Tanzania*** Doris I. Munisi, Sokoine University of Agriculture
9:00-9:10	***Influence of tree farming on provisioning ecosystem services and community livelihoods in Mufindi District, Tanzania*** Vaileth Mashauri, Department of Economics, Open University of Tanzania
9:10-9:20	**Discussion**
Session 2	**Session leads** Chair: Prof. Camelius Sanga, Rapporteur: Dr. Alfan A. Rija
09:20-09:30	***Developing a Dynamic Partial Equilibrium Forest Sector Model for Mainland Tanzania and Assessing Impacts of Firewood and Charcoal Production and Consumption on Forest Sustainability*** Nyamoga, G.Z
09:30-09:40	***Tree architecture influences location and abundance of ant nests in an ant-Acacia zanzibarica mutualism*** Alfan A. Rija, Department of Wildlife Management, SUA
09:40-09:50	***Research and Technological Innovations Towards Transformation of Lower Middle Income Countrie*** Farida Mayowela, Department of Ecosystems and Conservation, SUA
09:50-10:00	***Partial equilibrium forest sector model for assessing impacts of firewood and charcoal production and consumption on forest sustainability in mainland Tanzania*** G.Z. Nyamoga, Department of Forest and Environmental Economics, SUA
10.00-10.10	***Modelling, Predicting and Mapping Above-Ground Biomass using Sentinel-2 Remote Sensing in Magamba Nature Forest Reserve, Northern Tanzania*** Sami Madundo, Department of Forest Engineering and Wood Sciences
10.10-10.20	***Rice Commercialisation in Mngeta, Kilombero District: Policy implications for inclusive poverty reduction and production sustainability*** *Aida Isinika, ICE, SUA*
10.20-10.40	**Discussion**
10.40-11.10	**Health Break**
Session 3	**Session leads** Chair: Dr. Nyamoga G.Z., Rapporteur: Farida Mayowela
11:10-11:20	***Groundwater Governance Levels in Njombe District in Tanzania*** Kabote S. J, Department of Policy, Planning and Management, Sokoine University of Agriculture
11:20-11:30	***Mitigation measures for human-wildlife conflict in Tanzania: are we on the right truck? A retrospective study*** A.M. Samiji, Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture
11:30-11:40	***Mapping Groundwater Potential Areas in Morogoro Urban Municipal using Landsat Images (2000-2018*** Calvin Samwel Swai, Department of Mathematics Informatics and Computational Science, SUA
11:40-11:50	***Quantitative Determination of Antibiotics in Aqueous Samples from Rivers, Mindu Dam and Mafisa Wastewater Treatment Plant Located in Morogoro Municipality, Tanzania*** Ally M.HS et al, Department of Veterinary Physiology, Biochemistry and Pharmacology, SUA
11.50-12.05	**Discussion**

Session 4	**Session leads**	Chair: Prof. Kabote S.J., Rapporteur: Ally M. HS
12:05-12:15	***Genetic diversity of Greater cane rat population in the Eastern Arc Mountains ecosystem, Tanzania based on D-loop region of MtDNA***	Shadia I. Kilwanila, Department of Mathematics Informatics and Computational Science, Sokoine University of Agriculture
12:15-12:25	***Local bird density varies in areas contrasting in hunting pressure in human-dominated rural landscapes of central Tanzania***	Alfan A. Rija, Department of Wildlife Management,SUA
12:25-12:35	***Current and potential future distribution of small mammals in Selous Ecosystem, Tanzania***	Aenea Saanya, (ACE IRPM&BTD)
12:35-12:45	***The influence of farming practices on okra yield at farms in Kilombero, Tanzania***	Sergio G. Milheiras, Department of Ecosystems and conservation, SUA
12.45-13.00	**Discussion**	
13:00-14:00	**LUNCH BREAK**	
Session 5	**Session leads**	Chair: Dr. Innocent H. Babili, Rapporteur: Sami Madundo
14:00-14:10	***Analysis of Utilization of honey by-products among beekeepers in Sikonge District, Tabora***	Kalista Higini Peter,Department of Geography & Environmental Studies, University of Dodoma
14:10-14:20	***The nexus between climate crisis & land use planning in Tanzania***	Andrew Mushi, Mzumbe
14:20-14:30	***Consumers' awareness and motivational factors to participate in Agritourism: Case studies of Dar es Salaam and Morogoro regions***	Nickson Peter Mkiramweni, Department of Tourism and Recreation, SUA
14:30-14:40	***Drivers and Causes of Land Cover and Land Use Change Patterns of Kilombero Wetlands, Morogoro, Tanzania***	Silvia F. Materu, Department of Biosciences
14.40-14.50	**Discussion**	
Session 6	**Session leads**	Chair: Dr. Proches Heironimo, Rapporteur: Andrew Mushi
14:50-15:00	***Optimum Food Crops/Tree Combination for Maximized Farm Profit in Mufindi District: A Multi-Period Programming Approach.***	Haji Ng'elenge, Jordan University College, Morogoro
15:00-15:10	***Impact of Salinity Intrusion on Transpiration Rates of Avicennia marina (Forssk.) Vierh. (White Mangrove) in Pangani and Wami Estuaries,Tanzania***	Mohamed, M., Center for Climate Change Studies, University of Dar es salaam
15:10-15:20	***Analyzing the Potential for Ecohydrology in Climate Stressed River Basins: Experience from Mara River, Tanzania.***	Magdaline K. Boniphace , Department of Geography and Environmental Studies, SUA
15:20-15:30	***Impact of Urban Expansion on Land Surface Temperature in Dodoma and Morogoro Cities, Tanzania***	Paulo Julius Mandela, Department of Mathematics Informatics and Computational Science, SUA
15:30-15:40	***Opportunities and Challenges of Wildlife Management Areas in Tanzania***	Innocent H. Babili, Institute of Continuing Education, SUA
15:40-16:00	**Discussion**	
16:00-16:15	**Evaluation of Day 2: All participants, speakers, Secretariat**	
16:15-16:30	**JOIN *ICE MAIN HALL* FOR CONFERENCE CLOSING REMARKS**	

Day 2	**PARALLEL SESSIONS**	**Venue: Extension 1**
	THEME 5: Public Engagement in Research and Innovation for Sustainable Economic Transformation	
08:00-08:30	**Registration**	
Session 1	**Session leads-**	Chair: Dr. Innocent Mathias Busindeli,, Rapporteur: Catherine M. Philip
08:30-08:40	***Training needs assessment in inventory based Participatory Forest Management planning: A case of Community Based forest Management in Tunduru district Tanzania***	Leopold P. Lusambo, Department of Forest and Environmental Economics, SUA
08:40-08:50	***The Economics of implementing Community-Based Forest Management (CBFM): A case of Lindi and Ruvuma Regions, Tanzania***	Gimbage Mbeyale, Department of Forest Resources Assessment and Management, SUA
08:50-09:00	***Water Resources Sensitivity: The impacts of Forests Losses from Human Activities in Morogoro***	Rashid N. Bumarwa, Urban Water Supply and Sanitation Authority
9:00-9:10	***Water Sources Sensitivity: The impacts of Forests Loss from Human Activities***	Rashid N. Bumarwa, Morogoro Urban Water Supply and Sanitation Authority
9:10-9:20	**Discussion**	
Session 2	**Session leads-**	Chair: Dr. Wilson Mugasha, Rapporteur: Valentin Ngorisa
09:20-09:30	***Supervised Enterprise Projects as Innovative Agricultural Extension Education Approach: Opportunities, Challenges and Way Forward Towards Improved Extension Service Delivery in Tanzania***	Catherine M. Philip, SUA
09:30-09:40	***Influence of Exogenous Variables on Interaction of Farmers with Other Actors in Agricultural Projects***	Ringo, G.P , Department of Policy, Planning and Management,CSHH
09:40-09:50	***Perception of SMEs in Pre-packaged Food Products on Product Innovation in Tanzania***	Marwa Masanda Wambura, SAEBS, SUA

09:50-10:00	**Determinants of Smallholder Farmers' Adoption and Willingness to Pay for Improved Legume Technologies in Tanzania** Charles B. Lugamara, CSSH
10:00-10:10	***Push and Pull Factors for establishing or joining self-created grassroots networks: The case VCONEs in Mkalama district, Tanzania*** Rasel M. Madaha, SNAL, SUA
10:10-10:20	***Roles Of Lead Farmers And Extension Officers In Facilitating Uptake Of Agricultural Technologies In Projects Applying The Ripat Approach In Tanzania*** D. E. Ringo, Department of Development Studies, CSSH
10:20-10.40	**Discussion**
10.40-11.10	**Health Break**
Session 3	**Session leads-** Chair: Dr. Gimbage Mbeyale, Rapporteur: Ringo, G.P.
11:10-11:20	***Effectiveness of different extension methods in scaling up innovations among small-scale farmers in Muleba District*** William George, University of Dodoma
11:20-11:30	***Youth Agribusiness in Tanzania: Success Factors, Opportunities, Challenges and Impact of Project Interventions*** N.S.Y. Mdoe, SUA
11:30-11:40	***Visitation Rates and Population Abundance of Hoverflies Foraging Cultivated Cucurbit Crops in Morogoro, Tanzania*** S.A. Kabota, Department of crop science, SUA
11:40-11:50	***Using computer vision approach to detect Tuta absoluta (Gelechiidae) infestation of tomato plants*** Sixbert K. Mourice
11.50-12.00	**Discussion**
Session 4	**Session leads-** Chair: Dr. Leopold P. Lusambo, Rapporteur: William George
12:10-12:20	***Information and Communication Technology in the Forest Sector of Tanzania. Applications and Challenges*** Hadija Ahmad Mchelu
12:20-12:30	***Human capital development Programme for Agricultural Extension workers for improved technology and innovation dissemination: The SUA mid-career training programme*** Innocent Mathias Busindeli, Department of Agricultural Extension and Community Development,SUA
12:30-12:40	***Influence of Exogenous Variables on Interaction of Farmers with Other Actors in Agricultural Projects*** Ringo, G.P, CSSH
12:40-12:50	***Understanding relationship between farmers' climate change knowledge, scientific climate change record and coffee production*** Suzana G.Mbwambo, Department of Crop Science and Horticulture
12:50-13:00	**Discussion**
13:00-14:00	**LUNCH BREAK**
Session 5	**Session leads-** Chair: Dr. Sixbert K. Mourice, Rapporteur: Siwel Yohakim Nyamba
14:00-14:10	***Environments for a successful use of mobile phones to access agricultural information: Smallholder farmers' perspective*** Siwel Yohakim Nyamba, DAECD
14:10-14:20	***Effectiveness of different extension methods in scaling up innovations among small-scale farmers in Muleba District*** William George, University of Dododma
14:20-14:30	***Water Resources Sensitivity: The impacts of Forests Losses from Human Activities in Morogoro*** Rashid N. Bumarwa, Urban Water Supply and Sanitation Authority
	THEME 5: Public Engagement in Research and Innovation for Sustainable Economic Transformation
14:30-14:40	***Human capital development Programme for Agricultural Extension workers for improved technology and innovation dissemination:*** Innocent Mathias Busindeli, Department of Agricultural Extension and Community Development,SUA
14:40-14:50	***Influence of Exogenous Variables on Interaction of Farmers with Other Actors in Agricultural Projects*** Ringo, G.P, CSSH
14:50-15:00	***Understanding relationship between farmers' climate change knowledge, scientific climate change record and coffee production records in the main Arabica coffee growing areas of Tanzania*** Suzana G.Mbwambo, Department of Crop Science and Horticulture
15:00-15:20	**Discussion**
Session 6	**Session leads-** Chair: Prof. N.S.Y. Mdoe, Rapporteur: Leopold P. Lusambo
15:20-15:30	***Environments for a successful use of mobile phones to access agricultural information: Smallholder farmers' perspective*** Siwel Yohakim Nyamba, DAECD
15:30-15:40	***Information and Communication Technology in the Forest Sector of Tanzania. Applications and Challenges*** Hadija Ahmad Mchelu
15:40-16:00	**Discussion**
16:00-16:15	**Evaluation of Day 2: All participants, speakers, Secretariat**
16:15-16:30	**JOIN *ICE MAIN HALL* FOR CONFERENCE CLOSING REMARKS**

Day 2	**PARALLEL SESSIONS** **Venue: Extension 2**
	THEME 2: Pests, diseases and innovative control strategies for improving food security and health
08:00-08:30	**Registration**
Session 1	**Session leads-** Chair: Dr. Charles Lyimo, Rapporteur: Nyangi C.
08:30-08:40	***Livestock, crop commercialisation and poverty among rural households in Singida Region, Tanzania*** N.S.Y. Mdoe
08:40-08:50	***A Study on Effective Of E-Based Tool in Detection and Management of Brucellosis Cases in Rural Setting in Tanzania*** Belinda J Mligo, Department of Veterinary Medicine and Public Health, SUA
08:50-09:00	***An epidemiological survey of Human Taenia solium cysticercosis and Associated Risk Factors in Kongwa and Songwe District,*** George Makingi, Department of Veterinary Medicine and Public Health, SUA

9:00-9:10	***Community's Knowledge and Practices Related to Human Taenia solium Taeniosis/ Cysticercosis in Kongwa and Songwe District, Tanzania.*** George Makingi, Department of Veterinary Medicine and Public Health, SUA
9:10-9:25	**Discussion**
Session 2	**Session leads-** Chair: Dr. Respikius Martin, Rapporteur: Belinda J Mligo
09:25-09:35	***Knowledge, Attitudes and Practices in Relation to Taenia solium Cysticercosis and Taeniasis in Tanzania*** Nyangi C, Department of Veterinary Medicine and Public Health, S8UA
09:35-09:45	***Development of Community-Based Health Education Package for the Control of T. solium, cysticercosis and taeniasis in*** Nyangi C, Department of Veterinary Medicine and Public Health, SUA
09:45-09:55	***The occurrence of Plant-Parasitic Nematodes in different rice Agroecosystems in Morogoro and Mbeya regions, Tanzania*** Yasinta Beda Nzogela
09:55-10:20	**Discussion**
THEME 3: Policy Framework, Economic Transformation and Quality Livelihoods	
Session 3	**Session leads-** Chair: Prof. John Jeckoniah, Rapporteur: Adida Sadick Kahangwa
10:20-10:30	***Sustaining Commercial Rice production for Sustainable food Security in Kilombero Valley, Tanzania*** N.S.Y. Mdoe
10.30-10.40	***Assessing the effectiveness of Agriculture e-extension and advisory services for smallholder farmers in Tanzania. A case of Five*** Valentin Ngorisa Olyang'iri
10.40-10.50	**Discussion**
10.50-11.20	**Health Break**
11:20-11:30	***A Review of Agricultural Development Models and Their Relevance to Smallholder Farmers in Tanzania*** Respikius Martin, Department of Agricultural Extension and Community Development
11:30-11:40	***Willingness to Pay (WTP) for Attributes of the Mastercard Farmer Network (MFN) in Tanzania and Uganda*** Edward Mushi, Department of Agricultural Economics and Agribusiness
11:40-11:50	***Awareness, Use of Modern Family Planning and Social Economic Factors Affecting Uptake of Modern Family Planning. A case*** Janeth Joseph Nandrie , Department of Business Management
11.50-12.00	**Discussion**
Session 4	**Session leads-** Chair: Dr. Doreen Ndossi, Rapporteur: Mohamed Khamis
12:00-12:10	***Brand image and customer's perceptions as antecedents of consumer's purchasing decision: a case study Nuru sembe company*** Fasha, G.S and Tenga, Department of Business Management, School of Agricultural Economics and Business Studies
12:10-12:20	***Consumer willingness to pay for the colour of cooking oil: a comparison of rural and urban consumers in Tanzania*** Jadida Sadick Kahangwa, Department of Agricultural Economics and Agribusiness, SUA
12:20-12:30	***Gender inequality in the Informal labour market for secondary school graduates: in Kigoma District-Tanzania*** Adam Mnyavanu, Agency for the Development of Education Management, Bagamoyo
12:30-12:40	***Inclusion of women and youth in rice and sunflower commercialization in Morogoro and Singida Regions*** John Jeckoniah
12:40-12:55	**Discussion**
12:55-14:00	**LUNCH BREAK**
Session 5	**Session leads-** Chair: Dr. Fasha, G.S., Rapporteur: Yasinta Beda Nzogela
14:00-14:10	***The Role of Informal Labour Market Conditions and Transferrable Competences on Informal Employments for Secondary School Graduates in Kigoma District, Tanzania*** Adam Mnyavanu, Agency for the Development of Education Management, Bagamoyo
14:10-14:20	***Commercialization Potential of Pig Industry in Mbeya and Mbozi Districts, Tanzania*** Jadida Sadick
14:20-14:30	***Market Performance of Pigeon Peas in Lindi Region, Tanzania Fredrick Nicholaus Masakia*** Fredrick Nicholaus Masakia, SUA
14:40-14:50	***Determinants of Apicultural Practices in Sikonge Tabora, Tanzania*** Mohamed Khamis Said, SUA
14:50-15:05	***Discussion***
15:05	**JOIN OTHER VENUES**

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KEYNOTE SPEECHES

Tanzania's Lower Middle Income Status: Implications for future economic growth strategies

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Abstract

Tanzania, having attained a *gross national income per capita* equivalent to $ 1,080 from a threshold of $ 1,035, graduated from a *low income country* to a *lower middle income* country status. The *lower middle income country* status milestone has been widely celebrated at the national and international level, partly because the Tanzania Development Vision 2025 envisaged achieving this status by 2025. This paper looks at the trends in some key macroeconomic data related to this development and draws implications for future economic growth strategies to sustain this achievement and move the country towards a *middle income country* status.

Keywords: gross national income per capita, low income country, lower middle income country, middle income country.

Innovations for Sustainable Livestock Production: Improving Nutrition and Income of Small-scale Farmers in Tanzania

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Abstract

Livestock keeping is one of the major economic activities in Tanzania and makes a significant contribution to food security and income of smallholder farmers. Moreover, it offers opportunity for achieving Sustainable Development Goals (SDGs) with the aim to end poverty (SDG1), end hunger and improve nutrition (SDG2) and achieve sustainable economic growth (SDG8). In 2020 the livestock sector in Tanzania comprised of 33.4 million cattle, 21.29 million goats, 5.65 million sheep, 83.28 million chickens and 2.14 million pigs. These livestock contribute 7.4% to the national GDP and produce 3.0 billion litre of milk, 701,679.1 tons of meat and 4.05 billion eggs which are important source of high-quality and bioavailable proteins and essential micronutrients for humans. Moreover, livestock are important source of cash income obtained from sales of live animals and livestock products and provide draught power and manure which is used to improve soil fertility and increase the productivity of crops. The demand for food of animal origin is expected to increase tremendously in our country due to increased human population, urbanisation and income growth. Since the demand for animal source foods (meat, milk and eggs) is increasing while the area available for livestock production is decreasing, there is a need to improve the efficiency of animal production while reducing the negative environmental impacts from livestock. Using cattle as an example, this study assessed the production performance of cattle under different production systems, identified the constraints and recommends the appropriate innovations for sustainable livestock improvement in Tanzania.

Keywords: sustainable livestock production, Sustainable Development Goals

Outsmarting Viruses through Genomics - a Case for SARS-CoV-2 Variants "Moving Target" and COVID-2019 Vaccines

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Abstract

Coronavirus disease 2019 (COVID-2019), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has changed our lives in many ways. As mid-May 2021, COVID-19 has infected more than 160 million people and at least 3.3 million people have died globally, and a total of 1.2 billion vaccine doses have been administered. The virus is evolving within the human population, especially after passaging through immunocompromised individuals, leading to new SARS-CoV-2 variants. Some of these viral variants have clinical consequences, as they are more readily transmitted; more virulent or pathogenic; and can evade immunity induced by vaccination or prior infection. The notable SARS-CoV-2 variants at the moment include those that were first detected in the United Kingdom, South Africa, Brazil and India. The current inactivated e.g. Sinopharm and Sinovac, protein subunit e.g. Novavax, viral vector e.g. Johnson & Johnson and AstraZeneca and mRNA e.g. Pfizer-BioNTech and Moderna COVID-19 vaccines use the same background Wuhan-Hu-1 virus, which was isolated in China in December 2019 before WHO's declaration of the COVID-19 pandemic. Some mutations in the spike protein of SARS-CoV-2 variants enable these viral variants to escape neutralization by antibodies induced by some of the COVID-19 vaccines. This paper will discuss the use of genomics in understanding the circulating viral variants and its relevance in COVID-19 epidemiology and vaccine development in order to tackle this moving target. The SACIDS Foundation for One Health at Sokoine University of Agriculture is using field-deployable next-generation sequencing platform for the complete genome sequencing of SARS CoV-2 and other viruses. The use of science and technology in addressing infectious diseases in Africa in line with the Science, Technology and Innovation Strategy for Africa, 2024 (STISA-2024) and Agenda 2063 of the Africa Union (The Africa We Want).

Keywords: SARS-CoV-2, COVID-2019, pandemic, viral variants, vaccine, genomics.

ABSTRACTS

SUB-THEME 1:
AGRICULTURAL INNOVATIONS FOR ENHANCED FOOD SECURITY AND ECONOMIC GROWTH

Assessment of Farmers Handling Practices and Effectiveness of Different Post Harvest Technologies of Maize: A Case of Kilosa Region-Morogoro, Tanzania

Constancia Laswai Henry and Rashid Suleiman*

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Abstract
Post-harvest management during handling and storage of maize are crucial for ensuring food security. This study was carried out to assess farmers handling practices and effectiveness of different post-harvest technologies of maize in Kilosa district. A household survey on farmers handling practices and post-harvest technologies used by farmers to store maize was conducted in Mabwerebwere and Ulaya wards of Kilosa district. Farmer's habits on maize handling practices were observed and recorded. Maize was mostly stored in polypropylene bags. The main cause of post-harvest losses was infestations by insects and rodents, which occurred mostly during shelling and transporting. Grain quality was analysed for maize stored in polypropylene/Hessian bags (PB), multi-layered plastic bags (PICS), metal silo (MS), roof storage with smoke (RS) and roof storage without smoke (R). The parameters analyzed were percentage moisture content (MC), grain damage (GD) loss and mould growth (MG) at 0 day, 90 days and 180 days. All these parameters were found to increase with storage time. The MC which ranged between 12.20 to 22.66 (%), GD loss from 0.85 to 21.01% and MG from 4.53 to 5.45 log CFU/g. It may be concluded that the grain quality (in terms of moisture and mould growth), deteriorated with storage period. Multi-layered plastic bags (PICS) and metal silo were the most effective storage structures for extended maize storage. These structures did not affect the grain quality unlike the hessian bags and roof storage (with or without smoking). More research on the levels of aflatoxins in the maize stored using different storage facilities is recommended.
Keywords: Postharvest losses, maize, storage technologies, and and Insect pests.

A simple Convolutional Neural Network Architecture for Monitoring *Tuta absoluta spp gelechiidae* infestation in tomato plants

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Abstract
Tomato leaf miner, *Tuta absoluta* spp *gelechiidae* is a serious tomato insect pest in Tanzania. Its management or control still poses a significant challenge. If left uncontrolled, the loss inflicted by the pest can be as high as 100%. Successful management of the pest may leverage on an integrated pest management (IPM) approach which requires a high throughput data on damage signs over space and time. This needs, in turn, a robust technique for pest monitoring. This study uses a deep learning technique to detect infestation symptoms of *T. absoluta* on tomato plants. The technique is rapid, automated and does not require trained or experienced personnel. An experiment was carried out at Sokoine University of Agriculture (SUA), where two sets of tomato plants *Solanum lycopersicum* (cv. Asila F1) were planted, one in a screen house and the other in an open field. High-quality images of the tomato leaves were captured from both sets at seven days intervals for 70 days following transplanting. Other images were collected from tomato gardens around Morogoro town. Collected images were labeled as either infested or non-infested. A simple convolution neural network (CNN) architecture with four convolution layers, three pooling layers, one flat layer and one dense layer, powered by Keras library and python's Tensorflow backend, was developed in R-Software. The model accuracy was 90% on training and 82% on test data sets. This study suggests that the model can accurately identify *T. absoluta* infestation in tomato plants to a considerable extent.
Keywords: Machine vision, Deep Learning, Neural Networks, Lepidoptera, Artificial Intelligence

Contribution of Fish in Improving Micronutrients Content in Complementary Foods for Children Aged 6 To 23 Months in Lindi

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Abstract
Lindi region has high prevalence of stunting (about 35%). Inadequate intake of micronutrients for children especially those under 2 years, is among the attributors for stunting. This study aimed at assessing contribution of fish in improving micronutrients, specifically vitamin A, zinc and iron contents in complementary foods for children aged 6 to 23 months in Mchinga ward, Lindi Rural district. A cross-sectional study was done whereby; interviews were conducted to 212 caregivers with children aged 6 to 23 months. Demographic information and commonly consumed complementary foods for targeted children were recorded. A 24 hours dietary recall was used to record consumed foods. Nutritional analysis for zinc, iron, vitamin A contents and proximate composition were done for commonly consumed complementary foods. About 89.2% of children were given fish based complementary foods. On average fish based complementary foods had higher vitamin A concentrations (342 mcg RE/100g serving) compared to non-fish based complementary foods (4 mcg RE/100g serving), but low in iron and zinc concentrations (0.66 and 0.067 mg/100g serving respectively) than non-fish based complementary foods (0.74 and 0.074 mg/100g serving respectively). Furthermore, fish based complementary foods had higher proximate composition (except for % moisture content) compared to non-fish based complementary foods.
Keywords: Lindi, fish, complementary foods, children, micronutrients.

CoolBot Coldroom Technology Enhance Postharvest Quality and Shelf-life of Tomato (*Solanum lycopersicum)* Fruits

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Abstract
Fruit and vegetable value chain actors in developing countries experience postharvest losses of 20 – 50% depending on the crop and management practices. Lack of affordable technologies to enhance produce storability during handling after harvest is among the factors responsible for these losses. Temperature management serves as number one practice for extending shelf life of fresh produce. CoolBot is a device coupled to room air conditioner capable of dropping the room temperature to as low as 2 °C. Storage rooms installed with the technology seem suitable for handling of fresh fruits and vegetables over extended period. However, most value chain actors aware of the technology are skeptical of its performance and cost effectiveness during utilization. This study was designed to evaluate performance and cost effectiveness of two CoolBot Cold-rooms (CB-CR) independently set at temperature of 13±1 °C and 16±1°C, respectively. Tomato fruits of the variety Assila harvested at three maturity stages were used during the evaluation. A 2x3 factorial experiment arranged in a Completely Randomized Design (CRD) with two factors; storage condition (CB-CR at 13±1 °C and CBCR at 16±1°C) and Maturity stage (mature-green, breaker and light-red) was used. Following 42 days storage of 6 crates (14.25kg each) per treatment combination, results indicated no significant interaction of maturity stage and storage condition among variables. However, external fruit colour change (L*C*h*), marketable fruits (%), soluble solid content (%Brix), titratable acidity (MeqL-1), weight loss (%) and firmness-compression (kg/mm2) varied with maturity stages. External fruit colour change from yellow yellow-green (L*C*h* = 57, 31.7, 110) to yellow yellow-red (L*h*C*= 39.7, 42.3, 43.0) was delayed more on mature green (MG) compared to other stages at both CB-CR (13±1oC and 16±1oC). Percentage marketable fruits was much higher on mature green fruits (84.83%), followed by Breakers (60.91%) and light red (48.58%). Based on electricity consumption, storage of tomato at CB-CR 16±1oC (160.2 KWh) was

more beneficial than at CB-CR 13oC (272.7 KWh) due to less power consumption. It is therefore imperative to conclude that, more benefit can be realized when CB-CR storage is combined with proper harvest maturity stage. More studies are required to map price change of tomato over seasons for proper storage timing using the technology along the year.
Keywords: CoolBot cold room, Postharvest storage technologies, Tomato storage, Tomato harvest maturity stages

Determination of Benzo(A)Pyrene and Heavy Metals Contamination in Smoked *Lates niloticus* and *Oreochromis niloticus* From Lake Victoria

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Abstract
Fish remains to be an important source of proteins in developing countries including Tanzania. Fish processing methods like smoking aim at improving the shelf life of smoked fish as well as taste and aroma. During smoking, the by-products from different materials used as source of heat are deposited onto the fish. The deposited by-products include carcinogenic polyclic aromatic hydrocarbons (PAHs) and heavy metals. Benzo(a)pyrene has been used as a marker for the occurrence of carcinogenic PAHs. The current study was conducted to assess the different materials used in fish smoking practices, determine the levels of chemicals (benzo(a)pyrene, mercury, cadmium and lead) in smoked *Lates niloticus* and *Oreochromis niloticus* from different fish smoking areas in Mara and Mwanza regions. A total of 32 fish smokers were interviewed to gather information on the type of materials used and and the methods used to smoke fish. This was followed by a collection of 32 smoked fish samples for chemical analysis in the laboratory. The findings of the study indicated that both firewood and charcoal were used as the main sources of heat. Plastic materials were not used. Laboratory results indicated that mercury and cadmium were not detected in any fish species while lead was detected (0.28 µg/kg). This is below the recommended level of 0.3 µg/kg as set by the EU. It may be concluded that smoked fish from Mara and Mwanza did not contain harmful heavy metals levels. The mean benzo(a)pyrene concentration detected was 4.79 µg/kg. This amount is higher than 2 µg/kg set by the EU in 2014. There is therefore, a need for people who are engaged with fish smoking business to use other/ improved methods which will lower the levels of benzo(a)pyrene.
Keywords: Smoked fish, *Lates niloticus, Oreochromis niloticus*, heavy metals, and Lake Victoria.

Evolution of Locally Packed ready-to-eat Cashewnuts in Tanzania: Does their Production Follow Food and Environmental Standards?

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Abstract
This study tested compliance of ready-to-eat Roasted Cashew Kernels (RCK) to food and environmental standards. We randomly sampled packaged RCK in small (n=109), medium (n=87 and large (n=128) transparent polyethylene bags from vendors in three different bus stops located along the highway that connects Dar es Salaam City and Morogoro region, in Tanzania. An integrated approach involving consortium of enteric bacteria, RCK lebeling characteristics and polyethylene waste generation rates was applied to evaluate compliance of RCK production to food and environmental standards. Results show that RCK did not meet food safety standards as pathogenic bacteria including *Salmonella typhi, Escherichia coli, Salmonella*

enteritidis, Enterobacter aerogenes were isolated on their surfaces, 5% of the investigated RCK packages were poorly sealed and critical food labeling information such as nutritional contents, shelf life and storage conditions were missing. There was a significant correlation of Enterobacteriaceae concentrations ($r=6.7$, $p<0.05$) between hygienic condition of packer's hand and bacteriological quality of RCK, suggesting that packaging process is the critical factor determining the bacteriological safety of RCK in small scale industries. Of all the RCK packages investigated, small-sized packages were the most contaminated with Enterobacteriaceae. On the other hand, consumption of packaged RCK contributed 2.1±0.76 g/vendor/day of polyethylene to the environment, suggesting the accumulation of undegradable plastics in the environment that may have significant ecological impact in the long run. Therefore, results from this study suggested non-compliance of RCK production to food and environmental standards and propose the need for the application of good hygienic practices in small scale industries coupled by the use of eco-friendly packaging materials.

Keywords: Environmental health, Enterobacteriaceae, Public health, Roasted cashew kernels.

Impact of Adjusting Planting Dates to Reduce Climate-related Risk: Evidence from an Early Maturing Maize Variety in Semi-arid Central Tanzania

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Abstract

Planting dates are increasingly becoming unpredictable and that contributes to poor productivity of rain-fed cereals. Semi-arid and dry sub-humid areas are highly affected by uncertainties on information regarding planting decisions. Climate Smart Agriculture (CSA) has demonstrated practices to help smallholder rain-fed cereal farmers on making the appropriate planting decisions. Adjusting planting dates, therefore, has become an important CSA practice in the quest to address uncertainties encompassed in the anticipated rise in temperature and more extreme weather events. Owing to the immense significance of appropriate planting dates on minimizing the risk of crop failure in rainfed cereals, assurance of their associated benefits is critical. The objective of this analysis was, therefore, to quantify the impacts of adjusting planting dates as an adaptation strategy at the farm level. The crop modelling was carried out using the Agricultural Production Systems Simulator (APSIM). Climate modelling was carried out by using two representative concentration pathways (RCPs), i.e., RCPs 4.5 and 8.5, and five global circulation models (GCMs). Six different planting dates were tested. The model accurately predicted grain yield and biomass of an early maturing maize variety with low RMSE-values (below 5% of mean) and high d-index (above 0.6). These results show that planting an early maize variety in late December leads to production of highest grain yields in semi-arid central Tanzania. However it lowers yield if planting delayed until mid-January. Appropriate choices of planting dates could significantly enhance the resilience of smallholder rain-fed agriculture to the impacts of climate variability and change.

Keywords: climate risk, vulnerability, planting date, productivity, farm-level adaptation, climate smart agriculture.

Pre-Storage and Storage Practices in Relation to Contamination of Mycotoxins in Two Subsistence Farming Ecosystems in Tanzania

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Abstract

A survey was conducted to establish association between pre-storage and storage practices on occurrence of multiple mycotoxins in two maize farming ecosystems in Tanzania. A questionnaire was administered to establish an inventory of pre-storage and storage practices. Maize samples were collected from farmers' storage facilities. Standard procedure was used for mycotoxins extraction. Compound quantification was done using Ultra-high performance liquid chromatography/time-of-flight mass spectrometry (UHPLC/TOFMS). Differences between ecosystems were observed on the indicators which the farmers used to determine physiological maturity of maize. Delayed harvesting of 4 to 12 weeks after maturity was observed across the ecosystems. More than 60% farmers shelled maize mechanically by beating on floor, in bags and elevated platforms. Most important storage insect pests were confused flour beetle (*Tribolium confusum* Jacquelin du Val) (100%), followed by 80% larger grain borer (*Prostephanus truncutus* L). Presence of aflatoxins - FB1, FB2, DON, ZEN, HT-2, T-2, OTA, AFB1, AFB2, AFG1 and AFG2 were determined. Significant ($p \leq 0.05$) positive and negative correlations between mycotoxins and storage practices were obtained. The study suggests that pre-storage and storage practices applied by subsistence farmers in the two ecosystems can be fine-tuned to be included in Good harvesting and storage practices as measures to reduce risk of potential mycotoxins contaminating maize.

Keywords: Pre-storage, storage, subsistence farming, mycotoxins, agro ecological zones

Smallholder Farmers' Commercialization Pathways in Proximity of Large-scale Commercial Farms: Evidences from Three Agri-investment Clusters in Tanzania

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Abstract

Smallholder farmers are central in the transformation of African agriculture mainly entered on commercialization. Following unprecedented hike in global food price in 2007-2008, Tanzania has experienced an influx of land-based Foreign Agricultural Investments (FAIs). The surge in FAIs has happened in tandem with a growing interest of local investors to venture in commercial farming. Arguably, such developments have shaped commercialization pathways of smallholder farmers in proximity to FAIs and other Local Commercial Farms (LCFs). Studies have shown that smallholder farmers operating within the geographical spheres of influence for large-scale commercial farms are inevitably impact in different ways. In this paper, we hypothesize that territorial proximity related influences from large-scale commercial farms have had shaped commercialization pathways of smallholder farmers. The analysis is based on a sample of 1200 smallholder farmers surveyed between April and June 2019, covering three "investment clusters" – two in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) and one in Northern Tanzania with a total of about 40 large-scale commercial farms. We systematically analyze commercialization pathways followed by smallholder farmers differing in spatial proximities to large-scale commercial farms. Commercialization pathways are illuminated in the context of geographical distances to different types of commercial farms as territorial spheres of influence and impacts. Empirically, this paper contributes to knowledge regarding commercialization pathways for

inclusive economic growth and rural development through foreign and domestic investments in African agriculture.
Keywords: Smallholder commercialization, large-scale commercial farms, land acquisitions, food price, Tanzania

Smallholder Farmers' Storage Practices and Awareness of Aflatoxin Contamination of Cereals and Oilseeds in Chamwino, Dodoma, Tanzania

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Abstract

Agricultural produces in the tropics are vulnerable to mycotoxins contamination. Hot and humid conditions are favourable conditions for fungal growth and production of mycotoxins. Inadequate drying and storage practice aggravates the susceptibility of produce to mycotoxins contamination. The purpose of this study was to assess the storage practices and awareness of smallholder farmers regarding mycotoxin contamination in cereals and oil seeds in Chamwino District, Dodoma region. A total of 90 smallholder farmers were interviewed using a structured questionnaire containing closed-ended questions. Smallholder farmers kept their produces on the bare ground during harvesting (43%), used open-sun drying (92%), used rudimentary method to check produce dryness (72% visual assessment and 9% biting) and stored grains in plastics or woven bags which were placed on the floor without pallets (95.6%). Moreover, majority of respondents have neither heard about mycotoxins (88.9%) nor aware of fungal contamination and effects of consuming mycotoxins contaminated products (81.1%). Unfortunately, the overwhelming majority (96.7%) of smallholder farmers involved in this study were not aware that feeding animals with aflatoxins contaminated feeds led to contaminated animal/poultry products. This indicates that people are exposed to products which are most likely contaminated with mycotoxins. Training of farmers and mass media campaigns are recommended to reduce post-harvest losses and mycotoxin contamination along the produces value chains.

Suitability of Pigeon Pea and Soybean flours as Extenders and Binders in Restructured Meat Product (Sausage)

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Abstract

The suitability of pigeon pea and soybean flours as an alternative to chemical binders and extenders in meat restructuring technology was investigated. Pigeon pea flour (PPF) and soybean flour (SBF) were separately developed, assessed for their protein contents and each was used for sausage preparation at 2, 4, and 6% with plain (CB) and chemical phosphate binder (PhB) sausages serving as control samples. The processed sausages were then subjected to texture profile, water solubility index (WSI), sensory profile, and consumer acceptability analyses to assess the flours'performance. Soybean flour had a significantly ($p<0.05$) higher protein content (31% DM) than pigeon pea flour (22-24% DM). Texture profile parameters differed significantly ($p<0.05$) between samples with the highest hardness value observed in CB (424.0±1.53g) and lowest values in SBFs (277±1.11-332±1.5 g). The PhB, the 4 and 6% SBFs samples had higher cohesiveness (0.46±0.02-0.54±0.03g), adhesiveness (9.0±0.10-10.9±0.25g) and

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WSI (2.8-3.0%) than respective lower values of 0.29± 0.04-0.42±0.04, 2.5±0.10-6.0±0.66 and 1-2.4% in plain control and PPFs samples. Sensory analysis results revealed that PhB samples had significantly ($p<0.05$) higher colour (8.2±1.30), saltiness (5.8±1.56), and mouth feel (6.9±1.20) intensities than other samples. Furthermore PhB, the 4 and 6% SBFs samples had significantly ($p<0.05$) higher moistness (0.46±0.02-0.54±0.03g), consumer acceptability (7.1±1.67-7.3±1.88) and preference (125-177) as well as lower hardness intensity (5.9±2.54-6.0±2.82) than other samples. In conclusion, soybean is richer in protein than pigeon pea and its incorporation of up to 6% in sausage produces a more acceptable product than plain control samples but with WSI, texture, and sensory profiles comparable to chemical binder samples. However, further studies to establish appropriate pigeon pea flour levels that will produce acceptable products with similar physical and sensory properties to chemical binder is recommended.

***Keywords**:* Pigeon pea, soybean, sausages; Binder, sensory profiles; water solubility index

Sustainable Management Strategies for "Leaf Yellowing Syndrome" of Rice (*Oryza sativa* L.) in Mvomero District

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Abstract

A study was conducted at Mingo village in Mvomero district, Morogoro region, Tanzania from May to September 2019, aiming to improve rice performance through enhanced soil fertility using organic fertilizers. A split–split plot experiment in a randomized complete block design with four replications and16 treatment combinations was used. The main factor was four rice varieties namely (i) Mbawambili (ii) Mwangaza (iii) Supa and (iv) Saro. The sub factors was different fertilizer types, (i) Cow dung manure at the rate of 5t ha-1, (ii) Urea 46% N at a rate of 80 kg N ha-1 and (iii) Compost at the rate of 5t ha-1 and (iv) No fertilizer (control). Rice was sown in 2m x 2m plots each with five rice rows at 20cm inter–and intra–row spacing. Data on weather, leaf yellowing incidence, crop growth, yield components and grain yield were collected. During the cropping season, rainfall was 280 mm and was poorly distributed, hence supplementary irrigation was done. Average temperature was 24° C with a mean relative humidity of 86.5%. Disease index results indicated that incidence of rice leaf yellowing disease was high in the unfertilized control plots and low or absent in fertilized plots. Varieties varied significantly ($P<0.01$) between growth parameters and yields components, Saro and Supa had high yield whereas low yield was obtained in Mbawambili. Fertilizer types also significantly ($P<0.05$) affected rice grain yield. Urea was the best, with the rice yield of 1.7 t/ha followed by compost and cow dung manure (1.5 and 1.6t/ha respectively). The lowest yield of 1.3t/ha was recorded in the control plots. Regression and correlation analyses showed positive correlation between growth components and rice yield. Generally, Mwangaza and Supa showed outstanding yield performance which should be supplemented by using integrated soil fertility approaches to increase rice productivity.

Sustainable Management Strategies for "Leaf Yellowing Syndrome" of Rice (*Oryza Sativa* L.) in Mvomero District

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Abstract

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Keywords: Leaf Yellowing Syndrome, Rice, Sustainable Management

The Impact of Covid-19 on Food Safety in Developing Country

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Abstract

In December 2019, Wuhan, Hubei Province, in China, became the epicentre of mysterious cases of pneumonia. On January 2020, Chinese scientists identified this as a novel coronavirus, or severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Its name was then changed to coronavirus disease 2019 (COVID-19) by the World Health Organization in February 2020 as the disease spread worldwide. As of the 31th January 2021, over 223 countries, areas or territories have been affected by the COVID-19 disease with over one hundred million confirmed cases leading to over 2 million deaths and over 57 million recovered. According to the Food Agriculture Organization (FAO), and the World Health Organization (WHO) COVID- 19 pandemic not only effect health sector but also food and nutrition security for millions of people around the world. However, the effect is grievous in developing countries due to poor and inadequate health facilities. Covid-19 is far more than an infectious disease; it has a profound effect on global economics and social restrictions. These restrictions have direct impact on agriculture production, food systems, food safety, and endanger the livelihoods of workers. Moreover, the advice from WHO regarding social/physical distancing and working from home to reduce transmission of the disease. Although there was closure of many businesses and people work from home, for the case of food companies it is impossible to work from home. To maintain the consumer confidence in the safety and availability of food. The food industry should have

Food Safety Management Systems (FSMS) such as the Hazard Analysis and Critical Control Point (HACCP) principles in place to manage food safety risks and prevent food contamination. Nevertheless, many food industries in developing countries do not have systems in place increasing risk of contamination and transmission of disease. Although, there is no evidence to date that viruses can be transmitted via food or food packaging. It is possible that someone may become infected by touching a contaminated surface or object. This can happen, for instance, when someone touching door knobs or shaking hands without properly washing or sanitizing their hands. Therefore, food companies are strongly advised to impose stringent hygienic and sanitation measures like promoting proper wearing of personal protective equipment (PPE), such as masks and gloves; and frequent and effective handwashing and sanitation at each stage of food processing.
Keywords: COVID-19, Food safety, Hazard analysis, Developing countries.

The role of Conservation Agriculture in Bridging Gender gaps in Tanzania: The case of Sustainable Agriculture Tanzania

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Abstract

Despite the great potential of the agricultural sector in economic contribution to Tanzania, the sector faces diverse challenges. One among the long term challenge is the existence of gender gaps in accessing agricultural production resources and benefits from the sector that impede growth of the sector. One among various measures to address the sector limited productivity is an introduction of Conservation Agriculture (CA). The CA technologies is promoted as a solution to get rid of the effects and challenges of the conventional agriculture by maintaining soil fertility and conserve water and hence high productivity with less cost of production. There is limited knowledge on how conservation agriculture has managed to reduce the existed gender challenges in agriculture.

This paper examines gender gaps in conservation agriculture programme implemented by Sustainable Agriculture in Tanzania (SAT), specifically analyzed gender participation and relations in conservation agriculture in Morogoro municipal and Morogoro rural. This study used both qualitative and quantitative data from four villages where SAT implements its activities, the respondents are from Ruvuma, Tulo, Kiroka, and Lamkamangala villages. This study conducted four Focus group discussions, one from each village. A sample of 60 farmers were engaged in collecting quantitative information. Findings show that conservation agriculture has significantly reduced gander gaps in accessing production resources and services as well as raised participation of women in decision making with regards to production and use of income obtained from sales of produce. It also reduces the dependency of women on men to finance production activities since in CA the inputs for productions are cheaply obtained through the natural substance which plently available in the localities of farmers. Through CA farmers regardless of the gender can access extension services, accessing credits through various established groups, performing various initiative collectively through farmers network that has been established by SAT, able to access the inputs of production since they are locally self-made, reduce significantly cost of production, accessing markets through agents from various places who were located by SAT. The majority of farmers have realized improving in their living standards and many now owning various properties including taking their children to good schools, all these come after they have been involved in CA. Despite the economic liberation to farmers by increased income through selling of produce at a premium price, findings show that CA is laborious and takes much of farmers time, the woman being more affected with this challenge given the gender division of labour where women perform more farm activities compared to men.

Therefore, it is recommended that governments and various stakeholders should promote the spread of conservation agriculture technologies since it reduces the biasness in agriculture and empowering women. Ensuring access to advanced cheap technologies to farmers should be given priority to reduce the burden that is left to farmers particularly female farmers.
***Keywords**:*

Trans Fatty Acids in Tanzania: Are Consumers and Processors aware of the Associated Health Hazards? A case of Morogoro

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Abstract
Several studies have shown an association between Trans Fatty acids (TFAs) consumption and increased risk of cardiovascular diseases (CVD). FAO and WHO recommend that the TFAs in human dietary fat should be reduced to less than 1% (Li *et al*., 2019; WHO, 2019). The current study was conducted to assess the awareness regarding TFAs among consumers and food/oil processors in Morogoro region, using a cross-sectional study design. Study sample included 340 households, whereby 176 were from Morogoro urban and 164 from Morogoro rural districts, as well as 32 food/oil processors (22 = small scale; 10 = large scale). Structured questionnaires were used to collect data. Descriptive statistics were conducted to determine the awareness on TFAs and the health effects associated with the consumption of foods containing TFAs. About 98% of all consumers had neither knowledge nor awareness about TFAs and associated health effects. Nevertheless, awareness level was observed to improve with residence location and level of education. The level of awareness of TFAs in Mji Mkuu ward (urban) was significantly different from Kiroka ward in rural area (OR: =18.111; P= 0.020). No significant differences were observed in the level of awareness between consumers in Kiroka (rural) and in Mazimbu ward (urban) (OR: = 5.397; p=0.126). Large scale food and oil processors were more aware about TFAs than small scale food and oil processors. General awareness on TFAs and the associated adverse health effects among consumers were very low compared to that of processors which were also influenced by residential location and level of education. This study shows that consumers in the study area were at high risk of exposure to TFAs and developing conditions such as cardiovascular diseases (CVDs) which may result in stroke, leading to significant disability, emotional problems and death in the worst case.
***Keywords**:* TFAs, Cardiovascular Diseases, Awareness, Consumers, Food/Oil Processors.

Understanding the Impact of Climate Smart Irrigated Agriculture on Household Food Security: A Counterfactual Analysis of Southern Highland Zone of Tanzania

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Abstract
In Tanzania, the agriculture sector continues to be driven by rain-fed practises, resulting in low agricultural productivity and food security problems. Available data show that, the suitable land for agriculture production is about 44 million hectares of which about 29.4 million hectares are potential for irrigated agriculture (URT, 2012). The objective of the study was to evaluate the impact of irrigation as Climate-Smart Agriculture (CSA)-practise on household food security whereby the endogenous switching regression model was applied to control for the self-

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select bias problem. A cross-sectional study design was applied to collect information from a sample of 1443 farming households in the study area. The study found that radio ownership, education of the household head, farm experience, production diversity and livestock ownership were the determinants of using irrigation in the study area. Additionally, the average treatment effect of the treated (ATT) and the average treatment effect of untreated (ATU) were positive and highly significant for both irrigator and non-irrigator farming households. This implies that the use of irrigation as a CSA-practise has a positive impact on household food security. The study recommended policymakers to consider rehabilitating the existing irrigation schemes and constructing new schemes to widen the impacts of irrigation to household food security. However, despite the positive impact of irrigation, the study recommended the use of other irrigation practises such as drip irrigation, sprinkler irrigation in the areas where construction of small-scale irrigation is not possible. The study used cross-sectional data which has some limitations. Therefore, the use of panel data in future studies may give results that are more robust.
Keywords: Food

Women Empowerment, Household Food Security and Dietary Diversity: Experience from Rice and Sunflower Commercialization in Tanzania

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Abstract
Empowerment is commonly reported both as process of change and an outcome. As a process of change, it entails a process through which those who have been denied an ability to make strategic life choices acquire an ability to do so. Empowerment as an outcome, entail the expansion of freedom of choice and action to enforce the desired change. The social and culturally ascribed gender roles restrict women's ability to make and enforce desired choices, hence a barrier to women empowerment. In the context of agricultural commercialization there is over emphasis of the individualistic approach which places more emphasis on women economic empowerment where access to market and control over income is usually given an amplified attention. This paper analyses the impact of rice and sunflower commercialization on women empowerment hence making the empowerment outcome more visible and realistic. The paper use data that were collected from a study that was conducted in Iramba and Mkalama districts in Singida region as part of the Agricultural Policy Research in Africa (APRA). The study adopted a repeated cross-sectional design and mixed methods approach in data collection, the quantitative survey involved 601 farm households. Qualitative data was collected using focused group discussion (FGD) from each of the 15 villages, and in-depth interviews that involved a total of 205 key informants. Qualitative data were analysed using content analysis, with the constant comparison technique. Descriptive statistical analysis was computed from quantitative data. The level of women empowerment was established by developing the composite women empowerment index, and then the degree of sunflower commercialization attained by different farmers and household was computed using Microsoft Excel, SPSS and STATA software. To estimate the influence of agricultural commercialization on women empowerment the fractional probit model was adopted. The study found that that rice and sunflower production and productivity is generally low. The mean score on food security were higher for MHH than FHH. There was a significant difference across commercialization and food security levels, whereby those with low level of rice and sunflower commercialization were also less food secure. In addition, there was a significant difference in the proportion of household meeting dietary diversity scores among SSF and MSF such that MSF were more likely to meet the dietary diversity than their SSF. There is a significant difference in the mean yield

of rice and sunflower between men and women (P>0.05). The rice and sunflower commercialization was related to women empowerment (P>0.05); household commercialization had a significant impact on women empowerment (P<0.05) than individual crop commercialization implying that diversification of the household portfolio of source of income is more important predictor for women empowerment than focusing on rice and sunflower commercialization in isolation of other initiative. However, women derive less benefit from their engagement in rice and sunflower commercialization compared to men, partly due to cultural norms, which exclude women from decision making in marketing and expenditure of farm proceeds. The study recommends to Local government authorities (LGA), development actors and NGOs to increase efforts that result in empowering women.

Keywords: Women Empowerment, Food Security and Dietary Diversity commercialization

Water Lifting Devices in Tanzania: Farmers' Knowledge and Constraints for Dry Season Vegetable Irrigation

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Abstract

Demands on water for agriculture are increasing for decades as the pressure to provide food to growing population increases. A challenge remains on how to access the world's portion of suitable water efficiently and economically to fulfil this demand for vegetable irrigators sub-sector. This study evaluated the sub-sector for key player's understanding on agricultural water access by use of various water lifting devices and their constraints in Mvomero, Morogoro, Tanzania. Both review of previous documents on water lifting devices and direct interaction with farmers were used to gather information. It was found that dry season vegetable irrigators have insufficient knowledge on water lifting devices in terms of irrigation techniques, operating costs and dry season vegetable production. However, farmers have developed local technics of determining the levels of irrigation application. Their technics are still unquantified scientifically in terms of efficiency and effectiveness. Furthermore, the use of water cans and manual pumps has dropped while the use of motorized pumps has increased. Solar pumps and electrical pumps were not reported to be used in the study sites despite being potential as alternative water lifting devices. Farmers criteria for pump and crop selection differed among themselves. Therefore, proper knowledge of water lifting devices is vital during planning and management of small-scale dry season vegetable irrigation sub-sector as it grows into among major income generators in Tanzania. This paper has provided some key information on selection criteria for water lifting devices and vegetable crops to be irrigated, operation, and maintenance of motorized water pumps to enhance their efficient use in irrigation activities.

Keywords: vegetable, dry season irrigation, water lifting devices, pumps, irrigation schedule

The Role of Agricultural Value Chain Incubation Programmes to Youth's Employment: A Case of the Sokoine Graduates Entrepreneurs Cooperative, Morogoro, Tanzania

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Abstract

Youth unemployment is on the rise globally Tanzania included. Nonetheless, for Tanzania, the agricultural sector does have potential for employment creation at the various nodes of the agricultural value chains. Therefore, the paper generally examines the contribution of the Sokoine Graduates Entrepreneurs Cooperative (SUGECO) in enabling its graduates self-employ themselves while creating employment for others. Specifically, the paper determines the contribution of the above-mentioned programme to youth's employment; identifies challenges facing the programme, and examines the policy gaps. The study on which the paper is based adopted the cross-sectional research design whereby data were collected one using a structured questionnaire from 88 respondents. In addition, data was collected from five key informants. Quantitative data was analyzed using SPPS and qualitative data through content analysis. Generally, study findings show that SUGECO has the potential to support young entrepreneurs' development and job creation in Tanzania. Findings also show that SUGECO offers a variety of trainings which equip its graduates with business management and employment skills. In addition, marital status and being trained in agribusiness were significantly ($P \leq 0.05$) associated with the graduates employment creation. However, findings also show that SUGECO and its graduates face a number of challenges these include lack of funding, lack of commitment among the graduates, and unsupportive government policies. Therefore, SUGECO needs to adhere to its predefined criteria when selecting those to go through the incubation programme so as to only recruit the committed ones. In addition, the Government and non-governmental organizations should collaborate and put some efforts to promote the SUGECO agribusiness incubation programme as it has the potential for employment creation and poverty reduction among the youth.

Keywords: SUGECO, Youth's Employment, Agribusiness incubation

Influence of Exogenous Variables on Interaction of Farmers with Other Actors in Agricultural Projects

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Abstract

Studies have reported on the importance of the interaction of farmers with other actors on their participation in agricultural projects and subsequent adoption of agricultural technologies. Exogenous variables have the potential to influence interactions; however, this has received little attention in the literature. Guided by Ostrom's Institutional Analysis and Development (IAD) framework and social exchange theory, the study sought to describe the patterns of interactions between farmers and other actors, and determine exogenous factors influencing farmers' interactions using the RIPAT-SUA project as a case study. Quantitative data were collected through a questionnaire survey. Qualitative data were collected using Focus Group Discussion (FGD) and key informant interview. Descriptive or multiple regression and content analysis were used to analyse quantitative and qualitative data respectively. Farmers' interactions with other actors in agricultural projects increase with a decrease in distance from the crop market. Also, the diversity of crops/livestock produced and the number of resources shared by the actors showed a statistically significant influence on farmers' interactions. The RIPAT approach plays a crucial role in shaping farmers-other actors' interactions; it influences the type of actors the farmers interact with as well as the pattern of

interactions. The findings support the IAD and the social exchange theory, which, respectively, postulate that biophysical conditions (in this case proximity to crop market), and cost and rewards (in this case resources shared) are important driving forces for farmers' interactions. Rather than referring to it just as cost and rewards, it should be explicit in the social exchange theory that both material and social benefits are important when it comes to motivating actors' interactions. The study recommends the establishment of market infrastructures in strategic locations and ensuring that agricultural interventions are rewarding to farmers. Designing and implementation of agricultural projects ought to employ the RIPAT approach to spur fruitful farmers-other actors' interactions.
Keywords: Interactions, farmers, agricultural projects, actors, RIPAT approach.

Identification of resistant genotypes to rice leaf blast disease caused by *pyricularia oryzae* using rice blast differential lines and traditional varieties in Zanzibar

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Abstract
Rice leaf blast disease caused by fungal pathogen *Pyricularia oryzae* Cavara is an economically important disease distributed in rice growing areas of the world. In Zanzibar, rice leaf blast is considered a major disease, causing severe yield losses due to unavailability of rice genotypes with high resistance potential. Nineteen rice blast differential genotypes including one susceptible check (BKN Supa) and ten traditional varieties preferred by farmers in Zanzibar were inoculated with strain of *Pyricularia oryzae* and evaluated pathogenicity (virulence potential) to blast in the screen house. Complete Randomized Design (CRD) with three replicates was applied. Phenotypic disease score data for susceptible (S) or resistant (R) reaction of the tested genotypes to the *Pyricularia oryzae* was assessed through visual observation by examining the leaves for blast infection symptoms using standard scale of 0-9 developed by IRRI, Area under disease progress curve (AUDPC) were developed based on six scores at interval of ten days viz; 15, 25, 35, 45, 55 and 65days. Yield and growth yield parameters were assessed. A total of 13 rice blast differential genotypes were resistant to the disease and were recommended for breeding purposes for the benefit of Zanzibar rice farmers. Four varieties were moderately resistant and three were highly susceptible including one susceptible check which had the highest area under disease progress. From ten traditional varieties tested, none was found resistant. Three varieties were found moderately susceptible and seven were susceptible to disease.
Keywords: Differential genotypes, Severity, AUDPC, Inoculation, and Pathotypes.

Assessment of rice yield losses caused by rice leaf blast disease (Pyricularia oryzae Cavara) in Zanzibar

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Abstract
Rice leaf blast disease caused by Pyricularia oryzae Cav, is the devastating diseases of rice in most rice growing areas. Chemical fungicide is an important tool to control disease. Field experiment was conducted during two main cropping seasons of 2016-2017 and 2017-2018 in Unguja and Pemba. A susceptible rice blast variety in Zanzibar BKN Supa was planted in Randomized Complete Block Design with three replications to assess disease infection and yield loss caused by Pyricularia oryzae. There were two treatments viz; one set of protected plots and

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second set of unprotected following pair plot technique design. Fungicide Megasin – M70% WP was sprayed on the protected plots during the experiment period and unprotected plots left natural as control. SPSS statistical package was used to analyse data using t-test to compare two sample variable means. In Pemba, during 2016-2017, percentage yield loss (63.789%/ha) deferred with the percentage yield loss (49.548%/ha) registered in 2017-2018. In Unguja, 2016-2017 yield loss (84.621% /ha) and 2017-2018 which was (55.906%/ha) was registered. There was significant variations of percentage yield loss between seasons. The results implies that for both islands in 2016 – 2017 rice yield loss was higher due to the environment conditions favouring disease occurrences while in 2017 – 2018 yield loss was low, this observation was associated with the environmenal conditions with less favour to disease. Futher more in Pemba from 2016-2018 registered loss was low at 56.671% and Unguja from 2016 to 2018 registered loss was higher at 70.670%. The result was associated with inoculum pressure, weather conditions, fungicide applied etc.
Keywords: Zanzibar, Pyricularia oryzae, yield loss, severity and BKN Supa.

Rice Commercialisation in Mngeta, Kilombero District: Policy implications for inclusive poverty reduction and production sustainability

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Abstract

Agricultural commercialisation is widely sought by governments and development partners because it has been associated with productivity improvement (Andersson *et al*, 2019), which is expected to raise farmers' income from rising marketed farm produce and subsequent livelihood improvement, hence poverty reduction (Poulton, 2017). Rising agricultural commercialisation also contributes to employment creation, foreign currency for tradable goods and government revenue through taxes. Agricultural commercialization may however have undesirable outcomes such as exposing smallholder farmers to market price volatility, enticing farmers to risky contractual arrangements and exacerbating food and nutrition insecurity as farmers sell most of their farm produce leaving less food for domestic consumption. Moreover, rising commercialisation from area expansion may increase the vulnerability of smallholder farmers as they become squeezed out to near landlessness and destitution (Khamalidin *et al*, 2013). Agricultural commercialization from intensification can also have negative effects due to increasing use of agrochemicals. Both area expansion and intensification have been identified to contribute towards rice commercialization in Kilombero valley (Isinika *et al*, 2020). This paper uses panel data on rice commercialisation from Mngeta division collected in two waves (2017 and 2019) to assess factors influencing rice commercialisation in the study area and the impact of such commercialisation levels on livelihoods, food security and social inclusion. The analysis compares across different categories of farmers the level of input use, productivity, Rice commercialisation index (RCI), Multi-poverty index (MPI) and indicators of food security. The findings have wider national and regional implications. Based on the findings, policy implications for more resilient, inclusive and sustainable rice commercialisation are drawn.
Keywords:

Assembling 'Mkulima Agricultural Knowledge Hub' For Up-Scaling the Adoption of Agricultural Innovations among Farmers in Tanzania

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Abstract

Agricultural sector plays a very important role in the economy as it employs more than 75% of the total population, contributes about 25% to the GDP, brings about 66% of the foreign exchange, and provides raw materials for local industries. For optimal agricultural production and post-harvest handling farmers need timely access to relevant knowledge. Inopportunely, agricultural knowledge is mainly accessed through print media, agricultural extension and advisory system. However, the accessibility of print media in most rural areas in Tanzania is very low. Likewise, there is a limited number of agricultural extension staff and inadequate resources to facilitate the provision of agricultural extension services. ICTs facilitate access to agricultural information services along the value chain. Empirical evidences from India, South Africa and Ghana show that ICTs enhance access to agricultural knowledge and cut down costs associated with accessing knowledge. Tanzania can do better by leveraging on high level of ownership of mobile phones among farmers, as present the ownership of mobile phones has not translated increased access to agricultural knowledge. This paper draws experience of Mkulima Resource Centre of the Sokoine National Agricultural Library and propose the prototype to develop it into the national agricultural knowledge hub for enhancing knowledge accessibility and adoption of agricultural innovations among farmers in Tanzania.

Keywords: Agricultural Innovations, Mkulima Agricultural Knowledge Hub, Up-Scaling the Adoption.

2021 - The International Year of Fruits and Vegetables: Are we Consuming enough Fruits? A Case of Chamwino, Dodoma

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Abstract

In sub-Sahara Africa, people's diets rely heavily on staples like rice, potato and cassava, which are high in calories but deficient in essential micronutrients. Micronutrient deficiencies affect about 300 million people every year, with many more at risk of experiencing these deficiencies. In Tanzania, vitamin and mineral deficiencies are high; about 58% and 34% of children below five years are iron and vitamin A deficient respectively (TDHS-MIS, 2015/16). Low fruit consumption is one of the key risk factors for cardiovascular diseases and some cancers, the two leading causes of death in the world (FAO 2013). In Tanzania, most micronutrients are obtained through fruits and vegetable consumption. However, consumption of 400g per day (WHO, 2003) is still a challenge. The current study was carried out in Chamwino District in Dodoma to assess fruits availability and determine factors influencing their consumption. Data was collected from December 2017 to May 2018. Interviewer administered questionnaire was used to collect demographic and socioeconomic information. Data on fruit consumption frequency was collected by using Food Frequency Questionnaire (FFQ). Descriptive statistics (frequency) was used for presenting the household socio-economic characteristics and levels of fruit consumption. Multiple logistic regression model was used to determine the relationship between fruit consumption frequency and household socio-economic features by using SPSS. Majority of households were male headed (74.5%), with an average household size of 5.7. The average monthly household income was TZS 75,000. Majority households rarely or never consumed fruits in a week while daily consumption of some fruits such as baobab, bananas, mangoes, and oranges was practiced by only 21.7%, 2.6%, 3.5% and 2.6% households respectively. Monthly

income and household size significantly affected fruits consumption at $p<0.05$. As 2021 is the International year of fruits and vegetables, all efforts should be geared towards awareness creation directing policy attention to the nutrition and health benefits of fruits and vegetables consumption, which will also improve Sustainable Development Goals (SDGs) 1, 2 and 3.

Keywords: Fruits availability, Consumption, Micronutrients, Food frequency, Awareness.

Effect of Shipping Packages on Postharvest Losses of Mandarin (*Citrus reticulate* Blanco) Fruits along the Value Chain in Morogoro, Tanzania

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Abstract

A study was conducted to compare the effect of three shipping packages; bamboo baskets (BAMB), bulk on truck (BULK) and stackable plastic crates (SPC) and fruit position in the package (bottom, middle, and top) on postharvest loss of mandarin (*Citrus reticulate* Blanco.) fruits along the value chain. A 3x3 factorial experiment in a completely randomized design (CRD) was used. Harvested mandarin fruits were sorted and the uniform undamaged fruits packed in SPCs, BAMB, and BULK. The fruits were transported for 161km (18 km rough and 143 km tarmac road) from Kikundi village in the Morogoro rural district through Chalinze to Sokoine university of Agriculture (SUA). Each shipping package was replicated four times. On arrival at SUA, fruits were held under wholesale (3 days) and retail (6 days) simulated conditions. During the period fruits were sampled for external and internal fruit quality evaluations. Results indicated a significant interaction between (i) shipping-packages and fruit position in respect to fruit pulp temperature, and (ii) fruit position in the package in terms of percentage decays. Percentage fruit weight loss increased significantly with storage duration. Fruit decay was higher on fruits at top than at the middle and bottom of the SPC. Similarly the pulp temperature of fruits at the middle and bottom of SPC and BULK was lower than those at the top. However, fruit packaged at the middle and bottom of SPC had the lowest pulp temperature than in others packages. Fruit internal qualities; soluble solid content (SSC), Titratable acidity (TA), and Ascorbic acid (ASC) changed only with storage duration. SPC reduced percentage fruit decay by 7.9 or 5.1% over BAMB and BULK packaging, respectively. The study recommends use of SPC for reducing fruit decays, and fruit pulp temperature rise.

Keywords: Mandarin fruit packaging, CoolBot cold room, Postharvest storage technologies, Tomato harvest maturity stages.

Evaluation of Groundwater Recharge Dynamics Using the WetSpass Model in the Usangu Plains, Tanzania

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Abstract

A comprehensive understanding of groundwater recharge dynamics is of great importance in enhancing the sustainable management of the groundwater resources and the sound planning of their utilization. This study aimed at evaluating the groundwater recharge dynamics in the Usangu Plains (20,810 km^2) by the help of a hydrological GIS-based model named WetSpass. The Water and Energy Transfer between Soil, Plants, and Atmosphere under quasi-Steady State (WetSpass) model used land use/landcover, soil texture, topography, slope, groundwater table and hydrometeorology data to simulate the temporal (yearly and seasonal) averages and spatial differences of groundwater recharge, surface runoff and actual evapotranspiration. The findings of this study showed that 17.8% of the mean annual rainfall contribute to the groundwater storage while 66.1% and

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16.1% are lost through evapotranspiration and surface runoff, respectively. The groundwater recharge zone with the highest recharge rates (338-767mm/year) occupied 47% of the total Usangu Plains, the zone receiving the moderate recharge rates (139-337mm/year) has 30% while the zone with the lowest rates (0-138mm/year) occupied 23%. About 25% (1.025km^3/year) of the annual recharge was found to be the groundwater that can be safely extracted for human and economic purposes. Compared to the water lost through evapotranspiration and surface runoff, the simulated portion of groundwater recharge is noticeably low. Consequently, it could be wise to initiate artificial groundwater recharge strategies particularly in the zones with moderate and low recharge rates to boost the groundwater storage as its users cannot cease to increase.
***Keywords**:* recharge dynamics, groundwater safe yield and WetSpass.

Chickens Genetic Signatures Retained Long Historical Relationship Between Zanzibar and Oman

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Abstract

The aim of this study is to appreciate the long historical relationship between Zanzibar and Oman, through the investigation of maternal lineage of chickens found in Zanzibar and Oman. Earlier traders and Explorer from Arabia, Persian Gulf, West India and China probably visited Zanzibar as earlier as the 1st Century AD. Oman in Southern Coast of the Arabian Peninsula at the Persian Gulf played a tense relationship between seafaring and commercial people in Indian Ocean. Furthermore, the history of Zanzibar is directly linked to Oman, after Oman Empire expelled and ended the Portuguese dominance of the Indian Ocean trade routes. In 1650 Oman becomes one of the main maritime and mercantile powers in the Persian Gulf and the western Indian Ocean (Vernet, 2009). Oman established itself as a major commercial and maritime power in the Indian Ocean. The sultans of Oman ruled over a substantial part of the Swahili Coast along the Indian Ocean from 1689-1856, controlling elaborate trade routes and cash crop plantations in East Africa. In the mid-1800s, they moved their seat of power from Muscat, Oman, to Stone Town, Zanzibar, and ruled as a constitutional monarchy. This historical relationship can be traced from maternal lineage of chickens that currently exist in Zanzibar and Oman. The mitochondrial genome has been the most widely used system for the investigation of the evolutionary history of species. The high rate of sequence divergence and its uniparental, maternal inheritance can retain evolution relationship as genetic fossils. The Phylogenetic network and Medial-Joining network analysis revealed strong association of evolution relationship between chicken ecotypes from Zanzibar and Oman. The prominent ancestral haplogroups indicated strong association of these chicken populations that were descended from the common ancestry. The Maritime trade interactions and consequences of Oman sultanate regimes in Zanzibar could significantly contributed to the ancestral relationship that existing today between Zanzibar and Oman Chickens.
***Keywords**:* Chickens Genetic Signatures, Oman, Zanzibar.

UAV-based multispectral imagery for improved nitrogen management in neglected horticultural species under tropical sub-humid conditions: A case of African eggplant *(Solanum aethiopicum L)*

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Abstract

Remote sensing studies on detection of nitrogen (N) application and yield effects on irrigated wheat and rice has shown great potential. However, to what extend Unmanned Aerial Vehicle (UAV) based imaging can be used to detect variations in N application under drip irrigated vegetables is less understood. This study evaluated the efficacy of UAV-based multispectral imagery for managing nitrogen (N) in drip irrigated African eggplant production under tropical sub-humid conditions. The study used a randomized block design (RBD) with four N treatments. N was applied through urea at the rates of 250 kg/ha (F100), 187 kg/ha (F75), 125 kg/ha (F50) and 0 kg/ha (F0) per season. Multispectral images were acquired using a multispec4c sensor attached to the fixed wings UAV. From the selected vegetation indices, GNDVI, NDVI and OSAVI performed best in determining and differentiating N leaf content between the different treatments at vegetative and full vegetative stages. For instance, GNDVI showed a strong capability in differentiating between F100 and F50 ($p < 0.01$); F100 and F0 ($p < 0.001$) as well as between F75 and F0 ($p < 0.01$) during vegetative stage. At full vegetative stage, significant differences occurred between F100 and F75 ($p < 0.05$); F100 and F50 ($p < 0.001$); F100 and F0 ($p < 0.001$); F75 and F0 ($p < 0.001$); and F50 with F0 ($p < 0.05$) respectively. The study recommends that, in order to maintain plants healthy, the GNDVI, NDVI and OSAVI should be kept above 0.3, 0.4 and 0.4, respectively.

Keywords: African eggplant, leaf Nitrogen, vegetation indices, UAVs, multispectral.

Yield Losses Associated with *Cylas* sp. Infestation on Improved Sweetpotato Varieties in Tanzania

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Abstract

A field experiment was conducted at Sugarcane Research Institute, (TARI-Kibaha), Coast region from October, 2014 to January, 2015 during short rain season and repeated during the long rain season from February to June 2015 to assess the effects of sweetpotato weevil, *Cylas puncticollis* and *C. brunneus* infestation and damage on yield of selected improved varieties; Ukerewe, Simama, Mataya and Kiegea. This was considered because of persistently reduced yield of sweetpotato roots in smallholder farmers in Coast region. Management practices; Mulch and insecticide (dimetioate) were tested alongside a control. Vine cuttings were dipped into an insecticide diluted at a ratio of 5 L: 20 L dimethioate: water solution before were planted. The plots which were planted with untreated vines were mulched at 30 days after planting. Yield reduction was established by comparing treated and untreated plots established under natural pest infestation. Results revealed that all varieties under mulch treated plots showed lower yield reduction due to weevil infestation. Orange fleshed varieties; Mataya and Kiegea yielded higher (2.02 ton/Ha and 1.76 ton/Ha) than white fleshed varieties; Simama and Ukerewe (1.66 ton/Ha and 1.53 to/Ha) respectively and were less susceptible to sweetpotato weevils infestation. There was a positive correlation between yield and percentage infestation by *Cylas* spp. Orange fleshed varieties are likely to increase sweetpotato production through increased yield per unit area thus, should be complemented with other management practices that have been shown to reduce weevil damage.

Keywords: Sweetpotato weevil, infestation, damage, varieties, yield loss.

Identifying the Right Plants for Diverse Biocontrol Agents in Tropical Smallholder Bean Farming Systems

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Abstract

Biocontrol agents that potentially regulate crop pest populations include predators, parasitoids and pathogens that feed directly on the pests, oviposit in the pest body or cause disease in the pest. While biocontrol has become a commercial enterprise in temperate horticulture, there is much less information on the biocontrol agents present in smallholder agricultural systems in the tropics and little knowledge about the importance of plant diversity in supporting their biocontrol activities. To address this knowledge gap, a botanical survey combined with observations of plant-insect interactions was conducted on field margin vegetation of 24 smallholder fields of common beans (Phaseolus vulgaris L.) in three elevation zones of a tropical ecosystem. The study revealed a wide range of natural enemy groups interacting with the field margin plants, particularly flowering forbs. The most preferred field margin plants were Ageratum conyzoides, Commelina benghalensis, Pennisetum purpureum, Panicum maximum and Tripsacum sp. The most common natural enemies found to interact with the field margin plants were spiders (Araneae), long legged flies (Dolichopodidae), predatory and parasitic wasps (ichneumonids and braconids), hoverflies (Syrphidae) and assassin bugs (Reduviidae). Preferences of the biocontrol agents to certain plant species were similar across all the three zones, indicating the importance of such plant in terms of food resource, shelter or nesting sites. The preferences of the biocontrol agents to some plant species indicate the need to identify the specific benefits of these species to the biocontrol agents to determine whether non-crop habitat manipulation might enhance natural pest regulation.

Keywords: Natural enemies, habitat manipulation, pest regulation, margin plants.

Assessment of Microfinance Customers' Transformation from Group to Individual Lending: Signs of Customers' Maturity in Tanzania

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Abstract

The potential of shifting customers from a group loan (GL) to an individual loan (IL) has been realized in several Microfinance Finance Institutions (MFIs) but in developing countries like Tanzania, the information on such shifting is limited and this made to be an appropriate research ground. This study aimed at investigating the transformation of customers from group to individual lending in MFIs of the Morogoro district in Tanzania. The district was selected due to the reason that many individual and group borrowers are engaged in various income-generating activities and reasonable numbers of these borrowers have access to various MFIs operating in the study area. The objectives were to identify; (i) interest and awareness of customers under GL repayment to move to IL (ii) challenges hindering customers' transformation from GL to IL (iii) duration for transformation from GL to IL for men and women (iv) signs of maturity of

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customers who shifted from GL to IL. A total of 120 customers was purposely selected from both the Vision Fund Microfinance Bank and Mkombozi Commercial Bank. The information was collected using the structured questionnaires that were administered to the respondents. The descriptive statistics, Chi-square tests, and the Principal Component Analysis (PCA) were used during the data analysis to generate the findings. The results indicated that GL customers were not aware of IL because of inadequate orientation during loan application but found being interested in IL in the later stages. Considering the challenges hindering the transformation of customers from IL to GL, the PCA indicated poor-loan management and inadequate training and monitoring by MFIs as the key obstacles to the transformation of borrowers from group to individual lending. Judging the period used by customers to shift from GL to IL, the minimum number of years to shift was two (2) years. Observing the signs of maturity for customers who managed to shift from GL to IL, the majority were found to manage their family needs, accumulate more assets but with little expansion in business. The study recommends that the MFIs and policymakers need to ensure an enabling business environment that would make it easier for loan borrowers to have an opportunity of the smooth transformation from GL to IL. The study concluded there is a difference in signs of maturity between customers in the group and individual lending models

Keywords: Microfinance Institutions, Principal Component Analysis, Lending.

Pedological Characterization of the Soils of Magozi Irrigation Scheme, Iringa, Tanzania

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Abstract

Understanding the nature of soils through pedological characterization is important for developing their sustainable use and management in crop production. Pedological characterization was carried out in Magozi Irrigation Scheme, Iringa, Tanzania. Three representative soil profiles namely MAG-P1, MAG-P2 and MAG-P3 were identified, excavated, described and sampled for laboratory soil physico-chemical analysis. The profiles were moderately to very deep with MAG-P2 and MAG-P3 profiles being dominated with mottles. The topsoil and subsoil bulk densities ranged from 1.21 to 1.69 g cm^{-3} and 1.34 to 1.72 g cm^{-3} respectively. MAG-P1 was dominated with heavy clay and slickensides. The topsoil pH ranged from 7.0 (neutral) to 8.1 (moderate alkaline) and 7.4 (mildly alkaline) to 9.0 (strongly alkaline) for subsoils. The strongly alkaline pH values were dominant in MAG-P1, attributed to low leaching of bases in clay soils. The soils of MAG-P1 and MAG-P2 profiles may have limitations in availability of some plant nutrients like P because of pH values > 7.5. The topsoil organic carbon ranged from 1.13% (low) to 1.59% (medium). The topsoil total nitrogen ranged from 0.13% (low) to 0.23 % (medium). All the topsoil available P were high (14.59 to 22.87 mg kg^{-1}). The topsoil CEC_{soil} (17.6 to 26.6 $cmolkg^{-1}$) were higher than their subsoil (3.4 to 24 $cmolkg^{-1}$) due to higher topsoil organic matter. The topsoil BS was > 50% (high) in all profiles. The BS > 100% in some horizons of MAG-P2 can be due to free solution Ca, Mg, and/or Na from soil salts. In the USDA Soil Taxonomy, the soils were classified as *Typic Haplusterts* (MAG-P1), *Vertic Endoaquepts* (MAG-P3) and *Vertic Epiaquepts* (MAG-P3) and as *Haplic Vertisols, Eutric Vertic Cambisols* and *Eutric Vertic Stagnic Cambisols* for MAG-P1, MAG-P2 and MAG-P3 respectively in WRB for Soil Resources. This information is crucial in planning the best soil use and management of this area.

Keywords: Pedological characterization, Vertisols, Inceptisols, Cambisols, Magozi Irrigation Scheme.

Performance and Cost Evaluation of Serological Tests for Human Brucellosis in Northern Tanzania

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Abstract
The control of brucellosis across sub-Saharan Africa is hampered by the lack of standardized testing and the use of tests with poor performance. This study evaluated the performance and costs of serological assays for human brucellosis in a pastoralist community in northern Tanzania. Serum collected from 218 febrile hospital patients was used to evaluate the performance of seven index tests, selected based on international recommendation or current use. We evaluated the Rose Bengal test (RBT) using two protocols, four commercial agglutination tests and a competitive enzyme-linked immunosorbent assay (cELISA). The sensitivity, specificity, positive predictive value, negative predictive value, Youden's index, diagnostic accuracy, and per-sample cost of each index test were estimated. The diagnostic accuracy estimates ranged from 95.9 to 97.7% for the RBT, 55.0–72.0% for the commercial plate tests, and 89.4% for the cELISA. The per-sample cost range was $0.69–$0.79 for the RBT, $1.03–$1.14 for the commercial plate tests, and $2.51 for the cELISA. The widely used commercial plate tests performed poorly and cost more than the RBT. These findings provide evidence for the public health value of discontinuing the use of commercial agglutination tests for human brucellosis in Tanzania.

Keywords: Rose Bengal test, serological tests for human brucellosis, Tanzania.

Relationship between plant parasitic nematode, arbuscular mycorrhizal fungi and soil characteristics on clove (*Syzygium aromaticum* (l.) Merr and Perr) agroecosystem in East Usambara mountains-Tanzania

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Abstract
Native communities of arbuscular mycorrhizal fungi (AMF) and plant parasitic nematode (PPN) were examined in fields previously under of climate smart agriculture (CSA) and non-climate smart (NCSA) of East Usambara Mountains. The field were differing in soil properties and agricultural practices. Soil samples were taken from 10 sites in each of the 30 fields. AMF spores and PPN were isolated using wet- sieving method and Baermann tray method respectively. The isolated fungal spores and PPN were morphologically identified, classified and quantified. A total of 10 AMF and 22 PPN genus were recorded. The CSA and NCSA fields had 51% and 56% of genus *Glomus* respectively. About 73.2% and 72% of genus *Rotylenchulus* were recovered in CSA and NCSA respectively. In both CSA and NCSA fields, fine roots from all plants were colonized this AMF at a level of 80% to 100% respectively. No association was found between AMF and

PPN, significant correlation between PPN and AMF abundance with agricultural practices was observed. Correlating AMF and PPN with soil properties showed no significant difference ($p>0.05$) except for PPN with total nitrogen. High percentage of AMF colonization demonstrate an important indicator in the suppression of plant parasitic nematodes. The high AMF colonization, PPN and spore abundance is influenced by agricultural practices and host plant rather than soil properties.

Keywords: Arbuscular mycorrhizal fungi, climate smart agriculture, cloves, plant parasitic nematode.

Farmers' Perspectives on Occurrence and Management of Rust and Groundnut Leaf Spot Diseases in Different Agro-ecological Zones of Mtwara Region

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Abstract

Rust and leaf spot diseases are important constraints of groundnut (*Arachis hypogaea* L.) production in Mtwara. This study aimed at establishing farmers' viewpoint on occurrence and management measures against foliar fungal diseases in coastal (CZ) and eastern plateaux and mountain block zones (EPMBZ) of Mtwara region. Random and purposive sampling methods were employed and 200 farmers sample size was used. Semi structured questionnaire was administered. 100 farms were selected and, square quadrat was used whereby in each square, 5 plants were assessed for disease severity and incidence. Early leaf spots (ELS) had the highest incidence (93%) and severity (49%) followed by rust (79% incidence and 35% severity). Lowest incidences and severity were observed for late leaf spot (LLS) as 71% and 30% respectively. There was significant different ($p = 0.033$) between farmers on the awareness of the fungal diseases in the two zones. Farmers in the CZ were more aware of rust and leaf spot diseases than those in EPMBZ. Majority of farmers in the CZ adopted appropriate disease management measures especially removal of volunteer plants (94%) and use of conventional tillage (29%) respectively in order to reduce disease inoculum from soil surface. The study conclude that, farmers in Mtwara region differentially understood the fungal foliar diseases. The occurrence and severity of rust, ELS and LLS varied between locations suggesting there is environmental influence. Lastly the study has established that farmers in CZ and EPMBZ employed different disease management agricultural practices. Use of chemical fungicides was not being adopted by farmers in the region. The findings will be used as baseline in devising appropriate disease management options to increase groundnut yield in the Mtwara Region.

Keywords: groundnut, *Cercospora arachidicola*, *Cercosporidium personatum*, *rust, leafspot*.

SUB-THEME 2:
PESTS, DISEASES AND INNOVATIVE CONTROL STRATEGIES FOR IMPROVING FOOD SECURITY AND HEALTH

Examination of seasonal variations in levels and risks of organochlorine pesticides in fish: A case of *Lates niloticus* products from Lake Victoria

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Abstract

This study examined seasonal variations in the levels and risks of organochlorine pesticides (OCPs) in fresh muscles and locally processed products of Nile perch (*Lates niloticus*). Fish samples were collected during dry and rainy seasons between 2016 and 2019 and extracted by means of QuEChERS method. The detection and quantification of the organochlorine pesticides (OCPs) was accomplished by means of a Gas Chromatograph equipped with Electron Capture Detectors (GC–ECDs) and Gas Chromatograph equipped with Mass Spectrometry (GC–MS).

Ten OCPs were detected at measurable concentrations at least in one of the seasons in different *Lates niloticus* products. The levels of the detected OCPs were higher during the rainy seasons than the dry seasons suggesting that seasonality has significant impacts to OCPs contamination as the agrochemicals are transported by rain water to areas where there are no historical uses. The lowest concentration during the dry seasons was α- HCH (0.39 µg/kg) detected in smoked products whereas the highest was HCB (2.35 µg/kg) which was detected in deep fried products. During the rainy seasons the lowest concentration was aldrin (0.32 µg/kg) that was quantified in salted- sundried products of *Lates niloticus* while the highest quantity was p,p'- DDE (3.42 µg/kg) which was detected again in salten – sundried products. Nevertheless, the levels of OCPs in *Lates niloticus* products as per the current study are below the MRLs established by FAO/WHO and the EU for fish and fishery products indicating that the *Lates niloticus* products were safe for human consumption in terms of OCPs residues.

The risk assessment established the cancer risks during the dry seasons ranging from 1.32E-5 to 3.34E-4 and from 1.02E-4 to 2.22E-3 during the rainy seasons. This is an implication of a low-to-moderate cancer risks that are associated with consumption of *Lates niloticus* products from Lake Victoria. Similarly, the non-cancer risks ranged from 8.48E-3 to 1.67E-2 during the dry seasons and from 6.82E-3 to 5.54E-2 during the rainy seasons. This indicates that the non- cancer risks are insignificant since the HI were less than 1 in both seasons.

Keywords: organochlorine pesticides, Seasonal variations, fresh muscles, processed fish products, POPs.

Genome-wide Association Mapping of Whitefly Resistance in Cassava Genotypes

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Abstract

Bemisia tabaci (Gennadius) (Hemiptera: Aleyrodidae) is the most widely distributed and economically important Bemisia species. The species has gained importance as a pest and vector of plant viruses, particularly geminiviruses. To date, many efforts have been to combat the viral diseases although host plant resistance is considered as the most effective and environmentally-sound approach to manage cassava viral diseases. However, limited information on the genes that underpin quantitative variation in cassava disease resistance caused by whitefly *Bemisia tabaci*. To address this gap, a genome-wide association study (GWAS) was conducted with the aim of identifying regions with whitefly resistance as a basis for undertaking systematic genetic improvement of cassava. A high throughput genotyping was used to genotype a diverse association panel of 700 cassava genotypes and 32,762 single nucleotide polymorphisms (SNPs) were found to be distributed across the genome. Notably, a genomic region on chromosome 4 was identified with three SNPs and that was significantly

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associated with whitefly resistance. A survey of cassava genome sequence v 6.1 positioned these SNPs in the vicinity of Manes.04G056800.1 locus, which is a gene known to play important roles in plant defence response. Manes.04G056300.1 and Manes.04G055500 also revealed associated genes with unknown function, which would have remained undetected in a candidate gene approach constrained by annotation for disease resistance. This study provides practical application of GWAS for dissecting the genetic basis of whitefly resistance traits in cassava. Findings presented herein offer practical grounds for whitefly resistance in cassava through marker-assisted breeding.

Keywords: Genome wide association study (GWAS), Single Nucleotide polymorphism (SNP) and Best linear unbiased Predictions (BLUPs).

Knowledge, Attitudes and Practices in Relation to *Taenia solium* Cysticercosis and Taeniasis in Tanzania

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Abstract

Taenia solium cysticercosis taeniasis (TSCT) is reported to be endemic in major pig producing areas in Tanzania causing significant economic and health consequences. This study aimed to assess KAP with regards to TSCT in four districts in Tanzania. A cross-sectional study was conducted in Mbulu, Mpwapwa, Mbinga, and Rungwe districts. Data on KAP were collected through questionnaire and household infrastructure observation. Both descriptive and inferential statistics including Mann-Whitney U and Kruskal Wallis H tests were employed to compare scores of each category with demographic factors. Male respondents showed a statistically higher knowledge score than females with regards to human cysticercosis (249 vs 234, $p = 0.016$) and attitude score (266 vs 216, $p < 0.001$). With regards to education level, tertiary education had a higher knowledge score than other education levels regarding tapeworm (347, $p<0.001$), and a higher attitude score (370, $p<0.001$). Pig farmers had a significantly higher practices score than non-pig farmers (278 versus 129, $p<0.001$). This study demonstrated low knowledge, negative attitude but acceptable preventable practices in some aspects of TSCT. This result implicates the need to improve the community level of knowledge regarding TSCT.

Keywords: Knowledge, Attitude, Practices, smallholder pigs, *Taenia solium*, Cysticercosis, Taeniasis

Livestock, Crop Commercialisation and Poverty among Rural Households in Singida Region, Tanzania

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Abstract

Livestock is an important component of mixed crop-livestock farming systems in Singida Region, directly or indirectly contributing to poverty reduction among rural people in the region. The direct contribution to poverty reduction can be through production of meat, milk and eggs that can be consumed to improve household food security and nutrition or sold to generate income while the indirect contribution can be through provision of farm yard manure and draft power for crop production. Nonetheless, the competition for resources as livestock numbers increase can inhibit commercialisation of crop production. Moreover, livestock production in the mixed crop-livestock farming system provides a new commercialisation pathway to crop production. Thus, increasing share of livestock income relative to that from crops would suppress the commercialisation tendency for crop based income sources. This paper examines the effect of livestock in the agricultural commercialisation process in Singida Region in central Tanzania using data from a study on sunflower commercialisation in Singida Region, collected in 2018 under the Agricultural Policy Research in Africa (APRA). The paper addresses some key policy-relevant questions including 'Does livestock enhance or inhibit crop commercialisation? and 'How does commercialisation affect livelihoods of people of different socio-economic groups? The results show higher crop commercialisation and lower poverty levels for farmers with livestock than farmers without livestock, implying that livestock enhances crop commercialisation and contributes to poverty reduction. Additionally, commercialisation and poverty levels were found to differ between male and female headed households, young and old farmers as well as medium and small scale farmers. This calls for efforts to improved crop-livestock integration, promoting use of livestock manure and other productivity enhancing technologies. Government interventions to promote access to agricultural technologies should target small scale farmers and female headed households.

Keywords:

Lymphatic filariasis, infection status in *Culex quinquefasciatus* and Anopheles species after six rounds of mass drug administration in Masasi District, Tanzania

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Abstract

Background: Lymphatic filariasis (LF) elimination program in Tanzania started in 2000 in response to the Global program for the elimination of LF by 2020. Evidence shows a persistent LF transmission despite more than a decade of mass drug administration (MDA). It is advocated that, regular monitoring should be conducted in endemic areas to evaluate the progress towards elimination and detect resurgence of the disease timely. This study was therefore designed to assess the status of *Wuchereria bancrofti* infection in *Culex quinqefasciatus* and *Anopheles* species after six rounds of MDA in Masasi District, South Eastern Tanzania. Methods: Mosquitoes were collected between June and July 2019 using Center for Diseases Control (CDC) light traps and gravid traps for indoor and outdoor respectively. The collected mosquitoes were morphologically identified into respective species. Dissections and PCR were carried out to detect *W. bancrofti* infection. Questionnaire survey and checklist were used to assess vector

control interventions and household environment respectively. A Poisson regression model was run to determine the effects of household environment on filarial vector density. Results: Overall, 12 452 mosquitoes were collected of which 10 545 (84.7%) were filarial vectors. Of these, *Anopheles gambiae* complex, *An. funestus* group and *Cx. quinquefasciatus* accounted for 0.1%, 0.7% and 99.2% respectively. A total of 365 pools of *Cx. quinquefasciatus* (each with 20 mosquitoes) and 46 individual samples of *Anopheles* species
were analyzed by PCR. For *Cx. quinquefasciatus* pools, 33 were positive for *W. bancrofti*, giving an infection rate of 0.5%, while the 46 samples of *Anopheles* species were all negative. All 1859 dissected mosquitoes analyzed by microscopy were also negative. Households with modern latrines had less mosquitoes than those with pit latrines [odds ratio (*OR*) = 0.407, $P < 0.05$]. Houses with unscreened windows had more mosquitoes as compared to those with screened windows ($OR = 2.125$, $P < 0.05$). More than 80% of the participants own bednets while 16.5% had no protection.
Conclusions: LF low transmission is still ongoing in Masasi District after six rounds of MDA and vector control interventions. The findings also suggest that molecular tools may be essential for xenomonitoring LF transmission during elimination phase.
Keywords: Lymphatic filariasis, *Wuchereria bancrofti*, *Culex quinquefasciatus*, *Anopheles gambiae*, *Anopheles funestus*

Occurrence of Ventillicium Dahliae in African Eggplant

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Abstract
African eggplant is one of the important African indigenous vegetables due to its long cycles of cultivation, nutritional quality and a good source of income. However, its production faces challenges from fungal infestation (Ventillicium dahliae). A disease survey study was conducted in Moshi district from April to October 2020, to evaluate wilting diseases caused by the fungi. Incidence of diseased plants was recorded and expressed as means percent of African eggplant showing wilt or interveinal chlorosis symptoms. Survey results show 30-95% incidence, the decline of the crop cycle and difficulties in controlling the problem. The symptoms observed included yellowing and leave dropping, the edges of the leaves roll inward on infected plants, and foliar wilting ensues. The foliage of severely infected plants turns brown and dry. The dried leaves and shrivelled fruits remained attached to plants that died. Brown discolouration of the vascular tissue was observed when the roots and lower stem of a wilted plant were cut longitudinally. The observed symptoms coincide with the V. dahliae symptoms. However, to ascertain the infestation, clear laboratory analysis and characterization of the infestation is required. Based on its destructive nature, V. dahliae require thorough research to control and manage its effects on African eggplant production. It is from this insight that a breeding program is proposed to produce African eggplant varieties that are resistant to the infestation. Hence this study proposes to screen the fungal pathogen, in order to understand the infestation and pathogenicity and later develop a resistant African eggplant variety. This study intends to enhance vegetable production, quality of African eggplants and economic well-being to growers.
Keywords: African eggplant, verticillium dahliae, wilting

Porcine Cysticercosis Seroprevalence and Potential Transmission Risk Factors before a Digital Education Intervention in Iringa Rural District, Tanzania

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Abstract

Porcine cysticercosis is known to be endemic in Tanzania, especially in the southern and northern highlands of the country. The disease reduces meat quality and affects pig industry. Its current seroprevalence and potential risk factors were studied in selected areas of Iringa Rural district, southern Tanzania, prior to a digital health education intervention. A total of 346 pigs from 88 households of Izazi, Migoli and Mlowa wards was studied. Antigen ELISA (Ag-ELISA) detected 22.3% as positive for porcine cysticercosis, ranging from 21.3% to 25.7%, of which 47 (53.4%) households had at least one seropositive pig. Confining pigs was significantly related to low porcine cysticercosis seropositivity (odds ratio 2.426, 95% CI: 1.5%, 33.3%; p=0.026;), where by scavenging pigs had two times chances of being Ag-ELISA seropositive. Pig management skills and community sensitization on personal and environmental hygiene are recommended. Practical ways of delivering health educaiton to the rural communities like those in this study should be investigated.

Keywords: Baseline, porcine cysticercosis, seroprevalence, digital health education

Prospects and perspectives for the control of Taenia solium infections in Tanzania

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Abstract
The pork tapeworm *Taenia solium* affects health and income of poor people in pig keeping communities. In endemic areas, it is responsible for up to 50% of epileptic cases, and can lead to devaluation of infected pigs by up to 60%. Despite availability of several options, control of the parasite has remained rather elusive. A pig vaccine - TSOL18, and an anthelmintic - oxfendazole (OFZ) are relatively new control tools. The tools have recently been assessed for their effectiveness in a quasi-experimental group design study in Mbeya Rural and Mbozi districts, involving two groups T1 (treatment with OFZ only) and T2 (concurrent treatment with OFZ and vaccination with TSOL18). Random groups of pigs were slaughtered pre- and post-intervention, to compare prevalence of *T. solium* cysts in predilection carcase sites. Cost-benefit and cost-effectiveness analyses were conducted ex post, to assess financial and health benefits following the interventions, respectively. A Fisher's exact test showed a significant reduction in prevalence after both interventions (T1: p=0.005, T2: p=0.001). Firth's Penalized Maximum Likelihood method ruled the reductions were not significant relative to their controls (T1: p=0.245, T2: p=0.076), probably due to small sizes of the control groups. Benefit-cost ratios were 0.1 for T1 and 0.06 for T2, showing that the intervention costs grossly outweighed the monetary benefits. Cost-effective ratios were Tsh. 2,198,822 for T1 and 3,859,802 for T2, which were below the WHO cost-effectiveness thresholds, suggesting the interventions were cost-effective.
The findings show positive prospects regarding control of *T. solium* using TSOL18 and OFZ in endemic areas of Tanzania. The findings also suggest a bigger impact of the control of porcine cysticercosis on human health than on the monetary benefits, underscoring the importance of taking a One Health perspective.
Keywords:

Seroprevalence and risk factors for Taenia solium infections in pigs in Kongwa and Songwe Districts, Tanzania

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Abstract
Porcine cysticercosis (PCC) due to *T. solium* is a zoonotic disease endemic in many developing countries with low sanitary conditions and poor pig management causing serious economic and public health impacts. A cross-sectional study was conducted between June and September 2019 in 42 villages; 28 in Kongwa and 14 in Songwe districts to estimate the seroprevalence of PCC and its associated risk factors. The PCC seroprevalence was analyzed through detecting circulating antigens using Ag-ELISA. A structured questionnaire and observation checklist were used to assess risk factors for disease transmission such as, the pig rearing practices presence of pigpen, use of latrines, water supply and boiling drinking water. A total of 692 randomly selected pigs were sampled (450 from Kongwa district and 242 from Songwe district). The overall sero-prevalence of PCC was 9.7 % (95% CI: 7.58, 12.13). The prevalence in Kongwa was 7.3% (95% CI: 5.10, 10.14) while in Songwe was 14.0% (95% CI: 9.93, 19.08).Village level prevalence in Kongwa district ranged from 0% to 26.7%, while 5% to 33.3% in Songwe district. About 28 % (n=193) of the examined pigs were kept under free range conditions (12% in Kongwa,

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57.4% in Songwe) while 8.7% (n= 58) of households lacked latrines (2.9% in Kongwa, 18.6% in Songwe). Prevalence of PCC was considerably higher in pigs reared in households lacking latrines than in those with latrines (P= 0.03; OR 3.061=; 95% CI = 1.487- 6.560). Also increase in age of pigs was significant risk factor associated with the prevalence of PCC (P=0.000; OR =8.44; 95% CI=2.547 - 27.997). From these results it is recommended for significant improvements in the use of latrines, total confinement pig husbandry and improving pork inspection. Awareness campaign of PCC among medical doctors, veterinarians, meat animal family producers and the public should be improved.
Keywords: Porcine cysticercosis, pigs, Ag-ELISA, risk factor, Tanzania

A Study on Effective of E-Based Tool in Detection and Management of Brucellosis Cases in Rural Setting in Tanzania

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Abstract

Brucellosis an important zoonotic disease worldwide, which frequently presents as an undifferentiated febrile illness with otherwise varied and non-specific clinical manifestations. The study aimed at promoting early detection of brucellosis in rural settings using electronic based tool.

Methods

A quasi-experimental study was conducted in two districts, Kilosa (treatment group) and Chalinze (control group) from December 2019 to September 2020. A baseline survey was conducted aimed to assess the knowledge, attitude, practices (KAP) related to brucellosis control among the frontline health workers (FHWs) composed of healthcare workers (HWs) and community health workers (CHWs). One Health training was conducted in Kilosa on proper diagnosis and timely reporting using electronic reporting system powered by (AfyaData app). Post survey data collection was conducted in both districts. A semi-structured questionnaire uploaded in AfyaData app was used to collect data related to KAP from 16 HWs and 16 CHWs in Kilosa, and 16 HWs and 16 CHWs in Chalinze. Blood sera samples were collected from 141 febrile patients attending selected health facilities using barcodes as patient's identification with their associated brucella risk factors in Kilosa district. Responses related to KAP domains were assigned to scores that were aggregated for each participant. Rose Bengal test (RBPT) was used to screen the serum samples and c-ELISA for serology test. Multivariate logistic and Pearson correlation computed for assessing association between seropositive patients and the risk factors.

Keywords:

Prevelance of Haemoparasites in Rodents and Their Zoonotic Potential from Ruaha Ward in Kilosa District, Tanzania

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Abstract
Zoonotic haemoparasites are among the public health problems that affect human population and are capable of being transmitted from wildlife reservoirs. Study on prevalence of haemoparasites in rodents and their zoonotic potential from Ruaha ward in Kilosa district, Tanzania was carried out on March 2020. The total of 99 Rodents were captured from different localities in Ruaha, using Sherman and locally made live traps. Blood samples were collected from supraorbital vein of captured rodents, both thick and thin smears were made, dried and stained with Giemsa at the ratio of 1:10. After washing and drying they were observed under microscope at 100 magnification with oil immersion for haemoparasites. Out of 99 rodents captured there were, Rattus rattus 22 (22.22%), Mastomys natalensis 72 (72.73%), and Aethomys chrysophilus 5 (5.05%). Among the captured rodents, 62 (62.63%) were males and 37 (37.37%) were females. Rattus rattus rodents appeared to be predominant species in resident areas, while Mastomys natalensis followed by Aethomys chrysophilus bieng dominant in fallow and cultivated land areas. The infectious agent (Protozoa) belonging to genus Trypanosoma was found infecting the rodent population. Rattus rattus (n=3/99, 3.03%) were shown to have high prevalence compared to Mastomys natalensis (n=1/99, 1.01%), meanwhile Aethomys chrysophilus (n=0/99, 0.00%) were found not infected with any haemoparasites. The overall prevalence of haemoparasites were (n=4/99, 4.04%), however captured female rodents were not infected with any haemoparasites. It is concluded that zoonotic agent (Trypanosoma spp.) that is infectious to humans are prevalent to rodents in Ruaha ward, hence it is recommended that local communities should apply ecological rodents control measures, that will reduce rodent-human interaction, meanwhile reducing the risk of zoonoses transmission.

Keywords: Haemoparasites, Prevalence, Rodents, Zoonoses, Public health

Formulation and Sensory Evaluation of Complementary Foods Using Low-Cost, Locally-Available and Nutrient-Dense Ingredients by Linear Programming Method

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Abstract
Meeting energy and micronutrient requirements during complementary feeding period especially in developing countries has been questionable. This has been attributed by many factors and one of them is poverty. This study was carried out with the aim of developing low-cost complementary foods using locally available ingredients by linear programming method. It was conducted in Rombo district, Kilimanjaro region, Tanzania. Frequently used complementary foods and the ingredients used were identified by semi-structured and 24-hour dietary-recall questionnaires. Market and field surveys were done to identify available ingredients and their monetary values. Linear programming was used to identify the cheapest possible combination of food ingredients that meet a set of nutritional requirements with the help of Tanzania Food Composition Table. Seven recipes (banana porridge with either minced beef, fish, pumpkins or milk as well as maize and composite flour porridges) were developed, prepared in the laboratory

and then subjected to sensory evaluation using 5-point likert scale. Data was analysed by one way analysis of variance (ANOVA) model using R software (Ri386) version 3.3.1 for windows. The means and standard deviations (mean ± standard deviation) were calculated for acceptability of the sensory attributes of the complementary foods. Results showed that banana porridge with minced beef was highly acceptable. There was no significant difference in terms of acceptability between banana porridge with fish, maize porridge, composite flour porridge and banana porridge with pumpkins. Banana porridge with milk had the least score. Linear programming was found to be a good method to improve nutrient content of complementary foods using low cost, locally available and cultural acceptable ingredients.
Keywords: Complementary foods, linear programming, formulation, sensory attributes, porridge

An Epidemiological Survey of Human Taenia solium cysticercosis and Associated Risk Factors in Kongwa and Songwe District, Tanzania

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Abstract

Background: Taenia solium Cysticercosis is high on the global agenda of neglected tropical diseases, however there has been no sustainable surveillance programme in place in most endemic countries, Tanzania inclusive.

While this was the case, there were fewer reports on the prevalence of human cysticercosis in general public that result to insufficient deployment of intervention strategies. This Study was performed to assess the prevalence and risk factors of human cysticercosis in villages of Kongwa and Songwe District.

Objective: To estimate sero-prevalence and risk factors of human Taenia solium cysticercosis in Kongwa and Songwe districts.
Keywords:

Clinical and Radiological Presentations of NCC among PLHIV and HIV Negative Individuals in Southern Highlands of Tanzania

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Abstract

Background: Taenia solium (T. solium) Cysticercosis/Taeniosis is a neglected tropical disease caused by the pig tapeworm (T. solium). This zoonotic disease affects both human and porcine health. In its most severe form, patients develop cysts in their brain after ingestion of the infective T. solium eggs. This is called Neurocysticercosis (NCC) which is one of the leading causes of seizures and epilepsy in developing countries.

The increased frequency of Human Immunodeficiency Virus (HIV) infection in endemic areas of cysticercosis needs much attention since it is not clearly known if the burden of NCC differs between people living with HIV (PLWHIV) compared to HIV negative individuals.

This study aims to close the gap of burden and disease manifestation of NCC among PLWHIV compared to people who are HIV negative.

Main objective: To determine epidemiological, clinical characteristics and treatment response among people living with HIV co-infected with Taenia solium neurocysticercosis from southern highlands, Tanzania

Development of Community-Based Health Education Package for the Control of T. solium, Cysticercosis and Taeniasis in Tanzania

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Abstract

Background: Current Taenia solium cysticercosis taeniasis (TSCT) control relies, among others, on proper pig management, sanitation/hygiene, and meat inspection. However, these control methods alone seem to have a limited effect. Few studies conducted in other regions of the world, indicate that a health education package developed and implemented with community participation can contribute to effective control of TSCT. However, there is no community-based health education package in place to address TSCT in sub-Saharan Africa including Tanzania. The present work developed a community-driven ready to use health education package for controlling TSCT in Tanzania.

Methods: To identify potential TSCT infection risks and formulate key messages for the health education package development, a formative research method was used. Data were collected using a questionnaire and household infrastructure observation. For triangulation purposes, 12 focus group discussions (FGDs) and 38 key informant interviews (KIIs) were conducted and analysed using ATLAS.ti 8. Data from the questionnaire survey were analysed using SPSS statistical package.

Results: The general knowledge of transmission, health effects, prevention, and treatment of TSCT was poor across all four districts studied. Significant risk practices for TSCT transmission included drinking untreated water, free-range pig management, not washing hands with water and soap after visiting toilets and before eating, and undercooking of pork. A community-based education package was developed that comprised the following components; (1) improving knowledge and attitudes on TSCT transmission, causes, health effects, treatment and control measures (2) proper pork cooking and general food handling practices (3) good pig husbandry practices and (4) improvement on the general sanitation/hygiene practices. The health education package consisted of a training manual for training of trainers (TOTs), leaflet, poster, and handbook containing illustrations.

Conclusions: This is the first study to develop a community-driven ready to use health education package for control of TSCT using the key messages formulated from the potential infection risk. The approach used in this study can be adapted in other countries where TSCT is endemic for and with similar health challenges.

Keywords: Taenia solium; cysticercosis, health education package; Tanzania

Effects of Medicinal Plants Harvesting on Plants Conservation: A Case of West Usambara, Tanga-Tanzania

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Abstract

In recent decades, medicinal plants have been over utilized. Failure of some modern medicines, an increase of degenerative diseases and trading medicinal plants are among the factors that have triggered such over-utilization. West Usambara Mountain Ranges is known to consist various medicinal plants. The medicinal plants from this ecological region have been increasing harvested by both the communities living within and outside the area. However, the effects to harvest such plant species on plants conservation have not been examined. This study was carried in West Usambara Mountains to investigate the effects of medicinal plants harvesting

on plants conservation. Interview-based field study was the main data collection methods in which the collection of medicinal plants, preparation, use and effects of harvest to plant conservation were systematically investigated. A total of 150 respondents were randomly selected and interviewed. Non probability method was applied to obtain key informants. The findings from the study revealed 105 medicinal plants species distributed in 57 families used for different human ailments. The most dominant family is compositae, consisting of twelve (11) different species (10.47%) followed by Lamiaceae with nine (9) species (8.57%) each. Among these medicinal plants, the key informants identified ten most preferred medicinal plants. The most used medicinal plant parts were roots 32%, leaves 31%, and barks 17%. Decoction was found as the most preferred form of medicinal plant preparation. The study revealed some medicinal plant species such as Omphalogonus calophyllus and aloe spp being unsustainably collected and highly threatened. West Usambara is a rich region of diverse medicinal plants and traditional health care knowledge. However, cultural changes of medicinal plants use and collection are threatening the medicinal plants, thus it signals the need for serious efforts to create public awareness, initiate and enforce by laws so that appropriate measures are taken to conserve the medicinal plants in this fragile natural ecosystem of mountainous regions.
Keywords:

The knowledge and practices related to the epidemiology of *Taenia solium* cysticercosis and taeniasis in Tanzania

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Abstract

Introduction: The purpose of this study was to examine the influence of knowledge and socio-cutltural factors regarding epidemiology of *Taenia solium* cysticercosis and taeniasis (TSCT) in eight villages from four districts of Tanzania.

Methods: A cross-sectional study was conducted in randomly selected households in Mbulu, Mpwapwa, Mbinga and Rungwe districts using quantitative and qualitative data collection methods. Data on socio-demographic factors regarding knowledge and practices were collected through questionnaires; key informant interviews (KIIs) and focus group discussions (FGDs). Quantitative data were analysed using statistical analysis system (SAS) 9.4 version for windows, while qualitative data were analysed using ATLAS.ti 8 version for windows.

Results: A total of 483 household questionnaire interviews, 12 KIIs and 38 FGDs were conducted in this study. Education and geographic location (districts) were the main factors that significantly contributed to the overall model that determined knowledge and practices towards TSCT. Respondents with tertiary education were found to be more likely to have heard of pork tapeworm (P=0.0072), be aware of tapeworm transmission (P=0.0020), being aware of tapeworm health effect (P=0.0046), and being aware of human cysticercosis (HCC) transmission (P=0.0282). With regards to practices, respondents from Mpwapwa district were more likely to wash their hands with soap after defecation (P<0.0209). While those from Mbulu district were less likely to treat drinking water (P=0.0130) and less likely to confine their pigs (P<0.0001). Male respondents were more likely to know PC transmission (P=0.0006), and washing hands with soap before eating (P=0.0216) compared to women.

Conclusion: Ignorance and the socio-cultural settings are major drivers for the ever persistent of TSTC. Awareness level significantly contribute to the knowledge and practices towards TSCT. It is necessary to understand the

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influence of socio-cultural settings towards the efforts to control and eliminate TSCT. However, more consideration should be given to the health education to the community members, to create awareness and lead them to change their practices and behaviour towards control of TSCT.

Keywords: socio-cultural, knowledge, practices, *T. solium* taeniasis/cysticercosis, Tanzania

The occurrence of Plant-Parasitic Nematodes in Rice Agroecosystems in Morogoro and Mbeya regions, Tanzania

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Abstract

Rice is a crop that feeds the entire world, and for many years to come, it will remain the most wanted crop globally. Rice consumption in Tanzania has increased dramatically due to the ever growing population. The agricultural policies have been centred on increased rice productivity by intensification at the given unit of land. However, rice productivity is hampered by, among other factors, plant-parasitic nematodes (PPN). The most important species being root-knot nematode (RKN) (Meloidogyne species) and root-lesion nematodes (RLN) (Pratylenchus species). This study characterized nematode problems and associated rice resistance in different agroecosystems in Tanzania. A diagnostic survey of rice from upland, lowland and irrigated fields was conducted, and a total of 190 soil and root samples were analyzed. PPN were extracted from soil and roots using a modified Baermann funnel and sieving and decanting techniques. Nematodes were morphologically identified to the genus level, and the most prevalent genera Pratylenchus and Meloidogyne were identified to species level using both morphological and molecular methods. For Pratylenchus, D2D3 expansion segments of the 28S gene were amplified, and the obtained sequences were compared with those of Pratylenchus species in the GenBank database. The comparison confirmed the morphological identification and revealed a population of *P. zeae*. Investigation of the phylogenetic relationship of the Tanzanian *Pratylenchus zeae* populations showed a high similarity (99-100%) with other *P. zeae* populations. *M. arenaria* were identified by sequencing the Nad5 gene and by PCR using species specific Sequence Characterized Amplified Regions (SCAR) primers. The survey revealed that RLN *P. zeae* were a major nematode parasite of rice prevailing in 100% of the samples from all rice agroecosystems. The upland rice agroecosystem is more infested than lowland and irrigated fields.

Keywords:

The Relevance of Formal and Informal Institutions in Local Chicken Genetic Resource Conservation: A case of Igunga District, Tanzania

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Abstract

Knowledge on farmers' and regulators' views regarding institutions for local chicken (LC) genetic resource conservation forms the basis for the management of Animal Genetic Resource (AnGR). A qualitative study was conducted to assess the relevance of formal and informal institutions on LC genetic resource conservation in rural and peri-urban areas in Tanzania. Igunga district was considered as a case study due to substantial number of crossbred LC with exotic breed. Primary data were collected through in-depth interviews with fourteen key informants, ten focus group discussions (FGDs) with farmers as well as documentary review of the existing formal

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institutions. Atlas.ti (version 7.5.7) computer software was used in the content analysis of data solicited from key informants and FGDs. Findings show that, formal institutions do not have a clear focus towards the governance of AnGR. However, existing informal institutions such as informal gifts, beliefs, traditional healing and sacrifice are incentives that can enhance conservation of LC genetic resources. The study therefore suggests that, the government should formulate or improve existing formal institutions for effective management of AnGR.

Keywords: indiscriminate crossbreeding, animal health services, stakeholder participation, socio-cultural use, Igunga

Trade Development of Products of Medicinal Plants in Tanzania: Overlooked Research Area?

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Abstract

The existence of trade of products of medicinal plants reflects their significance on health care and local economy. The progression changes that shifted medicinal plants from local consumptions to economic contexts is the development of diversified products and industry in general after being backed by trade information. This paper used systematic literature review to analyze information on trade of medicinal plants in order to explore its structure and identify research gaps. About 540 research articles were retrieved where 46 of them were reviewed. The contexts of the trade were natural forests and healthy sectors influencing supply and demand sides, respectively. The trade of products of medicinal plants attributed as a source of biodiversity degradation. The supply chain differed among literatures. Despite the importance of the medicinal plant trade in Sub Sahara Africa, its understanding has relied on isolated bits and pieces of information from other researches. The research trend led to lack of information on the trade like value chain and trade mechanism, the evidence as overlooked research area. The conservation of medicinal plants could be also contributed by trade efficiency. The combination of ethnomedicine, conservation and economics research domains could ensure sustainable use of scarce resources of medicinal plants to meet the limitless demand of the healthy community.

Keywords: herbal medicine trade, traditional medicine, Tanzania, medicinal plants context.

Morogoro Tanzania

Understanding Vulnerability and Redefining Adaptation Strategies of Agro-Pastoral System to Reduce Climate-related Risks: Evidence from Selected Agro-ecological Zones of Tanzania

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Abstract

Agro-pastoralism in Tanzania is increasingly vulnerable to the effects of climate variability and change. The ensuing poor productivity of the system threatens the food security and livelihoods of agro-pastoralist communities predominantly dependent on it. Existing information regarding analysis of vulnerability and adaptation mechanisms has not only equivocally surfaced within the agro-pastoral system, but also it is deficient in addressing and comparing the specific contexts both spatially and temporally. A participatory data management framework has the potential to help in better analysing the vulnerability of the agro-pastoralists and in devising the feasible adaptation strategies thereof. Recognizing the large potential of agro-pastoralism to the improvement of community livelihoods, unequivocal information needs to be presented which include but not limited to the spatial-temporal analyses. A sample of 377 respondents was taken across the four-point transect from Ngerengere in Morogoro to Kazuramimba, in Kigoma regions. Other points were Bahi in Dodoma and Sikonge in Tabora regions. Results confirm that growing seasons are uncertain and temperature and dry spell trends are increasing, with significant contribution in intensifying the vulnerability level of agro-pastoralists to climate change. Identified indicators of climate change across the transect span the rise in temperature to the increase in extreme weather events. Contextually and specifically understood vulnerability analyses help in undertaking informed decisions on adaptation strategies that would offset the envisioned adverse impacts on agro-pastoralists due to climate change. For example, ensuring accurate and predictable planting dates would minimize "false starts" and eventual crop failures. Moreover, enhanced understanding of vulnerability to climate change culminates in enhanced adaptation of agro-pastoralists. Finally, recommendations are made to stakeholders on comparative risks reduction strategies across agro-pastoral-ecological zones.

Keywords: climate change impacts, vulnerability, data management framework, productivity, farm-level adaptation, agro-pastoralism, ecological zones.

Whitefly Resistance in African Cassava Genotypes

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Abstract

Whitefly (*Bemisia tabaci*), a major pest and vector of viruses in cassava, is the greatest current threat to cassava production in sub-Saharan Africa (SSA). Research efforts have focused on management of the two viral diseases: cassava mosaic disease (CMD) and cassava brown streak disease (CBSD), and have ignored the whitefly vector that is driving the spread of the viruses causing CMD and CBSD in SSA. The objective of this study was to evaluate cassava genotypes for resistance to *B. tabaci* based on field infestation and damage in Uganda. The study was carried out in four sites with diverse agro-ecologies including: Namulonge, Kasese, Ngetta and Serere during 2015 and 2016. Whitefly nymph abundance and feeding damage were assessed on each test genotype from 3 to 6 months after planting (MAP). In 2015, the highest broad-sense heritability estimates were

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39% (4 MAP) and 53% (5 MAP) for whitefly nymph abundance and feeding damage, respectively. In 2016, broad-sense heritability estimates were 23% (3 MAP) and 41% (4 MAP) for whitefly nymph abundance and feeding damage, respectively. Analysis of variance of whitefly nymph abundance showed a significant ($P< 0.05$) location × genotype × season interactions at 3, 4, 5 and 6 MAP. There were also significant ($P< 0.05$) location × genotype × season interactions at 3 and 4 MAP for whitefly feeding damage. Ten genotypes showed good levels of resistance to whitefly infestation and feeding damage including: UG120202, UG120174, NASE13, UG120160, UG120286, UG120293, UG130075, CSI-142, CS1-144 and UG130085. These genotypes may serve as parental materials for breeding programmes for whitefly and viral disease control.

Keywords: *Bemisia tabaci*, cassava brown streak disease, cassava mosaic disease, Uganda.

Challenges and opportunities in the diagnosis of *Taenia solium* cysticercosis and taeniosis in developing countries: Tanzania's experience

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Abstract

Taenia solium cysticercosis/taeniosis (TSCT) is a zoonotic disease complex caused by *T. solium* tapeworm. There is perceived inefficient diagnosis of infections by either form of the parasite in developing countries, Tanzania inclusive. This study aimed at identifying potential gaps around TSCT diagnosis to be addressed for effective disease control in Tanzania. A cross-sectional study was conducted between January and April 2020 in Manyara, Dodoma, Ruvuma, Iringa and Arusha regions in Babati, Mbulu, Kongwa, Mbinga and Nyasa districts. We interviewed 152 officers' in-charge (OsIC) of primary health facilities (PHFs) and 108 meat inspectors (MIs) using structured questionnaire and 33 medical and veterinary officers using checklist. Quantitative data were analysed in SPSS for proportions. Content analysis was used to analyse qualitative data in ATLAS.ti software. Quantitative data revealed inadequate microscopic diagnostic facilities (54.6%) and personnel (100%) for taeniosis diagnosis in PHFs (n=152). MIs (81.2%) scored above average regarding *T. solium* cysticerci knowledge compared to OsIC (57.9%) who scored below average. Nevertheless, 61.2% of OsIC scored above average regarding *T. solium* tapeworm knowledge while 57.4% of MIs scored below average. Qualitative data revealed inadequate advanced diagnostic facilities (neuroimaging machines) and personnel for specific diagnosis of neurocysticercosis. Inadequate qualified MIs, slaughter slabs and resource facilitation challenged porcine cysticercosis diagnosis. It is concluded that TSCT diagnostic capacity and knowledge among OsIC of PHFs and MIs regarding TSCT is insufficient in both medical and veterinary sectors. One Health approach should be adopted to improve TSCT diagnostic capacity and practitioners' knowledge in both medical and veterinary sectors.

Keywords: *Taenia solium*, Diagnosis, Cysticercosis, taeniosis, One Health, Tanzania

Community's Knowledge and Practices Related to Human *Taenia solium* Taeniosis/ Cysticercosis in Kongwa and Songwe District, Tanzania

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Abstract

Background: Taenia solium taeniosis/cysticercosis is one of the neglected tropical zoonotic parasitic infection of public health importance in Tanzania, which necessitates the development of sustainable and cost-effective integrated control approaches. This requires an assessment of the community's knowledge and practices regarding the disease.

Aim: This survey was conducted in Kongwa and Songwe District to determine the existing knowledge and practices on transmission and management of Human *Taenia solium* cysticercosis and taeniosis.

Methods: This was a community based descriptive cross-sectional study conducted from June to September 2019. Households of the two districts were the subjects for sampling. Cluster sampling was carried out, whereby villages (clusters) keeping pigs were selected based on probability proportional to pig population size.

Results: A structured questionnaire was administered to 872 participants (279 from Songwe and 593 from Kongwa) from 42 villages. A total of 624(71.6%) respondents had a primary level of education, 121 (20.4%) of the respondents from Kongwa and 29 (10.4%) from Songwe had heard about human cysticercosis. About 177 (29.8%) of participants from Kongwa and 178 (63.8%) from Songwe had seen cysticercosis infected pork. A total of 165 (27.8%) respondents within Kongwa and 177 (63.4%) within Songwe admitted to being practising free-range pig rearing system. Using toilets in the household was more popular in Kongwa 563 (94.9%) compared to 139(49.8%) from Songwe. The study revealed that 404 (68.1%) of the households in Kongwa were supplied with tap water compared to 46 (16.5%) in Songwe. What about taeniosis? Pork preparation and eating behaviour? Slaughtering and inspections issues? What are the practices in hospitals with regard to identification of taeniosis? etc

Conclusion: The study demonstrates poor knowledge of respondents on transmission dynamics of the infection, contributing to practices which favour the persistence of the disease. Open field defecation and use of unsafe water sources was more popular in Songwe a peripheral district, putting the community more at risk of acquiring the infection. The study community has to be educated on the causes, mode of transmission and prevention of the disease.

Keywords: Cysticercosis; Knowledge; Practice; *Taenia solium*, human, Tanzania

Intra-Household Decision Making on Production and Income Generation among Women in Mara Region, Tanzania

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Abstract

Women's ability to make decisions on production matters and income generation in the household is crucial to reduce gender-based violence, improve women's production ability, improve the livelihood of household members and reduce poverty among women and the Country in general. The study examined the contribution of the Cassava Adding Value for Africa II project towards empowering women cassava producers to make decisions on production matters and income generated from cassava crop sales. The study was conducted in Rorya, Bunda and Serengeti Districts in Mara Region where the project was implemented. The study employed multi-stage

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stratified sampling whereby in the first and second stages, districts and wards were selected purposively due to the existence of the project. The third stage involved selection of 246 participants randomly and the proportion of 50% was applied to select the participants from the sampling frames of women who participated and those who did not. The questionnaire was used to collect quantitative data and Focus Group Discussions and Semi-structured interviews were used to collect qualitative data. The study found that the project empowered women to have an independent source of income out of which women were able to buy land and make all production decisions. Also, the study found that the project empowered women to produce improved cassava varieties which in turn allowed women to generate more income and make independent decisions. It is recommended those projects which opt to deploy the agriculture value chain approach to empower women should be encouraged and supported in rural areas since it empowers women smallholder farmers.

Keywords: women empowerment, Intra-household decisions, production and income generated, Tanzania

Natural Occurrence of Moulds and Mycotoxins in Synadenium Glaucescens Extracts (SGE) from Different Plant Parts under Different Storage Conditions

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Abstract

Fungal growth and mycotoxin contamination in value added medicinal plants products are quality and safety attributes which negatively affect entry to the market. This research aimed at investigating on occurrence of spoilage fungi and mycotoxins in Synadenium glaucescens extracts (SGE) from different plant parts and storage conditions. Laboratory whole water extraction method was used to prepare SGE from root-wood, root bark, leave, stem-bark and stem-wood. SGEs were subjected to storage temperature (25oC and 4oC refrigeration) and light (light and dark) conditions for 21 days. Samples were evaluated weekly to enumerate occurrence of spoilage fungi and identified. In a follow up experiment, pure cultures of Fusarium moniliforme and Aspergillus flavus were inoculated in SGEs and incubated for 14 days to allow production of mycotoxins. Aflatoxin and fumonisins were quantified using LC-MS/MS. It was established that 70% of samples of SGE contained Fusarium moniliforme and 60% Rhizopus spp. SGE samples stored under full light illumination were spoiled by Rhizopus species (35%), F. moniliforme (30%), F. pallidoroseum (3%), Cladosporium leguminicola (5%), C. sphaerospermum (2%), Alternaria alternate (6%) and Curvularia lunata (4%). Highest isolation frequency of F. moniliforme was in SGE from root wood (42%) and stem (42%). Highest (38%) isolation frequency of Rhizopus sp. was in SGEs from stem wood followed by root bark (32%) and 30% in both stem and root. Aflatoxin B1 was not detected in any sample. Fumonisin B1 (FB1) was detected in 80% of the samples and the concentration varied from 0.01µg/Kg to 6.33 µg/Kg. Among the samples contaminated with FB1, SGEs made from roots had consistently had FB1 ranging from 0.03 to 0.04 µg/Kg, stem wood from 1.52 to 6.33 µg/Kg while in the root bark varied from 0.01 to 1.83 µg/Kg. In SGE made from stem bark had FB1 ranging from 1.03 to 4.04 µg/Kg. Since fungal contamination was noted after 7 days after incubation, the source of spoilage fungi could be from environment during postharvest handling. Therefore, it can be recommended that, SGE safety can be ensured if good manufacturing practices (GMP) are maintained during preparation. Moreover, the Leaf

SGEs were less vulnerable to fungal growth and fumonisin contamination under room temperature. Therefore, where the efficacy is same, the leaf of S. glaucescens is possibly a better source of SGE formulations. These findings provide benchmark of future investigation for more innovative GMP and safety measures to protect consumers against risks of exposure to mycotoxins.

Keywords: Synadenium glaucescens syrup, fungi, spoilage, aflatoxin fumonisin

Porcine Cysticercosis Seroprevalence and Potential Transmission Risk Factors before a Digital Education Intervention in Iringa Rural District, Tanzania

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Abstract

Porcine cysticercosis was reported is endemic in Tanzania, especially in the southern and northern highlands of the country. The disease reduces meat quality and affects pig industry. Its current seroprevalence and potential risk factors were studied in selected areas of Iringa Rural district, southern Tanzania, prior to a digital health education intervention. A total of 346 pigs from 88 households of Izazi, Migoli and Mlowa wards was studied. Antigen ELISA (Ag-ELISA) detected 22.3% as positive for porcine cysticercosis, ranging from 21.3% to 25.7%, of which 47 (53.4%) households had at least one seropositive pig. Confining pigs was significantly related to low porcine cysticercosis seropositivity (odds ratio 2.426, 95% CI: 1.5%, 33.3%; p=0.026;), where by scavenging pigs had two times chances of being Ag-ELISA seropositive. Pig management skills and community sensitization on personal and environmental hygiene are recommended. Practical ways of delivering health education to the rural communities like those in this study should be investigated.

Keywords: Baseline, porcine cysticercosis, seroprevalence, digital health education

Rodent and Flea Diversity on the Influence of Plague Persistence in Plague and non-plague Localities of Mbulu District, Northern Tanzania

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Abstract
Plague persistence and transmission are influenced by various factors, including multiple vector interaction with the host, mostly by species facilitating transmission of the plague pathogen. This study assessed 1) distribution of rodent host abundance, diversity, flea load, prevalence of flea infestation and flea diversity in localities, habitats and seasons; 2) the influence of rainfall, temperature and humidity on flea index and rodents population in the plague foci. Five transect lines with 10 Sherman traps were set in agricultural farm land and forest habitats. All traps were left overnight and inspected every morning for three consecutive nights. Data were collected between November 2018 and January 2020. There was a statistical significant difference of rodent abundance in the localities (p=0.001) and seasons (p=0.005). Higher population was in plague locality (6.89%) and in short rain season (5.16%). However, no significant difference observed in the habitats (p=0.94). Species richness had a significant difference in locality (p=0.01) and seasons (p=0.03) with no significant difference in the habitats (p=0.05). Flea load was statistical significant in localities and seasons (p=0.002) respectively with the total flea index 0.88. The flea load was more on *Mastomys natalensis* and led by the flea species *Dinopsyllus sp* (0.52) and *Xenopsylla brasilliensis* (0.21). Prevalence of flea infestation was statistical significant in localities (p=0.0001) and seasons (p=0.0002) However, there were no statistical significant in the habitats (p=0.91). Species richness was more in plague locality (S=6) than non-plague locality (S=4). Rainfall, temperature and humidity had effect on rodent abundance and flea index in the plague foci. We concluded that the available susceptible plague rodent and primary flea species maintain plague persistence in the plague foci. Also, climatic condition humidity, temperature and rainfall are among factors favoring their survival and development of both rodent and flea species.
Keywords: Flea species, Rodent species, Plague persistence, Plague foci

The Serological Survey for Human Cysticercosis Prevalence in Kongwa and Songwe Districts, Tanzania

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Abstract
Taenia solium taeniosis/ cysticercosis is emerging as a serious public health and economic problem in many developing countries. Despite the problem being high on the global agenda of neglected tropical diseases, there has been no sustainable surveillance programme in place in most endemic countries, Tanzania inclusive. Tanzania is among the sub-Saharan African countries with an average prevalence of porcine cysticercosis 17.2%, which increases the risk of human cysticercosis infection. This Study was performed to assess the prevalence and demographic risk factors of human cysticercosis in Kongwa and Songwe district of Tanzania. This cross sectional study included 42 villages, 28(out of 87) from Kongwa and 14(out of 43) from Songwe. Blood samples were collected from 1552 participants and tested by Ag-ELISA and IgG Western blot assay. It was found that about 29(1.9%) of the community members had circulating antigens for *T. solium* and 32(2%) had antibodies signifying infection by human *T. solium* cysticercosis. Gender (higher risk in male) and age (higher risk in age group above 45 years) were risk factors associated with antigen and antibody seropositivity. This is the first ever study to assess the prevalence of human cysticercosis in the study

areas and it has revealed the problem. This study is significant for deployment of appropriate intervention measures on human cysticercosis in the study area and extends to the entire country.
Keywords: Human Cysticercosis, Prevalence, Kongwa and Songwe

Innovative "Swahili based Agricultural Apps" Underutilized new way of Reaching Farmers and Disseminating Information in Tanzania

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Abstract

Agricultural professionals are constantly in the search of innovative ways to engage farmers and timely dissemination of information. Smartphone application is one of the popular avenues used in some countries, to engage farmers and disseminate information. This study was conducted to assess the use of Swahili based agricultural apps in Tanzania. Virtual product snowball sampling was used to identify Swahili based agricultural apps in android Google Play Store for sixty days i.e. November and December 2020; and analysed their potential use. The findings show that at least 23 Swahili based agricultural apps were available in android Google Play. The oldest of identified apps was released on 2017, which suggest that the use of customised apps to reach farmers is the new phenomenon in Tanzania. Content of the identified apps show that three apps (13%) provide exclusively information on poultry farming; others have general information on crops and livestock. The content on fisheries and aquaculture is notably meagre in the existing livestock apps. Most (83.2%) of the apps had less than 10,000 downloads and only one app has reached 100,000. The users' opinions are skewed to positive. Taking into account the number of farmers and adoption rate of internet based smart phones in Tanzania, downloads figures suggest that existing apps are under-utilised. The study concludes that the use of Swahili based agricultural apps is a new practice at the early stage of adoption, which should be harnessed for timely and fruitful engagement with farmers and transformation of extension services in Tanzania.
Keywords: Apps, Smartphone apps, Agriculture, Agricultural technologies

SUB-THEME 3:
POLICY FRAMEWORK, ECONOMIC TRANSFORMATION AND QUALITY LIVELIHOODS

Influence of Social Capital on Adaptation to Climate Variability and Vulnerability in Farming System in Chamwino District, Tanzania

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Abstract

The study aimed at assessing the influence of social capital on farming households to climate variability adaptation and vulnerability in Chamwino District, Dodoma. The study employed a cross-sectional research design whereby 160 households were randomly selected for data collection using questionnaire. In addition, data were collected from 32 focus group participants and 5 key informants. Study findings show that social capital can influence accumulation or depletion of livelihood capitals among farmers whereby depletion of livelihood capitals depends on a farming household status the social-economic group of the farmer. Findings further show poor households who took roles outside their household in their endeavour to adapt to climate variability were vulnerable to the vagaries of climate variability compared to those less poor. Therefore, it is recommended that collective institutional support is important to strengthen farming households access to adaptation resources to enable them reduce vulnerability.

Keywords: Adaptation, climate variability, social capital, vulnerability, farming system

Legal Protection and Promotion of Livestock Breeding in Tanzania

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Abstract

Livestock is among the important component of agriculture sector which plays a significant role to the Tanzania economy. In the year 2016/2017 livestock sector contributed 6.9 percent to GDP. Livestock also contributes to crop and vegetable production by providing draft power for cultivation and organic manure. It is the source of income and determines the household economic and social status in many communities in Tanzania. The main types of livestock raised in Tanzania are cattle, goats, sheep, pigs and chicken. Products produced include meat, milk, hides, skin and eggs.

One of the objectives of the Tanzania national livestock policy is to "contribute towards national food security through increased production, processing and marketing of livestock products to meet national nutritional requirement" Despite this objective, the livestock sector has not been performing effectively and this is mainly due to low growth rates, high mortality rates, low reproductive rates and poor quality of the products.

This study makes an analysis on the effectiveness of the law on protecting and promoting livestock breeding in Tanzania.

Keywords:

Sorghum and Millet Value Chains for Food, Nutritional and Income Security in Semi-arid Lands of Tanzania: Investigation for Missing Synergies

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Abstract

The purpose of the study was to investigate the missing synergies in sorghum and millet value chains for food security, nutritional and income in nine districts in semi-arid lands of Tanzania. The primary objective of the study was understand sorghum and millet production, marketing value chain and their impact to small farmers' socioeconomic profiles, assets, household food and nutrition security. Primary data were collected for period of three years by interviewing farmers, traders and consumers selected randomly in Iramba, Kondoa, Kongwa, Moshi rural, Mwanga, Rombo, Same, Singida rural and Serengeti districts. Other data were collected in cities of Mwanza, Arusha and Dar es Salaam. The collected data were analyzed qualitatively, descriptively and quantitatively depending on the objectives. Results shows great diversity in time and space on sorghum and millets production, consumption and marketing hence the value chains variability. Social factors like ethnic groups, age and proximity to town centres and availability of alternative crops explain the resulting synergies observed recent years. The study recommends for location specific interventions in order make sorghum and millets contribute to food, nutritional and income security of the country.

Keywords: Sorghum, millets, vale chain, marketing, food security

Sustaining Commercial Rice Production for Sustainable Food Security in Kilombero Valley, Tanzania

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Abstract

Agricultural commercialisation is associated with productivity improvement through agricultural intensification and/or farm expansion, both may lead to rising marketed volume of agricultural output. It has been considered as a key strategy for reducing poverty, improving food security and general welfare of farmers across many countries in Sub-Saharan Africa. Apart from the positive it may lead to negative impacts such as environmental pollution, failure to improve food security and nutrition among poor farmers. This study explores how commercial rice production can be sustained in order to sustain food security in Kilombero valley without negative impact on the environment. The study uses baseline and follow-up survey data collected for the Agricultural Policy research Programme in Africa (APRA) project in 2017 and 2020 respectively. The study findings show that rice commercialisation in Kilombero valley is pursued through expansion of farm land and intensification. For farmers pursuing extensification, rice commercialisation level increased with farm size while for farmer pursuing intensification, commercialisation level was positively related to use of inorganic fertilisers and herbicides. Additionally, rice commercialisation had positive effect on food security but the impact varied across different categories of farmers. However, both extensification and intensification are likely to have negative impact on the environment in the long run. Negative environmental impact of extensification may result from farm expansion into marginal and protected areas, leading to land degradation. On the other hand, negative impact of intensification may result from overuse of agrochemicals (fertilisers and herbicides) leading to pollution of water bodies. In the long-run, these negative environmental impacts are likely to have negative effect on agricultural commercialisation through reduction in land productivity. Therefore efforts to promote rice commercialisation as stipulated in the

National Rice Development Strategy of 2019 should go hand in hand with controlling encroachment into protected areas and regulation of agrochemical use.

Keywords:

Performance, Success Factors and Challenges Facing Youth Agri-enterprises in Tanzania

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Abstract

Rapid population and income growth are expanding the demand for food and agricultural products in Sub-Saharan Africa (SSA), providing great opportunity for employment among youth in the region. Yet evidence from existing empirical literature indicates low participation of youth in agribusiness while youth unemployment is a growing concern. One of the reasons cited for the low of youth participation in agribusiness is that youth dislike agriculture and rural life. Studies on determinants of youth participation in agriculture in SSA indicate that even if youth want to become farmers they are constrained by limited access to land, inadequate knowledge and skills in agribusiness, lack of credit and poor market access. These constraints are likely to vary across SSA countries due to differences in socio-economic, institutional and policy environments. This paper presents the findings of an agri-entrepreneur surveys conducted in Tanzania in November 2017 and April 2020 to examine performance of youth's agri-business enterprises and determine success factors and challenges facing the enterprises. The surveys were part of the activities of the Young Innovators in Entrepreneurship and Leadership Development (YIELD) project. The YIELD project was initiated to assist young entrepreneurs to access and maximize opportunities in the rapidly evolving agri-food system in Africa through an integrated approach that combines action research with capacity building. The results show improvement of the performance of the youth's agribusiness enterprises since 2017 in terms of business turnover and employment creation. Factors considered key to becoming successful in agri-entrepreneurship are management/leadership skills, capital, education, innovativeness, commitment and resilience, self-esteem, technical skills, hardworking and organizational culture. Nevertheless the agri-entrepreneurs have been facing several challenges that have affected growth of their enterprises including but not limited to access to finance/capital and land, tax related issues, government bureaucratic procedures, lack of modern technology and COVID-19 pandemic. Addressing these challenges would enable youth exploit the opportunity growing food market and expand employment opportunities in agribusiness.

Keywords:

Scientific Evidence for Policy Making: A Missing Link in Higher Learning Institutions in Tanzania

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Abstract

Higher learning institutions are well known in the capacity to produce scientific evidence that can guide development initiatives in developing countries. Despite this acknowledgment, transferring of research findings into policy and practice has remained to be a long-time challenge in Tanzania. An action study was conducted to assess the use of research findings generated from higher learning institutions in decision making. Specifically, the study aimed at establishing the level of awareness on the concept of scientific evidence for decision making among researchers; assessing the capacity of researchers in disseminating research findings to policy makers and examining the coordination of higher learning institutions in contributing to evidence informed decision making (EIDM). A survey was conducted to a total of 29 researchers from 9 higher learning institutions and 7 key informants from selected ministries and regulatory authorities. Descriptive statistics and content analysis were used for data analysis. Findings indicate that higher learning institutions are academic oriented as such the research findings generated remain unsynthesized; and not repackaged and presented in a user-friendly language for easy uptake by policymakers and implementers. Limited awareness on EIDM among researchers; and weak coordinated efforts for evidences generated from higher learning institutions to influence policy change were also reported. The study suggests capacity building among researchers on research findings synthesis and dissemination for EIDM. This will be coupled with establishment of a research findings synthesis unit to facilitate the contribution of higher learning institutions in EIDM for the country's socio-economic transformation.

Keywords: Evidence informed, policy making, synthesis unit, EIDM

Structure And Dynamics of Tanzania Exports

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Abstract

Exports are important in economic growth and development. They contribute to the gross domestic product, foreign exchange earnings as well as employment among others. Composition of exports is one of the critical determinants of whether a country will benefit from trade or not. Success also hinges on a number of other factors largely those affecting the competitiveness of the exports. Over the last 15 years, the countries have witnessed the development of new and emerging economic growth poles; regulatory cooperation at the global and regional levels as well as improvement in the transport and communication infrastructure. At the same time, countries had to deal with the effects of financial crisis of 2008-2009 as well as impacts of climate change. These developments have had different implications on the patterns trade. Using trade data and analytical tools, largely descriptive, this paper explores the structure and dynamics of Tanzania exports for the last decade and a half. Whereas there has been an increase in exports over time, the structure and composition of the exports have changed. Policy implications and measures of these developments for Tanzania are also presented.

Keywords: exports, export diversification, diversification index, non-tariff barriers, tariff barriers, trade integration

Review of Agricultural Development Models and Their Relevance to Smallholder Farmers in Tanzania

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Abstract
Investment in agriculture as a way of alleviating rural poverty and achieving economic development has featured in development policies in many developing countries. In particular, these countries have adopted various models of agricultural development to achieve economic development. Nevertheless, the persistence of high rural poverty rates and low labour productivity raises concerns regarding the effectiveness of the adopted models. This paper is based on extensive literature review with particular focus to Tanzania as a case for analysing the relevance of various agricultural development models that have been adopted over the years. Specifically, the paper seeks to examine the models and their central tenets. In addition, the paper analyses the relevance of the adopted models in terms of their being compatible with the context of smallholder farmers in Tanzania. Finally, the paper presents some policy implications in relation to Tanzania's agricultural development.
***Keywords**:*

Agriculture 4.0: Willingness to Pay (WTP) for Attributes of the Mastercard Farmer Network (MFN) in Tanzania and Uganda

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Abstract
Whereas technologies of the Fourth Industrial Revolution (4IR) have in the past two decades been applied into various sectors of the economy, the agricultural sector has relatively continued to lag behind not only in Africa but, even in developed economies. Nonetheless, the concept of digital agriculture "agriculture 4.0" provides some hope of real changes in the sector. Currently, mobile phones and internet connectivity are at the centre of Africa's agriculture digitalization. The above have proved among others to reduce transaction costs, link farmers to markets and improved financial inclusion. However, despite the rapid growth and penetration of mobile phone embedded technologies such as mobile money even in rural areas, digital divide remains challenge. The study on which the paper is based assessed the willingness to pay for attributes of the Mastercard Farmers Network (MFN). MFN is a digital platform that brings together various actors of agricultural value chains such as farmers, agents, and financial service providers into digital trade. The study involved 412 bean value chain actors in Tanzania and Uganda, where the MFN application was piloted. The contingent valuation approach was adopted, and the payment card techniques was used to elicit the WTP. Study findings show that the value chain actors in both countries find all the MFN attributes important in their agribusinesses, though they rank them differently. The actors proposed addition of more features into the MFN such as farming calendar, news section, and pictures of farmers. It was further observed that actors in both countries are willing to pay for the MFN. The overall WTP for Tanzania was 0.0042 while that of Uganda was 0.0038. However, the amounts of WTP for each MFN attribute were distributed differently with users' preferences. The actors' sex, age, education, direct experience with use of MFN, transport cost to the bank, and number of times one travels to the bank to do transactions were found to significantly determine WTP in both countries. The findings

serve as guidance for pricing the MFN, and further improvement of the product before final release into the market. The approach of setting price/charges of the MFN will address the challenge of digital divide, and ensure financial inclusion of rural smallholder farmers who are the primary target of the MFN application.
Keywords:

Assessment of Socio-Economic Factors on the Uptake of Modern Family Planning: A Case of Kishapu District

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Abstract
Increased use of modern family planning is important to reduce population growth, alleviate poverty and maternal mortality in Tanzania. A cross-sectional study was conducted in Kishapu District, Tanzania to investigate Socio-economic factors on the Uptake of Modern Family Planning. Using a questionnaire, data were collected from 120 women who were randomly selected from four villages in two wards in Kishapu District. Descriptive statistics and regression analysis were employed to analyse quantitative data while content analysis was used in the analysis of qualitative data. Study findings show that the use of modern family planning is still low, moreover, fear of side effects and desire for more children were the main reasons for women's low uptake of modern family planning services in Kishapu District. Socio-economic factors such as living with mother- in- laws, partner preference for modern family planning services and income were observed to have significant ($p \leq 0.001$) influence on uptake of modern family planning. It was observed that respondents with more education had increased awareness of family planning services. The study findings show that, despite the challenges Tanzania can still achieve its Modern Contraceptives Prevalence Rate (mCPR) of 47% according to National Family Planning Costed Implemented Program (NFPCIP-2019-2023).
Keywords: Modern family planning, Maternal Mortality, Socio Economic Factors

Awareness, Use of Modern Family Planning and Social Economic Factors Affecting Uptake of Modern Family Planning: A case of Kishapu District, Tanzania

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Abstract
Increase of the use of modern family planning is important to reduce population growth, alleviate poverty and maternal mortality in Tanzania. A cross-sectional study was conducted in Kishapu District, Tanzania to investigate uptake of modern family planning services and socio-economic factors affecting the same. Using a questionnaire, data were collected from 120 women who were randomly selected from four villages in two wards in Kishapu District. Descriptive statistics and regression analysis were employed to analyse quantitative data while, content analysis was used for qualitative data. Study findings show that the use of modern family planning is still low, fear of side effects and desire for more children were the main reasons for women not using modern family planning services in Kishapu district. Socio-economic factors such as living with mother in law, partner preference for modern family planning services and income were observed to have a significant ($p \leq 0.001$) influence on uptake of modern family planning. It's important to have more education to increase family planning

awareness. Study findings show that, Tanzania has a long way to reach its family planning target of 60% contraceptives prevalence rate by 2020.
Keywords: Modern family planning, Maternal Mortality, Socio Economic Factors

Brand Image and Customers' Perception as Antecedents of Purchasing Decision: A Case Nurusembe Company in Makambako, Tanzania

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Abstract
Branding is a set of marketing and communication methods that help to distinguish a company or product from competitors, aiming to create a lasting impression in the minds of customers. It plays a crucial role to boost any business performance and is an implied tool which can positively change people's purchasing behaviours. In the competitive market a company can make a significant impact on the business environment through the creation of their own brand. The purpose of the study on which the paper is based was to identify and analyze the impact of brand image and customers' perception towards their purchasing decision on NuruSembe fortified products the town of Makambako. The study adopted a descriptive survey design whereby data were gathered from both primary and secondary sources. The study employed purposive sampling technique to selected 100 respondents to whom a questionnaire was administered. The data were analyzed by multiple linear regression and Likert scale analysis using SPSS and Microsoft Excel. The findings show that brand image and customers' perception have a strongly and positive impact on consumers' purchasing of NuruSembe products. Generally, the brand image was strongly related to customers' decision to purchase. Therefore, the study recommends that NuruSembe needs to put more emphasis on designing its product brand as this largely influences how customers perceive their product. Thus, with good branding NuruSembe products sales could be increased.
Keywords: Branding, Purchase Decision, Business Performance

Consumer Willingness to Pay for the Colour of Cooking Oil: A Comparison of Rural and Urban Consumers in Tanzania

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Abstract
Colour is considered an important parameter that consumers take into account during product evaluation; however, this attribute may be lost or altered during processing of the product. The Tanzanian government has put sunflower as one of its priority crops under the Agricultural Sector Development Programme Phase Two (ASDPII), and to ensure food safety, it requires that all cooking oil sold in the market is double refined. The study on which the paper is based looked at consumer preferences and Willingness to Pay (WTP) for the colour of cooking oil among rural and urban consumers in Tanzania. In addition, the study assessed the effect of information about the level of refinement on the WTP for the colour of cooking oil. Using the multiple price list format in eliciting consumers WTP, an interval regression model was estimated. Study findings show that health considerations, naturalness and sensory taste are the most important factors influencing consumer preference and WTP for the colour of cooking oil. Findings further, show that without information, the average WTP for dark, light and very light cooking oil were TZS 3288/litre, TZS 3096/litre and TZS 2756/litre respectively. It was also found that urban consumers reduced their WTP for dark oil after getting information by 30.1% while rural consumers

increased their WTP by about 7.2% regardless. On the other hand, both rural and urban consumers increased their average WTP for very light oil by about 26% when they received information. Furthermore, estimates from the interval regression model revealed that very light-coloured cooking oil was discounted in the absence of any information, but that changed once consumers were exposed to information on the level of refinement. With information, urban consumers were willing to pay significantly higher for very light cooking oil followed by light cooking oil and dark cooking oil unlike their rural counterparts. Thus, it is recommended that the government should embark on educating the population to allay fears that pushes consumers away from very light cooking oil. In addition, the government can also revisit its policy on double refined cooking oil and make room for consumers who prefer unrefined oil due to health concerns.
Keywords: colour; information; WTP; Tanzania; interval regression

Gas Extraction Operation Activities and Changes in Livelihood Strategies: Experience from Mtwara District in Tanzania

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Abstract

The influence of Gas extraction operations on changes of livelihoods strategies from extractive areas is underreported. Therefore, the current paper examines changes in rural livelihood strategies resulting from gas extraction and investments in of the same in rural Tanzania. Generally, the study on which the paper is based explored changes in livelihood strategies due to gas extraction operation activities in Mtwara district. Specifically, it analysed gas extraction operation activities; examined livelihood strategies before gas operations activities and assessed the current livelihood strategies in the study area. The study was conducted in Mtwara rural district of Mtwara region in Tanzania, specifically in Madimba and Msimbati wards from July to November, 2020. The study was guided by the Sustainable Livelihoods Framework. Data was collected through 4 focus group discussions (FGD) with female (n=16) and male head of households (n=20) and 15 in-depth interviews with agricultural extension officers (n=4), village executive officers (n= 4), ward executive officers (n=2) and district officers (n=5). The qualitative data were analysed by using ATLAS.ti.v.7.5.7 and the quantitative data were analysed descriptively by SPPSS (IBM Statistics version 20). Despite the extraction of gas resources in rural areas being an important source of income and a means of livelihoods for low-income rural households, study findings show that local communities have limited control over land, earned income and have little negotiating power. The findings also show that the livelihood strategies used before gas extraction operations were; farming (100%); fishing (95.1%); crop sales (69.6%); petty business (26.5%); fishing gear repair (15.4%). Findings further show that a village's proximity to the gas processing plant hardly changed livelihood strategies after introduction of gas extraction operations such as; sea shells collection; motor cycle repair; carpentry and welding. The changes were driven either by gas extraction operations or its infrastructure that allow them to retain control over income and support their households. The results highlight the need to evaluate the long-term effectiveness of gas extraction operations in a context of livelihood strategies.
Keywords: Gas extraction, operations activities, livelihood strategies and local communities

Gender Inequality in the Informal Labour Market for Secondary School Graduates: in Kigoma District-Tanzania

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Abstract

Closing gender inequality in Tanzania is enshrined in many sectoral policies and plans; however, gender inequality remains a reality in the country. The study on which the paper is based examined gender inequality among secondary school graduates in Tanzania's informal labour market. Specifically, the study determined differences in informal labour market conditions between male and female respondents, determined difference in transferable competences between male and female respondents and lastly examined distribution of informal employment between male and female respondents. A cross-sectional study design was employed whereby quantitative and qualitative data were collected. Study findings show significant differences on the informal labour market conditions, transferable competences and distribution of informal employment opportunities among male and female secondary school graduates. Gender inequality has been observed to exist in three out of five informal labour market conditions namely; informal labour market accessibility, social networks, financial capital. Also, in four out of five transferable competences studied, i.e. self-efficacy, entrepreneurship, interpersonal relation, and farming competences. Furthermore, the findings have shown that there exists gender inequality on the way informal employment opportunities are distributed among the two sexes. The results from focus group discussions and key informant interviews were consistent with the findings from the quantitative data. Thus, it can be concluded that there is gender inequality in the informal labour market. The findings emphasise on the need for the informal labour market actors; Central Government, Local Government Non-Governmental Organisations to improve women's participation especially in gendered bias informal employments.

Keywords: Gender inequality, Informal labour market conditions, transferable competences, informal employment, secondary school graduates

Inclusion of Women and Youth in Rice and Sunflower Commercialization in Morogoro and Singida Regions

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Abstract

Rice and sunflower commercialization has potential to impact on livelihoods of people engaged in the production and marketing of the crops. In line with the government thrust on agricultural commercialization for industrial led economy; rice procuring areas in Kilombero valley and sunflower producing areas in Iramba and Mkalama Districts have received new impetus in terms of processing technologies and marketing linkages. While women and youth provide the bulk of labour forces required in the rice and sunflower production, it is not well established how rice commercialization is inclusive and impacts on the livelihood of youth and women. While it is generally believed that as households engage in agricultural commercialization, the gender division of labour and gender roles will change. Albeit, there is paucity of empirical evidence on both the inclusion and impact on gender roles for improvement in their livelihood. This paper uses data from the first and second rounds of Agricultural Policy Research in Africa (APRA) programme in Tanzania which focused on rice commercialization in Mngeta Division in Kilombero District, Morogoro Region and sunflower

commercialization in Mkalama and Iramba Districts in Singida region to explore whether and to what extent the ongoing rice and sunflower commercialization impact on youth and women inclusion in social and economic development in the study areas. The results show that rice and sunflower commercialization impact on women empowerment, although the level of improvement in livelihood is higher among men than women. Youths are driving benefits provided by the rice and sunflower supply chains for other livelihood improvement activities. Hence, the paper recommends for better ways for women and youth participation and benefits from rice and sunflower commercialization initiatives.
Keywords:

Competitiveness of Different Cotton Production Systems in Maswa and Meatu, Tanzania

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Abstract
Questions have been raised about the competitiveness of organic and conventional cotton production systems. In this paper we apply Policy Analysis Matrix (PAM) to analyse competitiveness of organic and conventional cotton production in Maswa and Meatu districts, Shinyanga, Tanzania. We use data collected from 2526 cotton farmers from 92 villages of Meatu and Maswa districts. The results show that both organic and conventional cotton production systems are not competitive lacking incentives to farmers
Keywords: Tanzania, Competitiveness, Organic cotton, Conventional cotton

The Impact of Rice Commercialisation on Livelihoods in Kilombero Valley, Tanzania: Anybody Left Behind?

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Abstract
Rice commercialisation play part in changing the current production practices from subsistence towards market oriented level. Commercialisation has potential to increase income and improve livelihood of farming households. However, commercialisation is likely to impact different gender social groups differently under different socio-economic, institutional and policy environments. This paper examines the impact of rice commercialisation on livelihood of different gender social groups in Kilombero valley, Morogoro region in Tanzania. The empirical exercise uses panel data set of the Agricultural Policy Research in Africa (APRA) covering 15 villages collected in 2007 and 2019. A mixed methods approach involved household interview, focused group discussion (FGDs) and key informant interviews (KIIs) were employed to collect both qualitative and

quantitative information. Descriptive and inferential statistical analyses were employed as tangible ways of presenting the findings. Empirical results show that rice commercialisation has positive impact on livelihood improvement. Meanwhile, rice commercialization affects gender social groups differently. Also evidence was found of a positive significant influence of the rice commercialisation and improved livelihood. Female household heads, older as well as small scale farmers had low rice yield, hence left behind on commercialization process, consequently are vulnerable to food and income poverty. The result also indicated that rice output, off-farm income, access to credit and production assets and income from the sale of rice had influence on livelihood improvement. Although rice commercialization is important and has increased in Kilombero valley, we need a combination of interventions and policies by the Government and responsible actors in agricultural sector to ensure no body is left behind.

Keywords: rice commercialization, social gender groups, livelihoods, resource endowment

Can Maize Smallholders in Southern and Northern Highlands of Tanzania Increase the Net Revenue From Their Storage Facilities?

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Abstract

Most farmers in Tanzania implement risk mitigation strategies of storing their maize in local facilities and selling the crops soon after harvest to buffer their livelihoods against crop price fluctuation. However, the revenue collected after selling their maize is low. This study aims to understand the place of Purdue Improved Crop Storage (PICS) facility in maize storage technology and its contribution to maize crop revenue. A survey and a storage experiment were performed among maize farmers in the maize growing regions of Southern and Northern highlands of Tanzania. Cross sectional data on the maize farmers and their farms' characteristics were collected from 560 households in an Agronomic Survey (APS) in 2016/2017 cropping season, the households being randomly selected within a spatial sampling frame. The storage experiment was conducted randomly on 147 out of 560 chosen households, in May 2017 to March 2018. We described the distribution of maize storage facilities in the study region as well as investigated the development of net revenue of farmers storing maize in local storage facilities only (LSO) and those who store their maize in local storage facilities and PICS (LSP). Finally, we explored the relationship between maize net revenue and price at largest sales, age, gender, area cultivated, yield, household size and region. We found that most of the maize farmers store their maize in local polyethylene bags without storage pesticides (79.46%) and very few (1.07%) utilize PICS storage. Maize farmers from the Kilimanjaro region store their maize across almost all the storage facility options compared to farmers from Njombe who store their maize in polythene bags with and without application of pesticides as well as in PICS bags only. Multiple linear regression results revealed that maize yield, seed costs and maize growing regions influence the maize net revenue. Maize farmers from Songwe, Mbeya and Njombe regions have higher maize mean net revenue than other studied farmers. An analysis of the differences in maize mean net revenue between LSO and LSP using student t test displayed a mean net revenue difference of Tshs 265,278, with LSP group having higher net revenue (Tshs 1,042,546.90) than LSO (Tshs 777,268.90). The results suggest that the inclusion of improved storage facilities and region characteristics components in yield improvement policies can lead to the enhancement of farmers' income.

Keywords: maize storage facilities, net revenue, maize smallholders, Northern and Southern highlands of Tanzania

Assessing the Effectiveness of Agriculture E-Extension and Advisory Services for Smallholder Farmers in Tanzania. A Case of Five Villages in Kilosa District

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Abstract

Tanzania like many other countries in the Global South still consider agriculture as the backbone of its economy despite the growth of other sectors like tourism, information technology, and mining among others. The sector employs 58 percent of the population, majority being smallholder farmers in rural areas and contributes to about 28.2 percent of the GDP. Capitalizing on the sector because of its critical importance, the government enacted policies, laws and created programmes geared to capture sectoral contributions in terms of revenues and increase of produces for food security reasons. To fully achieve policy, legal and programmes thirst the government has been emphasizing in the provision of quality and efficiency agriculture extension services and of recently embarked on e-extension services by taking advantage of technological advancement, usage in rural and urban setting and the role of private sector. The emphasis on the use of ICT came at the expense of failed conventional agriculture extension services. While this position by the government holds truth, we argue that, without adequate involvement of smallholder farmers (men and women) through their groups and networks at local level to decide the type/form of agriculture e-extension services and nature of actors to be involved, the over emphasized e-services will likely not achieve any notable results in favor of SHF. Drawing on from results of a Network of Groups of Smallholder Farmers based in Morogoro specifically five villages in Kilosa district, we examine agricultural extension services provision in the area by looking into two aspects of extension services that's the receiving and provider ends. We outline challenges affecting extension services provision in the country including inadequate extension officers, lack of strong research extension-farmers linkages, poor living and working conditions, and poor communication between service providers and receivers. Whereas paying attention to the challenges outlined, the paper however, presents how e-extension services is also class issue requiring a class lens analysis.

Keywords: Agriculture, e-extension, smallholder farmers, ICT, NGOs

Livestock, Crop Commercialisation and Poverty Reduction among Rural Households in Singida Region, Tanzania

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Abstract

Livestock is an important component of mixed crop-livestock farming systems in Singida Region, directly or indirectly contributing to poverty reduction among rural people in the region. This paper examines the effect of livestock on crop commercialisation and poverty levels among rural people. The paper uses data set collected in 2018 under the Agricultural Policy Research in Africa (APRA) Project. Descriptive statistics were used to examine differences in crop productivity, commercialisation levels, income and poverty between different categories of farmers. Regression models were employed to determine the effect of livestock on crop commercialisation and household poverty, controlling for other factors that can influence crop

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commercialisation and household poverty. The results of descriptive analysis show higher crop commercialisation and lower poverty levels for farmers with livestock than farmers without livestock, implying that livestock enhances crop commercialisation and contributes to poverty reduction. Also differences in commercialisation and poverty levels were found between male and female headed households and between households headed by small and medium scale and farmers. The results of the regression analyses show that livestock has positive effect on crop commercialisation and negative effect on poverty level, suggesting that that livestock enhances crop commercialisation and reduces household poverty. This calls for efforts to improve crop-livestock integration, promoting use of livestock manure, animal traction and other productivity enhancing inputs. Government interventions to promote access to agricultural technologies should target small scale farmers and female headed households
Keywords: Livestock, crop commercialisation, poverty, Singida Region

The Influence of Rural-urban Transformation on Land-use changes in Ilula and Madizini, Emerging Urban Centres, Tanzania

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Abstract

This study documents land-use changes resulting from rural-urban transformations in Ilula and Madizini, emerging urban centres (EUCs) in Tanzania, from 2007 to 2017. Maximum Likelihood Classification generated from Landsat 5 TM, Landsat 7 ETM and Landsat 8 OLI satellite images was used to classify different types of land use. Ilula and Madizini have both experienced land-use changes in the form of housing densification and spatial expansion. The household survey results indicate that housing (61%) and agricultural production (38%) in 2016 are the dominant land uses of households within these two emerging urban centres. Land use spatial analysis results revealed that, in Ilula, the built-up area increased from 149 ha (22.82%) in 2007 to 318 ha (48.7%) in 2017, an increase of 168 ha (113% increase), while agricultural land declined from 425 ha (65.08%) in 2007 to 246 ha (37.67%) in 2017, a decrease of 179 ha (-42% decrease). In Madizini, the built-up area increased from 68 ha (22.2%) in 2007 to 151 ha (49.5%) in 2017, an increase of 83 ha (122% increase), while agricultural land declined from 192 ha (62.9%) in 2007 to 147 ha (48.1%) in 2017, a decrease of 45 ha (-24%). Residential history, service availability and local geography are important locational influencing factors in respect of land-use changes and future urban potential growth in the study sites. The current land-use patterns in emerging urban centres pose challenges related to service provision and future urban growth, especially where there is limited public land. Participatory and proportional land-use planning informed by current land uses is recommended to avoid the development of unplanned settlements and land use-related conflicts, especially with regard to the repurposing of prime agricultural land for urban uses.
Keywords: urbanization, rural-urban transformation, land-use changes, emerging urban centres

Optimum Food Crops/Tree Combination for Maximized Farm Profit in Mufindi District: A Multi-Period Programming Approach

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Abstract
Finding an optimum combination of crop and tree mix that maximizes farmer profit is vital for reduced poverty and improved life standards of farmers, however, in the study area, there is paucity of knowledge on optimal land allocation for farmers who allocate both food crops and trees. Therefore, the aim of this study was to determine the combination that maximizes profits from the production of food crops and trees (Pines). Multi-period profit maximization programming model was used in the optimization. Results showed that, a farmer can maximize profit by allocating 1.81 and 1.74 acres for round potatoes and pine trees respectively. This gives a maximum profit of TZS 13 592 440.53 over a ten years period of which revenue from trees becomes available. Also, a farmer should allocate 0.57 and 0.35 acres for maize and beans respectively to meet family food requirements. Moreover, the study found capital and land to be binding, and therefore recommends promotion of low interest financial support to farmers to enable them increase their capital base and also rent more land to intensify production and increase profit. The endeavour can enable them to engage in other off-farm activities thereby reducing rural unemployment as labour was found to be slack.

Keywords: Multi-period Linear Programming; Net Present Value; Optimization

The Role of Informal Labour Market Conditions and Transferrable Competences on Informal Employments for Secondary School Graduates in Kigoma District, Tanzania

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Abstract
Secondary school graduate output in Tanzania has enormously increased without a proper placement plan in the labour market. Specifically, the paper delineates the differences in informal labour market conditions and transferrable competences between urban and rural secondary school graduates; presents an examination of informal employments for secondary school graduates; and denotes the impact of transferrable competences and informal labour market conditions on secondary school graduates' informal employment. A cross-sectional study design was employed to collect quantitative and qualitative data. Descriptive results showed trading, fishing, transportation, mechanics, food vending, palm oil processing and farming to be among main informal employments in which secondary school graduates are engaged. Mann-Whitney U test showed that there were significant differences in the effect of explanatory variables between urban and rural secondary school graduates. Binary Logistic Regression analysis showed that 8 variables namely, informal labour market accessibility, financial capital, social networks, labour market legal framework, self-efficacy, interpersonal relation, entrepreneurship, and farming competences had significant influence on informal employments of secondary school graduates. The results from focus group discussions and key informant interviews were consistent with the findings from the quantitative data. It is thus concluded that informal labour market conditions and transferable competences have an

influence on informal employment of secondary school graduates. Therefore, adjustments of informal labour market conditions and transferable competences could be an effective tool of expanding informal employments for secondary school graduates in the informal labour market. The findings emphasise on the need for alerting Local Government Authorities, labour offices, employment agencies, and Non-Governmental Organisations to adjust and re-organize informal labour market conditions and improve transferable competences for secondary school graduates, and hence, improve chances for the graduates getting informal employment.
Keywords: Informal labour market conditions, transferable competences, informal employment, secondary school graduates

Assessment of Socio-Economic factors on the Uptake of Modern Family Planning: A Case of Kishapu District

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Abstract
Increased use of modern family planning is important to reduce population growth, alleviate poverty and maternal mortality in Tanzania. A cross-sectional study was conducted in Kishapu District, Tanzania to investigate Socio-Economic factors on the Uptake of Modern Family Planning. Using questionnaires, data were collected from 120 women who were randomly selected from four villages in two wards in Kishapu District. Descriptive statistics and regression analysis were employed to analyse quantitative data while content analysis was used in the analysis of qualitative data. Results showed that, the use of modern family planning is still low, moreover, fear of side effects and desire for more children were the main reasons for women's low uptake of modern family planning services in Kishapu District. Socio-economic factors such as living with mother- in- laws, partner preference for modern family planning services and income were observed to have significant ($p \leq 0.001$) influence on uptake of modern family planning. It was observed that respondents with more education had increased awareness of family planning services. The study results suggest that, despite the challenges Tanzania can still achieve its Modern Contraceptives Prevalence Rate (mCPR) of 47% according to National Family Planning Costed Implemented Program (NFPCIP-2019-2023).
Keywords: Modern family planning, Maternal Mortality, Socio Economic Factors

Commercialization Potential of Pig Industry in Mbeya and Mbozi Districts, Tanzania

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Abstract
Tanzania is experiencing the growth of public and private sectors in marketing systems that stimulate commercialization of different sub-sectors including pig production that is getting more popular in recent period of time. The development and growth of the transportation and communication sectors with improved infrastructures play a great role in stimulating other economic activities including the pig industry. The purpose of this study was to evaluate the determinants of commercialization potential of pig industry and assess its contribution to the economics growth of smallholder pig producers in Mbeya and Mbozi districts. The 120 pig farmers were randomly selected from the study areas whereby the data were collected using questionnaire. The findings show that commercialization of pig production was positively influenced by gender, age, total annual income and alternative

sources of income of the respondents. The findings also show that that 98.3% of pig farmers were producing pigs for commercial purposes which show that many of them had shifted from subsistence farming to commercial production. The findings show further that the level of participation of pig farmers in commercialization was 60.7%. In addition, pig industry was found to improve economic growth of farmers whereby 68.4% of the respondents claim that some of the assets they own have been obtained from pig production. However, pig diseases were found to be the serious challenge (34.2%) faced by pig farmers, followed by uncompetitive price (15%) and high cost of pig production (13.3%). Moreover, the findings show that 54.2% of pig farmers were keeping pigs after been motivated by demand, although some of them claim that sometime sell pigs at low price. It is recommended that there should be a well management of disease control and well joint establishment of pig organizations where pig farmers will sell their pigs with good bargaining power and competitive prices. In addition, it is also recommended that further research should be done on marketing systems in order to establish a sustainable and competitive pig value chain that will ensure full commercialization of the industry.
Keywords: Business potential, pork, Southern Highlands, Tanzania

Market Performance of Pigeon Peas in Lindi Region, Tanzania

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Abstract
Pigeon pea (*Cajanus cajan*) is a highly nutritive legume of substantial export earnings for Tanzania. However, domestic consumption for pigeon peas remains low mainly due to limited scope of product utilization. The aim of this study was to examine the pigeon pea market performance in Lind Region. A survey of178 pigeon pea farmers and traders was undertaken using semi-structured questionnaires. Data was analyzed using SPSS software and Microsoft Excel. A Structure-Conduct-Performance model was adopted to analyze performance of pigeon pea market. Profit margin analysis was also performed to measure profitability of various market actors. Market structure results showed that capital was the main barrier to entry for pigeon peas trading. Market information asymmetry exists with traders being the key source of market prices to the farmers. Pigeon pea Market concentration was 24.23 % indicating that the market was unconcentrated and likely to be a competitive market. On market conduct study reveals that at the 93.3 % of the farmers reported that price was set by traders dependent on the final sale price to wholesalers. Traders received the highest profit margin of 25.81 % while farmers experienced a loss of about -383.49 % on the basis of sales. In conclusion, the pigeon peas market in the study area is performing poorly due to difficulties in securing credit/loans, high market costs and information asymmetry. It is recommended that farmers are organized into formal or informal groups and trained on different production, marketing and quality control techniques so as to improve their competitiveness in the pigeon pea market. The regulatory framework should also provide a mechanism for pricing and quality requirements for pigeon peas for market actors. ***Keywords:*** Pigeon Peas, Market Performance, structure, Tanzania

Contribution of Fisheries to Household Income, in the Little Ruaha River Catchments Iringa, Tanzania

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Abstract
Fish is an important component of aquatic biodiversity in Tanzania and plays

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an important role to the world's economy. However, the contribution of fish to household income in the Little Ruaha river catchments have not been given sufficient evaluation. This study determined the contribution of fish to the household income. Structured household questionnaire and field observation were used to collect information on the contribution of fisheries to household income in three sampling sites (in the upper reach, middle reach, and lower reach in Igowole, Kibebe, Migoli and Makatapora villages). Data were analyzed by using Statistical Package for Social Science (SPSS) computer software version 16.0 and Microsoft Excel was used to draw figures and tables. The contribution of fisheries to household income was assessed as the mean proportion of household income obtained from fishing activities. Fisheries contributes to an individual monthly income of up to TZS 500 000 (US$ 220) and supplies 51% of protein to community households, and about 40% of households depends on fish as their main source of income. Sustainable fisheries management in river basins contributes significantly to community livelihoods.
Keywords: Fisheries, Household income, Little Ruaha River Catchment

Determinants of Apicultural Practices in Sikonge Tabora, Tanzania

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Abstract
Beekeeping is one of the potential economic activities in rural communities in developing countries. However, in many developing countries beekeeping is traditionally practiced. This study was conducted in Sikonge District Tabora Region in Tanzania to determine the factors for apiculture practices. The sample size was 215 small scale holder beekeepers. In-depth interview, Questionnaire survey and focus group discussion were used in data collection. Data were analyzed by using IBM-SPSS version 23. Descriptive statistics including frequencies and percentages were used to analyze quantitative data. Also, binary regression was used to determine the factors influencing apiculture practices. Results revealed that 75% of the beekeepers used both traditional and improved beehives. Majority (92%) of the beekeepers set their beehives in Natural forest more than 100km a walking a distance from their home. It was investigate that beekeepers harvest only honey and beeswax. Various factors such as access to information, years stayed at school, years practicing beekeeping, level of income, age of the respondents and training were found to influence beekeeping practices, however, only access to information, years stayed at school, level of income and training tested statistical significant ($P<0.05$). Honey bee production is mainly limited by poor technology, access to market, livestock keeping, weather and transport. The study concluded that beekeeping practices requires technological improvement in order to harvest more products of honey. The study recommended that beekeepers need to be capacitated to harvest more products of honey.
Keywords: Honey bee-by products, apiculture practices, beekeeping and beekeepers

Structure and Dynamics of Tanzania Exports

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Abstract

Exports are important in economic growth and development. They contribute to the gross domestic product, foreign exchange earnings as well as employment among others. Composition of exports is one of the critical determinants of whether a country will benefit from trade or not. Success also hinges on a number of other factors largely those affecting the competitiveness of the exports. Over the last 15 years, the countries have witnessed the development of new and emerging economic growth poles; regulatory cooperation at the global and regional levels as well as improvement in the transport and communication infrastructure. At the same time, countries had to deal with the effects of financial crisis of 2008-2009 as well as impacts of climate change. These developments have had different implications on the patterns trade. Using trade data and analytical tools, largely descriptive, this paper explores the structure and dynamics of Tanzania exports for the last decade and a half. Whereas there has been an increase in exports over time, the structure and composition of the exports have changed. Policy implications and measures of these developments for Tanzania are also presented.

***Keywords**:* exports, export diversification, diversification index, non-tariff barriers, tariff barriers, trade integration

The Impact of Rice Commercialisation on Livelihoods in Kilombero Valley, Tanzania: Anybody Left Behind?

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Abstract

Rice is among the most popular cereal crops grown next only to maize in Tanzania and most African countries. Commercialisation of rice plays part in changing the current production practices from subsistence towards market oriented level. A diversity among farming households, in terms of resource endowment, land holding capacity and socio-economic characteristics have an implication on engagement and benefit accrued from rice commercialisation. This paper examines the impact of rice commercialisation on livelihood of different gender social groups in Kilombero valley, Morogoro region in Tanzania by comparing between 2017 and 2019. The empirical exercise uses panel data set of the Agricultural Policy Research in Africa (APRA) covering 15 villages collected in 2007 and 2019. A mixed methods approach involved household interview, focused group discussion and key informant interviews (KIIs) were employed to collect both qualitative and quantitative information. Descriptive and inferential statistical analysis were employed as tangible ways of presenting the findings. The households headed by female and youth, and small scale farmers had low access to inputs, hence low quantity of yield, and henceforth left behind on commercialization process, consequently are vulnerable to livelihood improvement and poverty reduction. There is a relatively livelihood improvement in 2019 compared to 2017, however, the most advantageous households are those headed by male, older farmers and MSF. The SSF, FHH and youth are less included in rice commercialisation, suggesting that more efforts including development of new policy strategies are required to ensure these marginalized households are taken on board and enjoy the benefits associated with rice production and commercialisation that are imperative for the livelihood enhancement and poverty reduction. Sustainable maintained livelihood improvement needs a diversity economic

options, and a combination of interventions (diversified livelihood options) and policies by the Government and responsible actors in agricultural sector to ensure no body is left behind.
***Keywords**:* rice commercialization, social gender groups, livelihood

SUB-THEME 4: CONTRIBUTION OF FORESTRY, WILDLIFE MANAGEMENT AND TOURISM TOWARDS ECONOMIC DEVELOPMENT

Examining Gender Differences in Indigenous Chicken Commercialisation Intent – Evidence from North-Western Zambia

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Originality: *The study is among the first to apply the theory of planned behaviour in the village chicken value chain in the under-researched Zambian context.*

Abstract

This paper contributes to the smallholder agriculture commercialisation literature by applying the Theory of Planned Behaviour in a developing country context. The study examines the influence of attitude, subjective norms and perceived behavioural control on the commercialisation Scaling-Up intent among smallholder village chicken farmers in North-western Zambia. Furthermore, the mediating role of commercialisation practices intention is examined. Based on a quantitative correlational design, primary sample data were collected using a structured questionnaire from 556 village chicken smallholder farmers from two farming blocks in North-western Zambia. The data were analysed using statistical correlation and regression models. The findings indicate that attitudes, subjective norms, perceived behavioural control as well as commercialisation practices intention had unique positive significant effects on commercialisation practices intention (CPI) and CPI in turn positively influenced commercialisation scaling-up intention (CSI). Notwithstanding the research limitations such as the study being cross-sectional and based on one district in Zambia, the findings have important implications. For policy makers and enterprise support institutions, understanding the socio- psychological factors of smallholder farmers are important before introducing any interventions to promote commercialisation of the village chicken. Additionally, for scaling-up to occur, there is need to encourage farmers to adopt commercialisation practices in management, investment and marketing. This would increase chances of transitioning from subsistence to commercial farming.

Keywords: commercialisation, village chicken, commercialisation practices Intention

Spatial and Temporal Abundance of Flower Visiting Flies Associated with Cultivating Cucurbit Crops in Morogoro, Eastern-Central Tanzania

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Abstract

Cucurbit crops are among major food crops that rely largely on insect pollination to set fruits and seeds. Their flowers offer large quantity of nectar and pollen as floral rewards to visiting insects. However, limited information is known about spatial and temporal abundance of flower visiting flies associated with cultivated cucurbit crops in Tanzania. Therefore, this study investigated the seasonal abundance of flower visiting flies associated with three cultivated cucurbit crops (Cucumis sativus L., Citrullus lanatus Thunb. and Cucurbita moschata D.) using yellow pan traps and hand netting in ten established cucurbit fields along mountainous and plateau zones of Morogoro region. Trapping of flower visiting flies commenced when crops were at least at 10% flowering stage from March to July 2020. A total of 7606 individuals were collected, of which 396 specimens belonged to eight (8) genera and nine (9) species of Syrphidae (Hoverflies). Of the total hoverfly species recorded, Eumerus (Meigen) sp1 was the most abundant and predominate species followed by Eristalinus megacephalus (Rondani) and Toxomerus floralis (Macquart) in the study area. The abundance of hoverfly species were influenced by agroecological zones and weather conditions which linked to variability in floral resources. The population abundance of dominant Hoverfly species varied among species across the two agroecological zones. This work suggests that spatial and temporal

abundance of hoverflies is dynamic on a micro-geographic scale as it seems to be mostly influenced by zones and species themselves.
Keywords: Spatial and temporal abundance, flower visiting flies, Hoverfly, Cucurbit crops

Tree Architecture Influences Location and Abundance of Ant Nests in an ant-*Acacia zanzibarica* Mutualism

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Abstract
Ant-plant mutualisms have been well studied but the mechanisms driving them vary spatially and with the type of species involved in the system. We characterized an ant-*Acacia zanzibarica* mutualism dominated by *Crematogaster sjostedti* in a lowland Tanzanian savanna to understand the plant traits influencing nest abundance and arboreality in this system. Tree height, foliage density and growth form were the strongest predictors of ant nest abundance in a tree. Nest abundance increased with height of the tree, the trunk and with the number of tree branches. There was a negative effect of the growth form and foliage density on the number of total tree ant nest with the nest abundance decreasing in clustered trees with foliage density below average. Also tree height and foliage density below average strongly predicted the number of roaming ants on the lower sects of tree stem. Ant nest arboreality was strongly influenced by the tree height and increased in singly than clustered growing trees suggesting a strong adaptive strategy by the ants to avoid destructive impact of savanna fires to their colonies. The ant-acacia-herbivore relationships may become complex as the browsing mammal assemblage are increasingly recovering and populating this humid savanna ecosystem.
Keywords: *Acacia zanzibarica*, ant nest, browsing herbivores, nest arboreality, plant traits, Saadani National Park, Tanzania

Impact of Salinity Intrusion on Transpiration Rates of Mangrove Avicennia marina in Pangani and Wami Estuaries, in Coastal Tanzania

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Abstract
Transpiration is an important force that drives circulation of water and nutrients in plants and a key process in the hydrological cycle, energy and water balance of the land surface. However salt stress conditions slows this process in mangrove plants. Thus, modelling the transpiration rate in coastal mangrove vegetation requires knowledge on the variations of transpiration rate in response to salinity intrusion.
We conducted field experiments in Pangani and Wami estuary in coastal Tanzania- areas with and without saline intrusion respectively to assess the impact of salinity intrusion on transpiration rate of mangrove Avicennia marina. The field experiement involved monitoring 60 freshly cut Avicenia marina trees connected to air-tight and sealed transpirometer. The water from the plant was recorded four times at an interval of 15 minutes for each freshly cut avicenia marina tree. The data from control and treatment experiments replicated at three stations were compared with the t-test. The results showed that the leaves of A.marina at Pangani estuary (saline intrusion) had significantly lower transpiration rates than those at Wami estuary (non-saline intrusion), indicating the negative relationship between salinity intrusion and transpiration rate. Both an increase and decrease of transpiration rate in response to salinity intrusion was observed. in the upper, middle and lower estuary of both Wami and Pangani estuary. These results suggest that

transpiration rate is may be modulated by local environmental conditions where the plant is growing and thus important when considering vegetative propagation of the mangrove trees.

Keywords: Transpiration rate, Salinity intrusion, Estuary, Avicennia marina and Mangroves

Functional diversity of bird communities correlates with local poaching and habitat degradation signals in a human dominated landscape of central Tanzania

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Abstract

Conservation of landscape processes under ongoing biotic erosion requires assessment of important population functional traits that are useful for ensuring ecosystem services provision. Unfortunately, many human-dominated landscapes bordering protected areas still lack such information despite being faced with increasing exploitation pressure of both plant and animal resources. This situation poses a huge risk of depleting ecosystem services offered by the animal communities such as birds. We conducted bird surveys in 144 plots in four sites with differing levels of hunting pressure and bushmeat trade in central Tanzania and assessed the vegetation structure in hunting sites to understand impacts of illegal poaching pressure and habitat degradation signals on some important bird functional traits.

We found species richness on average higher in farmland than other natural habitats (i.e. woodland, bushland etc.) and these were significantly lower in sites with high poaching. In contrast, bird functional diversity showed strong correlation with poaching and habitat loss signals. These results confirm that although tropical farmlands can have high bird density and species richness, presence of high exploitation pressure can erode species that perform important ecosystem functions with dire consequences on the ecosystem services provision. We suggest that conservation in landscapes bordering protected areas should improve strategies to reduce species loss associated with illegal hunting.

Keywords: Bird trade, bird trapping, ecosystem services, functional guild, Species richness

Analysis of Utilization of Honey by-products among Beekeepers in Sikonge District, Tabora

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Abstract

Beekeeping in Tanzania plays a major role in livelihood, economic and environmental Conservation particularly in protected areas. It is a source of food such as honey, pollen and brood. Furthermore, beekeeping contributes to various raw materials for industries such as beeswax candles, lubricants and medicine (honey, propolis, beeswax and bee venom). Beekeeping is among of the income generating activities and if full utilized, it can improve income of the bee keepers. However, there is limited information on whether beekeepers utilize other honeybee by-products such as bee venom, beeswax, royal jelly and bee soup to improve household income. Therefore, this study was conducted in Tabora-a leading honey producer region in Tanzania. Data

were collected through questionnaire survey, focus group discussion and key informant interview. The target population of this study was households of beekeepers, groups of beekeepers, officials (local government officials, officials from beekeeping and forest department and Forest based organizations) from Sikonge district. Descriptive and quantitative statistics and thematic analysis were used to analyze the collected information. Despite the potentiality of beekeeping in Sikonge district only honey and beeswax products were produced by the keepers while other products were not utilized. However, the honey and beeswax were produced at low quality. It was also noted that, there were several factors limiting standard honey and beeswax production and also the production of other bee –products. These included lack of technology and awareness that lead to poor harvesting and processing of honey and beeswax, low income to buy modern beehives to produce other bee-products, cultural inherited local technology from ancestors and low level of awareness among beekeepers. The study recommends policy options to influence beekeepers to produce other honeybee by-products. These include awareness creation, capacity building especially in training on beekeeping practices, provision of credit to facilitate the use of modern beehives and equipment in order to harvest other honey bee products.

Keywords: Honey bee-by products, utilization, beekeeping and beekeepers

Analyzing the Potential for Ecohydrology in Climate Stressed River Basins: Experience from Mara River, Tanzania

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Abstract

Mara River is a transboundary water body between Tanzania and Kenya that drains into Lake Victoria. This transboundary water body is crucial for various ecosystem services for the local communities along the catchment. Despite its ecological and economic importance, the river is under increasing pressure caused by anthropogenic activities and climate change impact. The basin is losing many of its important ecological and economic functions with serious consequences on aquatic biodiversity, significant reduction of livelihood opportunities, water eutrophication, changed water regimes and increased water use conflicts. This study was carried out to identify drivers for climate change and environmental degradation effects of mining activities on water quality effects of agricultural activities on stream discharge and to establish approaches for river basin management and environmental conservation. Socio economic data were collected through household questionnaires, interviews and participant observation. Ecological data on water quality, flow and heavy metals were obtained from gauging stations at North Mara environmental labaratory and Lake Victoria Basin Offices and data analysis was conducted using Statistical Packing for Social Sciences and Microsoft Excel. The study revealed that climate change and environmental degradation along Mara River Basin were caused by direct and indirect drivers. Direct drivers for environmental degradation and climate change was due to agricultural (41%), mining (34%), livestock keeping (13%) and deforestation (12%). The study found that impairment for water quality was due to excessive NO3 and PO43 concentrations that exceeded the recommended levels in most sites by direct drivers which cause adverse impact on the ecosystem. Based on these findings, this study proposes Ecohydrology and management framework that encompasses Integrated Water Resource Management (along the entire basin should be applied and also, developing new species susceptible to the impacts of climate change . It also recommends the incorporation of cultural attitudes / indigenous

knowledge and gender participation as the customary land tenure system along the entire river basin. For sustainability of the MRB resources, a well coordination of natural resources and livelihoods projects, programs and stakeholders' participation are necessary without neglecting cultural aspects in water resource management.

Keywords: Heavy metals, Hydrological services, Mara River Basin, River regime, Water quality

Consumer Willingness to Pay for the Colour of Cooking Oil: A Comparison of Rural and Urban Consumers in Tanzania

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Abstract

Colour is considered an important parameter that consumers take into account during product evaluation; however, this attribute may be lost or altered during processing of the product. The Tanzanian government has put sunflower as one of its priority crops under the Agricultural Sector Development Programme Phase Two (ASDPII), and to ensure food safety, it requires that all cooking oil sold in the market is double refined. This study looks at consumer preferences and Willingness to Pay (WTP) for the colour of cooking oil among rural and urban consumers in a developing country. In addition, the study also assesses the effect of information about the level of refinement on the WTP for the colour of cooking oil. Using the multiple price list format in eliciting consumers WTP, an interval regression model was estimated. The study identified health considerations, naturalness and sensory taste as the most important factors influencing consumer preference and WTP for the colour of cooking oil. The study found that without information, the average WTP for dark, light and very light cooking oil were TZS 3288/litre, TZS 3096/litre and TZS 2756/litre respectively. It was also found that urban consumers reduced their WTP for dark oil after getting information by 30.1% while rural consumers increased their WTP by about 7.2% regardless. On the other hand, both rural and urban consumers increased their average WTP for very light oil by about 26% when they received information. Furthermore, estimates from the interval regression model revealed that very light-coloured cooking oil was discounted in the absence of any information, but that changed once consumers were exposed to information on the level of refinement. With information, urban consumers were willing to pay significantly higher for very light cooking oil followed by light cooking oil and dark cooking oil unlike their rural counterparts. The study recommended that the government should embark on educating the population to allay fears that push consumers away from very light cooking oil and also government can revisit its policy on double refined cooking oil and make room for consumers who prefer unrefined due to health concerns.

Keywords: colour; information; WTP; Tanzania; interval regression

Impact of Urban Expansion on Land Surface Temperature in Dodoma and Morogoro Cities, Tanzania

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Abstract

The study aims to evaluate the impact of metropolitan growth on land surface temperature (LST) in Dodoma and Morogoro metropolises. The paper adopts remote sensing methods to extract and analyze time-series Landsat satellite images from 2000 to 2018. An administered taxonomy was applied to map urban land-use change. Thermal and reflectance bands analysis were employed to retrieve and compare the Surface Temperature, Normalized

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Difference Vegetation Index (NDVI), urban expansion patterns, and the overall growth prominence in the cities. The results revelead a negative correlation between LST and NDVI indicating that dissipating vegetation cover within the two study areas was responsible for the increase in LST over the study period. Also the metropolis of the study area rapidly expanded over the evaluation period with impermeable surface replacing soil and vegetation land cover categories. Increasing LST was mostly due to conversion to the built-up area from non-built area. Therefore, the study concludes that urban surface temperature is strongly influenced by land cover dynamics. The study suggests that planning of African cities should incorporate greening and sustainable energy use, and mass transportation.

Keywords: At-sensor brightness heat; urban planning; land surface temperature; SDGs; Dodoma; Morogoro

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

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Abstract

The long-term sustainability of agricultural systems 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 leads 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: Okra yield; Farming practices; Smallholder farmers; Agro-ecological practices

Local bird density varies in areas contrasting in hunting pressure in human-dominated rural landscapes of central Tanzania

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Abstract

Illegal hunting of birds for bushmeat and trade and habitat degradation are among biodiversity crises that have received considerable attention in research in many tropical countries, but most biodiversity bases targeted by the illegal hunting and trade are rarely assessed to evaluate status of the biodiversity exploited. This gap precludes the possibility for identifying the potential deleterious effect of over-exploitation of the target species and thus, the designing of the mitigative measures to improve biodiversity conservation. We assessed bird density in four rural areas of central Tanzania with differing levels of illegal hunting for bushmeat trade. We predicted that

bird density should be lower in areas experiencing higher trapping levels and high habitat degradation than areas with minimal bird trade and, that carnivorous bird guild at higher trophic level should have lower density due to the cascading effects of targeting their prey base. Bird density was two to three-times lower (111.4 bird/ha) in site with higher levels of illegal hunting and habitat degradation signal than other sites (266.79 bird/ha - 379.64 bird/ha) and also varied greatly between habitat types. Higher densities of birds were recorded in active farmland (53.59bird/ha) and woodland (65.21bird/ha) than in shrubland (6.59bird/ha) and fallowland (19.57bird/ha). Furthermore, the density of raptors (1.98bird/ha) was significantly lower than for other specialist feeding groups such as insectivore (129.2bird/ha) and granivores (61.1bird/ha). The low densities of important functional groups such as nectarivores (0.2bird/ha) and raptors suggest the negative impacts the illegal bird trade could have on these bird groups and, undermine the sustainability of the ecosystem functions performed by these birds. These results are important for devising strategies to minimize the impact of hunting on these potentially threatened bird guilds.

Keywords: bird survey; bird bushmeat trade; ecosystem services; functional guilds; poaching

A conceptual Framework Linking Well-being and Biodiversity Outcomes in Forest-agricultural Landscapes

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Abstract

Global and local demand for agricultural products continues to grow. However, efforts to boost productivity exacerbate existing pressures on nature, both on-farm and in the wider landscape. One of the pressing challenges of our time is how to ensure human well-being in rural tropical crop production landscapes, relied on for livelihood and food security, whilst maintaining or enhancing local biodiversity. There is still limited empirical evidence of the interrelationships between natural capital, the benefits derived from nature in crop production lands, and food security, especially when the specificities of local socioeconomic contexts are considered. Agroforestry practices are frequently framed as win-win solutions to reconcile the provision of ecosystem services important to farmers (i.e. maintaining soil quality, supporting pollinator and pest control species) with nature conservation. Yet, underlying trade-offs (including ecosystem disservices, e.g. from pest species and herbivores) and synergies (e.g. impact of ecosystem service provision on well-being) are seldomly analysed together at landscape scale. Here, I propose a system model framework to analyse the complex pathways, with which natural capital on and around farms interacts with human well-being, in a spatially explicit manner. We propose the application of the framework within a biodiversity priority landscape in the Southern Agricultural Growth Corridor of Tanzania, a public-private partnership initiated in 2010 to step up production of rice, maize, sugarcane, and other cash and food crops. The framework integrates across biodiversity, food security and climate change dimensions of resilient agricultural landscapes as socio-ecological systems that retain the capacity to adapt in the face of change in ways that continue to support human well-being. The system model is based on metrics and pathways that can be quantified and parameterised providing a measurable way forward for the management - and monitoring of management effectiveness – of forest-agricultural landscapes for multiple outcomes.

Keywords:

Addressing Residents' Vulnerability to Livelihood Shocks through Tourism Development adjacent to Protected Areas in Northern Tanzania

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Abstract
There is a general consensus that development of nature based tourism adjacent to protected areas (PA) diversifies livelihood to residents and in turn, helps in reducing vulnerability to multiple shocks. However, there is unclear understanding on extent of reduction in vulnerability to shocks through tourism, especially at household level. This study makes contribution to the body of knowledge concerning tourism impact on livelihood vulnerability to multiple shocks among residents in three PA-adjacent tourism destinations: Loliondo, lake Natron and Burunge. A multi-method approach was used to collect data. Interview, focus group discussions and survey among 555 tourism beneficiaries and 432 non beneficiary households, matched by propensity scores, led to effective triangulation of data on shocks, coping mechanism and changes in household's wealth from year 2008/9 to 2018/19. It was found that, tourism has significantly raised the wealth status from ordinary poor to normal among benefiting households than non-benefiting, thus, enabled them to reduce vulnerability to drought, livestock diseases, rise in food prices and illness, by effective shock-coping activities. Increased access to resident's financial and human resources are recommended for further reduction in vulnerability to livelihood shocks
Keywords: Tourism development, Vulnerability, livelihood shocks, northern Tanzania

Consumers' Awareness and Motivational Factors to Participate in Agritourism: Case Studies of Dar es Salaam and Morogoro Regions

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Abstract
Agritourism is increasingly becoming one of the very important pro-poor business opportunities in many countries. It is considered as a means of diversifying agriculture and tourism in order to stimulate the growth of income and poverty reduction in rural areas. In Tanzania, this venture has remained largely an overlooked and an untapped opportunity, and hence it has limited contribution to the overall rural economy development. People's participation is the key factor in agritourism performance in terms of revenue and profit collections. Studies have shown that lack of awareness and interest to participate can contribute to low performance of this niche tourism market. A qualitative study was conducted in Dar es Salaam and Morogoro regions to assess consumers' awareness, (measured in terms of knowledge and perceptions) and motivational factors for their participation in agritourism. Likert scale of five points and open-ended questions were used to collect data. The findings of this paper offer useful insights and grounds for planning and developing agritourism in the country.
Keywords: agritourism, rural economy, research and policy, Tanzania

Developing a Dynamic Partial Equilibrium Forest Sector Model for Mainland Tanzania and Assessing Impacts of Firewood and Charcoal Production and Consumption on Forest Sustainability

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Abstract

The Forest sector in Tanzania is facing a number challenges due to the high demand of the various forest products. The high demand of forest products is caused by various factors including the fast increasing population, technological changes, high urbanization rates as well as the relatively high economic growth. To plan and use the existing forest resources sustainably, models for estimating wood biomass demand and consumption in the country are therefore inevitable. However, development of these models need a vast amount of data, technical skills and expertise at a country level. This study aimed to address these issues by developing a forest sector model for Tanzania which could be used for various economic and policy analysis in the Country. The idea was to develop a forest sector model which integrates wood supply from detailed forest data from Tanzania's National Forest Inventory (NFI) NAFORMA with demand for wood products, and apply the model to evaluating sustainability impacts of the future production and consumption of firewood, charcoal and poles in mainland Tanzania. The developed model (TanzFor) is classified as an intertemporally optimized spatial equilibrium model, and links in an economic consistent framework supply and demand for fuelwood, poles and charcoal as well as other forest industry products. This is the first study Tanzania applying this kind of model using the detailed NAFORMA data and newly developed miombo forest growth functions as basis for the wood supply. The model results show alarming negative impacts on forest growing stocks by the steadily increasing consumption of firewood, poles and charcoal in Tanzania. This is mainly caused by high population growth, high urbanization rates, utilization of low efficient technologies in both charcoal production and consumption, and rather free access to forest land. Technological improvement for both charcoal and sawn wood production and consumption seems to be an important aspect for dealing with the high rate of deforestation in the Country.

Keywords:

Drivers and Causes of Land Cover and Land Use Change Patterns of Kilombero Wetlands, Morogoro, Tanzania

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Abstract

Understanding land cover and land-use (LCLU) change and the underlying socio-economic drivers for the change patterns is important in the management of wetlands globally. Thus, this study assessed the trends of LCLU changes and its major driving factors in the Kilombero wetlands. Remote sensing technique and geographical information system were used to generate biophysical data on LCLU spatial and temporal changes over the past 19 years (2000-2019). Image analysis was performed using the Landsat-5 Thematic Mapper from 2000 and the Landsat-8, Operational Land Imager from 2019 using semi-automatic classification algorithm for classification and QGIS 2.12.2 software for mapping. Land use classes included farmland, artificial surfaces, waterbodies, forest cover, wetlands, grazing land, and shrubs. Socio-economic data were obtained through key informant interviews, focus group discussions, household surveys, and triangulation

workshops. Between 2000 and 2019, the area ratio of farmlands increased by 871,372 ha (21.59%), whereby farming activities have encroached forest cover by 10.82%, shrubs by 0.25%, grazing land by 1.0%, water bodies by 0.11%, and wetlands by 0.95%. Grazing land has increased by 514,420 ha (12.74%), indicating that livestock keeping has increased grazing land by converting 7.12% and 0.43% of forest cover, and wetlands respectively. Grazing land has gained 0.63% from farmland. Forest cover was converted to 6.28% shrubs, 10.82% farmlands, and 7.12% grazing lands indicating a decrease of 1,711,888 ha (42.41%). Wetlands decreased by 124,783 ha (3.09%) while water bodies decreased by 38,890 ha (0.96%). Agriculture and livestock grazing were listed as major socio-economic factors that have amplified the degradation of the Kilombero wetlands. We conclude that over the past 19 years LCLU change has occurred in Kilombero mainly due to agriculture and livestock grazing. If these activities are not regulated, there is a danger of further impairments on this vital wetlands ecosystem. Therefore, we advise promoting sustainable crop-farming, and livestock production to avoid more negative impacts on Kilombero wetlands.

Keywords: Land use change, land cover, wetlands, forest cover, grazing land, waterbody

Economic Contribution of Tourism to Livelihood Development and Climate Change Adaptation in Lake Eyasi, Tanzania

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Abstract

Climate change constitutes one of the most pressing challenges to achieving sustainable livelihoods of most rural communities in Tanzania. In Lake Eyasi, the livelihoods of most indigenous community members are severely affected by severe droughts. Tourism is seen as an important activity which provides adaptation solutions necessary to overcome the effects of droughts. While many plans have been formulated and put in practice to maximise the contribution of tourism to rural livelihoods, there is little documentation of the extent to which such goal has been achieved. Using two communities in Lake Eyasi (Barabaig also known as Datoga and Hadzabe) as case studies, this article exemplifies some success stories about contribution of tourism to livelihoods development and adaptation to climate change impacts. The article is based on the empirical study conducted in 2019/2020; where gross margin profit ratios were used to compare the profitability of five livelihood enterprises: livestock keeping, agriculture, hunting, wild fruits collection and tourism. The findings of this study indicated that in Hadzabe community, tourism significantly contributed higher margin than hunting and fruits collection. Although in the Datoga community livestock scored the first in terms of profit margin, tourism significantly cushioned the community from being affected by severe droughts. In both communities, tourism contributed significantly to job creation, building of social and human capitals – particularly education; the benefits which, in turn, are used as strategies to increase the communities' resilience against climate change impacts and as means to stimulate conservation spirit among local communities.

Keywords: Tanzania, Tourism, climate change adaptation, livelihoods, conservation

Genetic Diversity of Greater Cane Rat Population in the Eastern Arc Mountains Ecosystem, Tanzania Based on D-loop Region of Mt-DNA

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Abstract

Conservation of smaller mammals is still underappreciated than for larger charismatic mammal species, partly because of their cryptic contribution to the mainstream economy, and the scarce information on important biological traits of smaller mammal species that would help improve their conservation. This poses a conservation dilemma especially for species already experiencing high exploitation pressure such as greater cane rats. We used non-invasive sampling techniques to characterize the genetic diversity and structure of the greater cane rat populations from two spatially-isolated mountain blocks in the Eastern Arc mountains ecosystem of Tanzania. Application of DNA sequences of the D-loop region of MtDNA of 50 cane rat samples from two Eastern Arc Mountains was used, Uluguru (n =35) and Udzungwa (n = 15) to understand potential conservation threats faced by the cane rat population based on the genetic signatures. A total of 25 haplotypes from 49 polymorphic regions (32 parsimoniously informative and 15 singleton sites) were defined. Of the haplotypes found, 15 were from Uluguru urban, 7 from Uluguru rural and 9 from Udzungwa. The mean haplotype diversity (pi) of the cane rat populations were 0.937±0.029 for Uluguru urban, 0.933±0.062 for Uluguru rural and 0.964±0.026 for Udzungwa. Further, nucleotide diversity (π) for the three populations was 0.01313, 0.01134 and 0.02254, respectively. These high haplotype diversity indices suggest high genetic diversity between the three populations. A median-joining network and neighbor-joining tree analyses established that all haplotypes were distinctly grouped into three major clades; from Udzungwa, Uluguru and mix of the two. The analysis of molecular variance (AMOVA) based on geographic structuring of the cane rat populations indicated significant difference between the studied populations (Fst=0.16, p=0.00098). This is the first study of cane rats in East and Southern Africa and provides a basis for conservation planning and future studies into the ecology of this species in the region.

Keywords: genetic conservation, genetic structure, haplotype diversity, small mammals, Tanzania

Geographic Biases in Cane Rat Research may Impede Broader Wildlife Utilization and Conservation in Africa: a Systematic Review

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Abstract

There is a growing body of literature about cane rats species but most of the published work is patchy and current spatial distribution is unknown which limits its wide application in utilization of the species for broader commercial game industry and for improving wildlife conservation across Africa. We conducted systematic review of 56 years (1964 - 2020) of the cane rat research to understand existing research gaps, to analyze the spatiotemporal and thematic patterns and investigated factors that influence publication of the cane rat research in widely recognized journal outlet. We found 308 publications on the cane rat species from 14 countries authored by 39 nationalities globally. The publications increased significantly over the study period, with 97.7% of these biased geographically and thematically towards the west and central African region. Further, the published research mostly covered one species, the greater cane rat, and none had covered the biogeography, food biology and conservation of any of the two cane rat

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species insitu. Also the author nationality was found to have the strongest influence on publishing the research in journals with or without impact factor. These results suggest that the financial limitation and quality of the research influenced most cane rat research published in local national or regional journals which mostly had limited accessibility for wide-spread research use to improve applied conservation programs. Expanding coverage of the cane rat research in other species-range countries in the east and southern African regions will be necessary to tapping the species as a priority commercial game to reducing exploitation pressure on the wild mammal populations particularly in the African savannas where illegal hunting for bushmeat consumption is a growing problem.
Keywords: Cane rat conservation, game farming, research trend, spatialtemporal, small mammals

Groundwater Governance Levels in Njombe District in Tanzania

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Abstract
Despite existence of institutional and legal framework of water management and governance in Tanzania, groundwater governance is less improved compared to surface water in the country. This study adopted governance principles to quantify groundwater governance levels from governance actors' perspectives. The study also adopted cross-sectional research design, and a random sample of 250 respondents was involved. The Kruskal Wallis H Test and the Mann Whitney U Test were used to compare responses between different groups while qualitative data were examined through the content analysis method. Overall, groundwater governance was low, and this was reported by 53.2% of the respondents. The level of groundwater governance was significantly low and differed statistically at 5% by localities and by governance principles mainly participation, equitability, efficiency, rule of law and responsiveness. Further, there was statistically significant difference in respondents' responses between male and female on the level of participation (P = 0.002), efficiency (P = 0.045) and the rule of law (P = 0.015). Female showed higher levels of governance principles than male respondents. The study concludes that groundwater governance was not impressive, and this is translated into poor groundwater governance. Therefore, groundwater governance actors should practise all eight (8) governance principles effectively to improve governance.
Keywords: Groundwater governance, Management, Njombe, Tanzania

Habitat Suitability and Distribution Shifts of 5 Rubiaceae Tree Species under Climate Change in Two Eastern Arc Forests, Tanzania

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Abstract
Climate change has already impacted many natural forest ecosystems and is projected to have increasingly serious impacts in the future. Tropical forest ecosystems are of particular concern due to the high levels of biodiversity that they maintain and the ecosystem services they provide. Therefore it is important to predict the effects of environmental change on distribution patterns of species for proper conservation planning and sustainable development. This paper highlights the results of a study that was conducted in the two forests of the Eastern Arc Mountain (EAMs) in Tanzania namely East Usambara Forests (EUF) and Udzungwa Mountain Forests (UMF) using five sample tree species belonging to family Rubiaceae. Using the sample tree species the study predicted the effects of climate change on tree species

distribution in EUF and UMF of the EAMs and explores some implications for economic development in Tanzania. Maximum Entropy Distribution (Maxent, version 3.3.3k), was used to model the distribution of 5 dominant Rubiaceae tree species based on the frequency of occurrence and 11 uncorrelated environmental variables. Fifty percent of the species were predicted to lose their habitats while the other fifty percent increased their habitats under 2055 A1B emission scenario in EUF. With few exceptions, the suitable habitats were predicted to increase for most species in EUF in 2055 B1, 2090 A1B and 2090 B1 emission scenarios while species in UMF were predicted to lose their habitats with few species predicted to gain habitats, a trend that was similar in all scenarios. Climate change effects were mainly driven by climatic variables followed by edaphic variables while topographic factors had no effect for the selected Rubiaceae species. Soil factors have shown stronger effects in the UMF than in the EUF while the effects of temperature and precipitation were strong in both site for all species. Mixed responses in species distribution suggest dynamics in future adaptation and mitigation plans as well as biodiversity conservation plans and thus to provision of ecosyetem services essential in economic development. That means local patterns of climate are essential in developing site-specific adaptation and mitigation and conservation strategies for economic development.

Keywords: Species distribution patterns, climate change, mitigation and adaptation, biodiversity conservation, economic development

Mitigation Measures for Human-Wildlife Conflict in Tanzania: are we on the Right Track? a Restrospective Study

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Abstract

Human-Wildlife Conflict (HWC) is no longer a new phenomenon as human and wildlife share the same landscapes and resources. A great concern related to HWC in Tanzania is its consequences on both human and the wildlife. In Tanzania, most Protected Areas (PAs) are surrounded by local communities making them an isolated islands. Rapid increase in human population and expansion of human settlements lead to encroachment and change in land use system hence accelerate conflicts. This calls for effective management strategies and the balancing between people's livelihood and wildlife conservation, because we need both wildlife and human resources for the country economic transformation. The objective of this study was to provide a general overview of the mitigation strategies used in the management of human-wildlife conflict in Tanzania in the past 20 years. To achieve the goal, a desktop review analysis was performed on published articles, government reports and scientific proceeding from Google scholar, PubMed and Google databases. It was revealed that different mitigation strategies have been employed in solving human-wildlife conflicts. However, most of the strategies used were specific for solving specific form of conflict at specific hotspot. This suggested that, there is no clear solutions that merged to be effective in every circumstance. Hence, there is a need for deep understanding on the strength and weakness of each method at different hotspots, as the way toward long-lasting solutions which will enhance livelihood and security of local communities as well as the wildlife resource.

Keywords: Human-Wildlife Conflict, Livelihood, mitigation strategies, Tanzania

Mapping Groundwater Potential Areas in Morogoro Urban Municipal using Landsat Images (2000-2019)

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Abstract

The decline of freshwater resources globally is hypothesized as a result of climate change, freshwater salinization, land use and land cover change (LULC), population explosion, and pollution of water resources by human activities. This decline has risen the need for having additional freshwater source apart from surface sources such as lakes and rivers in order to meet daily fresh water needs. In Morogoro Urban Municipal (MUM) this additional need for freshwater has been met through the utilization of underground freshwater storage.The study addresses this gap by examining: 1) spatial-temporal pattern of urban expansion, agricultural change and population growth in MUM (from 2000 to 2019); 2) The significance of the groundwater on the urban future of the city. Using Remote sensing satellite images (2000 and 2019) Digital Elevation Model (DEM) and GIS techniques were acquired and used to prepare drainage density, lineament density, slope gradient and topography thematic maps. Also soil types, population data and geological properties data were obtained from National Bureau of Statistics. The spatial analysis was prepared to overlay these thematic maps and to produce a groundwater potential map. Results indicated that, about 41.1% of MUM have a potential of consuming groundwater area with Mkundi, Lukobe, Mindu and Kihonda wards showing a highest potential than other wards. At this recorded rate of availability of underground water and increase in population in the city, there is clearly a potent of exploiting groundwater resources in MUM to meet both domestic demands and expanding agricultural demands. Therefore, the study recommends adoption of urban planning framework that integrates groundwater availability and surban agriculture as a major component of planning for a brighter future of MUM.

Keywords: Ground water, remote sensing, thematic maps; weighted overlay; Morogoro, SDGs

Lumber recovery and production rates of small-scale mobile sawmilling industries in Northern Tanzania

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Abstract

In the recent decade Tanzania had witnessed a large transformation in sawmill technology, moving from conventional fixed based to mobile sawmill industries. This is because of the advantages of mobile sawmills in terms of flexibility in their operations, less investment cost and less technical demand as compared to stationary saw mills. However, there is limited information on their technical efficiency in terms of lumber recovery and production rates across the country. Such information is important for understanding the general performance and economic viability of the mobile sawmill industries. Thus, this study was carried out in Lushoto district, Northern Tanzania to quantify technical efficiency of mobile sawmills by determining the lumber recovery rates and production rates of two mobile sawmills namely Wood mizer (band saw machine) and Ding dong (circular machine). The results indicated that wood mizer had lumber recovery of 51.3% and production rate of 0.64m3/hr, while Ding-dong had lumber recovery rate of 35.2%, and production rate 0.86m3/hr. Generally, our results have shown that both of the sawmills have reasonable lumber recovery rates and production rates irrespective of the differences between them, where Wood mizer had great conversion efficiency compared to the Ding-dong

machine. Considering the reduced supply of saw logs for sustainable forest management, a machine with high conversion efficiency is highly encouraged than machine with high speed of production, thus Wood mizer stands to have more chances of applications as compared to Ding-dong machine which had relatively higher production rates. However, we encourage further studies to investigte how other factors associated with the economics and tree species influence performance of these mobile sawmilling machines.

Keywords: fixed based, mobile sawmill, Wood mizer, Ding dong, Lumber recovery, production rates

Recent Changes in River Discharge in a Tropical Semi-arid Lowland: Climate Versus People in the Great Ruaha River Sub-catchment of Tanzania

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Abstract

River discharge in many semi-arid lowland environments of tropical Africa depends substantially upon water balances that occur remotely in humid uplands. In the Usangu Plains of the Upper Great Ruaha River (UGRR) Sub-Catchment of Tanzania, trends toward lower dry-season river discharge and an increased frequency of no-flow conditions have been observed downstream of this floodplain over the last two decades. Increased freshwater withdrawals for irrigation in this productive agricultural region within the Southern Agricultural Growth Corridor of Tanzania have, to date, been used to explain this hydrological change; less attention has been given to potential changes in the upland water balance. Here, we examine records of river discharge from five upland stations (i.e. Rivers Mbarali, Kimani, Chimala, Ndmebera, and Great Ruaha at Salimwani) and the lowland outlet of the UGGR at MSembe over hydrological years (1st Oct to 30th Sept) from 1972/73 to 2010/11. Due to substantial gaps in these observational records, especially in the late 1980s, comparative analyses were conducted over two 13-year periods (1972-1985, 1998-2011) for which near-continuous records exist. Our results provide compelling evidence that changes in the upland water balance, likely climate-driven, have played a critical and possibly dominant role in causing for observed reductions in dry-season river discharge at the sub-catchment outlet at Msembe gauge. First, river discharge at Msembe shows a strong linear dependence upon upstream specific (catchment-averaged) river discharge exceeding a threshold of ~50 mm over both time periods; second, substantial reductions in river discharge have occurred upstream and downstream between the two time periods; third, the amplification of statistically extreme high and low (5th & 95th percentile) river discharges is observed in both upstream and downstream river discharge; and fourth, no-flow conditions at the UGRR outlet have been observed in 1978-1979 prior to the expansion of irrigated agriculture in the 1980s. Further research is required to resolve whether changes in the upland water balance derive specifically from changes in climate alone or in conjunction with land-use change. Greater recognition is needed of the possibility of climate change in driving observed changes in dry-season river discharges in semi-arid lowland environments nationally and regionally.

Keywords: climate, Great Ruaha River, river discharge, tropical semi-arid lowland

Modelling, Predicting and Mapping Above-Ground Biomass using Sentinel-2 Remote Sensing in Magamba Nature Forest Reserve, Northern Tanzania

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Abstract

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is one of the global initiatives aimed at combating climate change impacts in the Tropical countries. However, successful implementation of REDD+ requires accurate information on forest area and carbon stocks as the basis for the computation of carbon emission. Thus, the main objective of this study was to estimate the above-ground biomass (AGB), a key parameter for the estimation of carbon stocks using the combination of field and Sentinel-2 remote sensing data at Magamba Forest Nature Reserve located in Lushoto district, Northern Tanzania. Fifty five field sample plots were established and measured. Cloud free Sentinel-2 data was downloaded from the United States Geological Survey (USGS) website and processed using Sentinel Application Platform (SNAP) software. Eighteen variables (ten bands and eight derived vegetation indices) were extracted using two approaches, a centroid and weighted approach. Statistical models relating measured AGB of each field plot with the respective Sentinel-2 variables extracted by each approach were developed. The performance of these AGB models were assessed using the coefficient of determination (R^2) and the relative root-mean-square-error (RMSE) computed based on these predictors. The results showed that the model derived from the weighted extracted values model had the highest accuracy (R^2 = 0.88, RMSE = 26.47%), followed by the centroid extracted values model (R^2 = 0.87, RMSE = 27.34%). A prediction map was produced whose mean AGB (209.33 Mg ha^{-1}) was close to that of the mean field AGB (225.19 MG ha^{-1}), the minimum and maximum values of AGB (44.04 and 596.11 Mg ha^{-1}) intersected with those in the field (19.05 and 720.19 Mg ha^{-1}). The uncertainty in the prediction map was about ± 3.038%. Therefore, results in this study demonstrated that Sentinel-2 imagery and RF-based regression technique has the potential for large-scale AGB estimation in tropical rainforests. Other Sentinel-2 variables such as textures, vegetation indices and their combinations with spectral bands of various seasons (such as rainy and dry seasons) can be considered in future studies to enhance precision of the estimates.

Keywords: Above-ground biomass, REDD+, remote sensing, Sentinel-2, uncertainty

Morphometric Analysis and Sexual Dimorphism of *Artemia* Population in Tanzania

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Abstract

This study aimed at analyzing morphometric characteristics of *Artemia* from salt pans in three regions:Tanga, Coast and Lindi located along the Tanzanian coast. Size distribution and morphometric traits between sexes were compared. At least 20 individuals per sex were measured making a total of 120 for the three sampled regions. We measured morphometric characteristics including total length, abdominal length, length of the furca, width of the head, diameter of a compound eye, inter-orbital width and ovidac width under dissecting microscope using ocular meter. Morphometric analysis was conducted using principal component analysis (PCA). The minimum and maximum size of total length of *Artemia* from Tanga and Coast saltpans ranged from 5.0 to7.2 mm with two cohorts. The PCA results showed that there is sexual difference in terms of size based on some morphometric characteristics showing sexual dimorphism. The common character which contributes on differences between the sexes for all sampling

sites was inter-orbital width for PC1 and PC2. Other characters were total length and eye diameter. It can be concluded that sexual dimorphism observed from all sampled sites indicate that probably this *Artemia* population belongs to the same species. Further studies recommended on the quality and molecular analysis to improve our understanding of the biology of these species.

Keywords: Sexual dimorphism, *Artemia*, Morphometric characters, Aquaculture

Patterns of Community Structure and Species Composition of Flower Visiting Flies Associated with Cultivated Cucurbit Crops in Morogoro, Eastern-Central Tanzania

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Abstract

Flower visiting flies are among major pollinator taxa of agricultural importance. Little was known about the patterns of community structure and species composition of flower visiting flies associated with cultivated cucurbit crops in Tanzania prior to this study. Understanding pattern of community structure and species composition of flower vising flies could be of great help in designing sustainable field pollinator conservation strategies. This study was carried out from March 2020 to July 2020 in the plateau and mountainous zone of the Morogoro region to investigate patterns of community structure and species composition of flower visiting flies in cultivated cucurbit crops. Flies were trapped using yellow pan traps and hand net from ten established cucurbit fields. A total of 7606 flies belonging to 22 morphospecies were collected. 77.58% of the individuals were collected from the mountainous zone while the remaining 22.42% were collected from the plateau zone. Both Shannon, Simpson and Margalef indexes placed mountainous zone as the most abundant and species rich zone. Species abundance distribution models described the patterns of community structures within cucurbit crops as hierarchical structured communities with only a few, abundant species dominating the communities and many rare species. All fields were highly similar as most of the species were shared between fields within each zone.

Keywords: Patterns of Community structure, Species composition, Flower visiting flies, Cucurbit crops

Productivity Analysis of Conventional and Integrated Timber Logging Operations

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Abstract

With the current demand of wood products and industrial revolution, plantation owners need
to re-think the ways in which harvesting is carried out and identify the most efficient harvesting system between Conventional Logging (CL) and Integrated Logging (IL) as per each industry's product specifications. In this paper we contribute to the discussion by comparing the productivity between CL and IL. A study was carried out in Sao Hill Forest Plantation in Iringa - Tanzania which focused on determining the harvesting productivity, costs and profit margins of IL and CL. A purposively selected compartment was sampled into IL block and CL block, with 30 trees randomly selected to be harvested at each block. Data collected involved stand parameters like DBH, tree height and log dimensions. Time studies of CL and IL systems, were used for productivity estimation. The findings portray IL had productivity of 13m^3/hr exceeding CL by 9% and average increased profits of 171 000 TZS/m^3 which is about double the profits obtained from CL. From the findings, the study deduced that the IL recovery of

standard stem-wood for use in different industries in this case study had significant impact on the productivity and profit margins of the systems.
Keywords: Conventional logging, Integrated logging, productivity, profits

The Nexus Between Climate Crisis and Land Use Planning in Tanzania

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Abstract
Tanzania like other East African countries and globally has been affected with climate change impacts. Climate change impacts said to worsen unless urgent measures are taken. Anthropogenic Green House Gas (GHS) emissions mainly from land use activities and continuous land use change linked to deforestation and agriculture from livestock and soil identified to worsen the situation as compared to other activities by sector. The finding of study from desktop research assessed and identified land policies, climate policies and strategies, the status of land tenure and how it influences land use and land use change, initiatives led by the Tanzanian government towards addressing climate crisis as linked to land use planning. Land use and land use planning policies and climate change related policies were analysed to find synergy to build community resilience for socio economic development. The study identifies existing gap between land use planning, land policies and climate change related policies. Some of them include lack of institutional coordination for implementation of land use policies and climate related policies. Land tenure and land rights identified to be central in land investment and projects planning and implementation, though sustainable land use management and climate change related issues have been noted with less emphasize. Legal framework identified to provide clear land protection for both men and women, though some discrepancies in enforcement and accountability at Village-level leads to land tenure insecurity for external and small group interest. Insecurity of land tenure found to cause community conflicts and undermine efforts to climate resilience and sustainable land use management. Moreover, women are said to be more prone to all forms of land tenure insecurity and violation of relation to land rights.
Keywords: Land tenure, Land use, Land use planning, Climate Change, Policy, Legal Framework

The Potential for Ecosystem-Based Management Approach through Riparian Forests Enhancement

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Abstract
Climate change, ecosystem degradation and hydro-ecological disasters are among the global threats toward achieving sustainable development. Population affluence is also known to worsen the situation via anthropogenic conducts in vital natural ecosystems. Nature-based ecosystemic solutions has in that regard been widely proposed to curb climate change and variability, enhancing resilience and management of hydro-ecological disasters via protecting vital ecosystems to ensure ecosystem services. Riparian forests are by controlling river-bank erosion, trapping and redistributing sediments, chemicals and pollutants filtration; essential for hydro-ecological systems management although they are globally impacted by climate change and anthropogenic influences. This study explored the vitality of riparian forests to the river ecosystem by examining riparian vegetation species, distribution, anthropogenic conducts within the riparian zone and associated impacts to riparian vegetation and the entire river ecosystem along Ngerengere River in Morogoro Municipality, Tanzania. Biological data (riparian vegetation) were

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collected by belt transect method along the river continuum at 100 m interval, then after, specie abundance was expressed in percentage while anthropogenic interactions were gathered by field observation and household interview. Descriptive analysis followed by the Statistical Package for Social Sciences and Microsoft Excel. The study found major seven riparian vegetation species: Pennisetum purpureum, Phragmites mauritianus, Typha domingensis, Phragmites australis, Cyperus rotundus, Sesbania sesban and Ficus sycomorus whose diversity and richness were highly threatened by the activities conducted, in some places becoming extinct. The major anthropogenic influences included cultivation, water abstraction and sand extraction causing severe degradation to the river ecosystem including riparian vegetation extinction and banks collapsing. Sites with plenty of riparian vegetations had better hydrological conditions (physical water quality parameters) and ecologically stable. This led concluding and recommending Nature-based ecosystemic solutions to river ecosystem management using low costs to curb major challenges like ecosystem degradation, enhancing ecosystem stability and productivity through eco-hydrological interventions like creation of buffer zones, wetlands and sequential biofiltration systems.

Keywords: Climate change, Nature-based ecosystemic solutions, Ngerengere river, Riparian vegetation, Sustainable development

Uncovering the Potential of Neglected and Lesser Utilized Non-Wood Forest Products for Food and Nutrition Secutiry

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Abstract

Neglected and Underutilised Species of non-wood forest products include hundreds of locally domesticated and wild species, which are rich in nutrients and adapted to low-input agriculture. Their traditional production systems can play a key role in supporting rural livelihoods. Non-wood forest products can be important in strategies to alleviate the effects of biotic and abiotic stresses particularly those related to climate change. Their commercialization can provide income opportunities and many species are important in traditional pharmacology. Due to the intensification of agriculture, rampant harvesting, deforestation, fire incidents and the commercialization of food markets towards a more narrow range of the most important food crops, their diversity and associated local knowledge is rapidly being lost. This scenario has to do with edible wild orchids which are listed in the IUCN Red list of threatened wild species and the Convention of International Trade on Endangered Species (CITES). This study was conducted to explore the domestication potential, nutrient and food composition of wild edible orchids which are under the category of non-wood forest products. Household questionnaires, field visits and documentary review were used to collect data. Orchid tubers were collected for analyses of nutrient content and food composition. Quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) orchid rubbers dissolved with Hydrochloric acid for food composition and proximate analysis. Analyses on nutrient content and food composition revealed that edible orchids had 5.36g protein content; 2.7% fiber content; 2.2% minerals (ash) content; 1.57% fat and 0.09 mg vitamins C and 0.02 µ g bête-carotene content. Proximate analyses of samples from Ibaga indicated higher nutrient content than samples from Kikondo village. Ash (3.67±0.26mg/100g), carbohydrate (5.97±1.22mg/100g), and crude fiber (3.36±0.04mg/100g). Sample from Kikondo had significantly ($p<0.05$) higher ß-carotene concentration (0.03±0.005mg/100g) than sample from Ibaga (0.01±0.003mg/100g). Sample

from Kikondo had the higher calcium content (33574±11.62mg/Kg). Considering the valuable contribution of edible orchids to human nutrition and the indications that its availability is decreasing interventions focusing on domestication and conservation is needed. Based on the results of the nutrient composition a detailed investigation has to be done to determine the nutritional potential. Furthermore, a thorough laboratory analysis should be undertaken to determine their medicinal value for treating various human diseases.

Keywords: Edible orchids, Orchidaceae, Nutrient content, Kitulo National Park, Tanzania

Opportunities and Challenges of Wildlife Management Areas in Tanzania

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Abstract

Since 1990s, Tanzania's policies guiding natural resources management in Tanzania shifted from centralization to decentralization. This paper which is based on desk research was undertaken by reviewing relevant literature and used content analysis in analyzing qualitative data on opportunities and challenges of Wildlife Management Areas (WMAs) in Tanzania, which was adopted following policy shift towards decentralization. The policy shift has been justified on the grounds of improving equity in benefit sharing, good governance, democracy, resource conservation and livelihoods. In developing countries like Tanzania, decentralization policy in wildlife sector was adopted initially in response to widespread poaching. Adoption of WMA approach aimed to improve both the conservation of wildlife resources and livelihoods of the local communities. Existing literature has tried to investigate the performance of WMAs in elucidating improvement in conservation of wildlife, improvement in people's livelihoods including development of income generation projects, supporting social services and capacity building of actors practicing WMAs. However, there has been inadequate scholarly attention on synthesizing the opportunities and challenges undermining performance of WMAs. This paper fills this information gap by examining opportunities and challenges facing WMA in Tanzania. Findings indicate that available opportunities of WMAs include existence of Wildlife Policy and Wildlife Management and Conservation Act, supporting income generation for local communities as an alternative to direct dependency on extraction of wildlife resources and institutional capacity building. Challenges faced by WMAs include conflicting interests of stakeholders, human and livestock conflicts with wildlife and land use conflicts. Findings from this study will be useful for practitioners and decision makers in formulating and implenting strategies for addressing challenges of WMA given available opportunities in the near future.

Keywords: Opportunities, challenges, wildlife management areas (WMAs), Tanzania

Willingness to Pay and Accept Compensation for Conservation of Usangu Plains in Mbarali District, Tanzania

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Abstract
Payments for ecosystem services (PES) compensate individuals or communities for undertaking actions that increase the provision of ecosystem services such as water flows. These payments rely on incentives to encourage behavioral change and can consequently be considered part of the broader class to stimulate market-based mechanisms for environmental policy. Usangu Plains is one of the important ecological systems in Tanzania that supplies water for various economic activities. But has been disturbed due to large agricultural investments and creates conservation needs which have not given enough evaluation. This study was carried out to evaluate willingness of both users of Usangu Plains to pay and accept compensation for conservation to aid flow of water downstream throughout the year. Data were collected through structured questionnaire which was administered to a random sample of 200 respondent's upstream Usangu Plains in four villages (Ubaruku, Ukwavila, Kapunga and Chimala). Further data were collected through check-list for Focus Group Discussions (FDG) and Key informants' interview. Information gathered during FDGs were analyzed using Content Analysis Approach. Based on data obtained from upstream respondent's willingness to pay was estimated through the use of choice experiment. Results show that downstream users of the plain were not willing to add any additional payment apart from what they pay as water user fees while upstream users are willing to accept several proposed conservations and environmentally friendly practices if they are compensated based on the performed practices and this is highly influenced by socio-economic factors. It can therefore be concluded that conservation of the plain through establishment of payment for ecosystem scheme is still challenging.
***Keywords**:* Market-based mechanisms, Payments for ecosystem services, Usangu Plains

Influence of Tree Farming on Provisioning Ecosystem Services and Community Livelihoods in Mufindi District, Tanzania

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Abstract
Tree farming offers various provisioning ecosystem services. While recognizing the important contribution of tree farming to livelihood, little is known about the influence of tree farming dynamics to provisioning ecosystem services and livelihoods in Mufindi District. Recognizing that, the study was conducted using remote sensing and GIS techniques to quantify the spatial and temporal changes of tree farming in Mufindi District from 1990 to 2018. Questionnaire interviews from 6 sampled villages were used to analyze the influence of tree farming on provisioning ecosystem services and contribution to community livelihood. It was revealed that, young tree farms (1-5 years) had the lowest percent of change (-62.81) while mature open canopy tree farms (6 years and above) had the highest percent of change (31.15%) followed by Built up area (29.18%). Respondents perceived that, tree farming had increased in the area and provisioning ecosystem services from tree farming had changed their livelihoods. Range equalization method revealed that, the surveyed community was highly sustainable in terms of financial capital (0.68) and physical, social, human and natural capitals were moderately sustainable. Among the factors that contribute to livelihood,linear regression model revealed that, the size of land owned by the household was

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the greatest factor that determine the size of the tree farm owned ($p<0.01$) and was statistically significant at $p<0.01$ with an R-square value of 72.5%. Other factors of age, annual income, household size and education level were not statistically significant at $p<0.01$. Infrastructure and transportation problems limit farmers from farming trees. This study highlights a need for ensuring good planning, education, and access to modern tree farming inputs, loan and good governance for improving tree farming in the study area.
Keywords: Tree farming, Ecosystem services, Livelihood, Change detection

Quantitative Determination of Antibiotics in Aqueous Samples from Rivers, Mindu Dam and Mafisa Wastewater Treatment Plant Located in Morogoro Municipality, Tanzania

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Abstract
The anthropogenic load of antibiotics in Morogoro Municipality water bodies was estimated using the ELISA technique. Commercially available enzyme-linked immunosorbent assay (ELISA) kits commonly used for detection of tetracyclines, sulfonamides and quinolones residues in meat, milk, eggs and honey were adopted for analysis of these antibiotics in surface waters. Thirty three sampling points were selected, including two rivers, one dam and one wastewater treatment plant. Results showed that there were detectable levels of antibiotics slightly high levels were detected in the downstream rivers in close vicinity to high human activities as well as wastewater treatment plant . In rivers, the maximum mean concentrations detected were 7.74, 8.76 and 8.94µg/l quinolones, tetracyclines and sulfonamides respectively. At Mindu Dam, mean concentrations were, 1.61, 4.84 and 3.65µg/l, quinolones, tetracyclines and sulfonamides respectively, while at wastewater treatment plant mean concentrations were, 31.55, 48.89 and 37.94µg/l quinolones, tetracyclines and sulfonamides respectively. The presence of antibiotics residues in Rivers, Mindu dam and Wastewater treatment plant although in very low concentrations poses risks to population to take the antibiotics at low doses. This can be through drinking water and consumption of crops produced through irrigation using water from these sources, this can lead to acceleration of antibiotic resistance through selection pressure.
Keywords: Antibiotics, ELSA, Water bodies, Morogoro,Tanzania

Willingness to Pay (WTP) for Attributes of the Mastercard Farmers Network (MFN) in Tanzania and Uganda

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Abstract
Whereas technologies of the Fourth Industrial Revolution (4IR) have in the past two decades been applied into various sectors of the economy, the agriculture sector has relatively been lagging behind not only in Africa but even in developed economies. At the centre of agriculture digitalization in Africa are mobile phones and internet connectivity. Despite the recent rapid growth and penetration of mobile phone embedded technologies such as mobile money even in very rural areas, digital divide is still a challenge. Using the contingent valuation approach, this paper assessed WTP for attributes of the Mastercard Farmers Network (MFN)–a digital platform that brings together various actors of agricultural value chains into digital trade. The study involved 412 bean value chain actors in Tanzania and Uganda. We found that actors in both countries are willing to pay for the MFN attributes. Estimated at USD/kg of beans, the overall WTP for Tanzania was 0.0042

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while for Uganda was 0.0038. However, the amounts of WTP for each MFN attribute were differently distributed with users' preferences. The actors' sex, age, education, direct experience with MFN, transport cost to the bank, and frequency of travels to the bank were found to be significantly determining the WTP in both countries. These findings serve as a guidance for pricing the MFN, and further improvements of the product before final release into the market. This will address the challenge of digital divide, and ensure financial inclusion of rural smallholder farmers, who are the primary target of the MFN application.

Keywords: Agriculture 4.0, Willingness to Pay, Mastercard Farmers Network, Contingent Valuation

Focused Groundwater Recharge to the Makutapora Wellfield of Central Semi-arid Tanzania: Empirical Evidence to Inform Managed Aquifer Recharge Options

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Abstract

Groundwater and its replenishment via recharge are critical to sustaining livelihoods and poverty alleviation in tropical drylands yet the processes by which groundwater is replenished remain inadequately observed and resolved. Detailed observations are examined from Little Kinyasungwe Catchment within the River Wami Basin of central, semi-arid Tanzania, where the Makutapora Wellfield supplies freshwater to the rapidly growing, capital city of Dodoma. The prominence of focused recharge from ephemeral stream discharges is shown from: (1) groundwater recharge correlates more strongly with the seasonal duration of ephemeral stream stage exceeding a threshold (R^2=0.90 to 0.95) than seasonal rainfall (R^2=0.26); (2) hourly monitoring of groundwater-levels and steam stage shows that sustained groundwater-level rises, indicative of groundwater recharge, correspond better to observed pulses of stream discharge and the timing and magnitude of daily rainfall observed in areas upstream of the wellfield than rainfall recorded proximate to piezometers; and (3) stable isotope ratios of O and H trace similar compositions of groundwater and ephemeral stream flow; both have undergone evaporative enrichment and are linked to intensive (>80th percentile) daily rainfalls. This characterisation of focused groundwater recharge provides a reference point for studies of focused recharge more widely in drylands and can inform options to augment replenishment of groundwater supplying the city of Dodoma.

Keywords: Focused groundwater recharge, Makutapora Wellfield, Dodoma, semi-arid Tanzania

SUB-THEME 5: PUBLIC ENGAGEMENT IN RESEARCH AND INNOVATION FOR SUSTAINABLE ECONOMIC TRANSFORMATION

"Swahili Based Agricultural Apps" Innovative Ways of Reaching Farmers and Disseminating Information in Tanzania

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Abstract

Agricultural professionals are constantly in the search of innovative ways to engage farmers and timely dissemination of information. Use of smartphone apps is one of the popular avenues in developed and developing countries. Agricultural professionals in Tanzania also use apps to engage farmers and disseminate information. This study was conducted to analyse Swahili based agricultural apps used in dissemination of agricultural information in Tanzania. Virtual product snowball sampling was used to establish agricultural Swahili apps in Play Store and analyse the potential usage of the apps in November-December 2020. The findings show that at least 17 Swahili based agricultural apps are available in play store. These apps have been released after 2017, which suggest that the use of customised apps to reach farmers is the recent phenomenon. The content, numbers of downloads and user's opinions were used as the indicators of potential use of the app. The findings reveal that six apps (35%) provide exclusively information on livestock; others have general crops and livestock information. Content on fisheries and aquaculture is notably missing in the existing livestock apps. Most (88.2%) of the apps had less than 10,000 downloads and only one app has reached 100,000. The users' opinions are skewed to positive. Figures of downloads suggest that existing apps are under-utilised. The study concludes that the use of Swahili based agricultural apps is a new practice, which should be harnessed for timely and fruitful engagement with farmers and transformation of extension services in Tanzania.

***Keywords**:*

Using computer vision approach to detect *Tuta absoluta* (Gelechiidae) infestation of tomato plants

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Abstract

While tomato leaf miner (*Tuta absoluta* (Gelechiidae)) has been acknowledged as a very serious tomato insect pest in the Eastern African region, its management or control still pose considerable challenge mainly because of its prolific reproduction nature and concealment of larvae which feed under the plant tissues. If left uncontrolled, the loss inflicted by the miner can be as high as 100%. Successful management of the pest is contingent upon early detection of the visual symptoms of infestation. However, early detection of *T. absoluta* as one of the most important steps in the management of the scourge has not received substantial attention in scientific literature. This study employs machine vision techniques to detect infestation symptoms of *T. absoluta* on tomato plants. The rationale for this technique lies in the fact that it is rapid and does not require trained or experienced personnel. An experiment was carried out at Sokoine University of Agriculture (SUA) within the Horticulture Unit, where two sets of tomato plants (cv. Asila F1) were planted. One set of 10 plants in 4-litre pots were grown in the screen house and another set of 10 plants were grown in the open field. The screen house set was free from *T. absoluta* infestation, unlike the open field set which was severely infested as evidenced by adult moths obtained from sweep net trappings conducted during the experiment. Digital camera (Nikon COOLPIX AW120) was used to capture high quality images of the tomato plant leaves at seven days interval for the next 70 days after transplanting. In addition, pictures of tomato plant leaves were collected from

tomato gardens around Morogoro town at Mazimbu, Sangasanga and Mlali. Collected images were labelled as being infested (if there were meandering feeding lines) or non-infested if there were none. In this regard, a total of 2600 images were collected. In each class, 80% of the images were allocated for training while 20% was used to test a deep learning model. The images were resized to 400*400 pixels and assigned to categorical values of 0 and 1 (infested and non-infested respectively). A convolution neural network (ConvNNET) model, powered by keras library and python's Tensorflow backend was created in R-Software. The model had four convolution layers, one flat layer and one dense layer with a total of 36,258,851 parameters. Rectified Linear Activation (ReLu) and Softmax functions were used to normalize the convolutional layers and model output respectively. The model took 26 hours to run on a Dell Precision Tower 7910 Workstation. The model accuracy was 90% on training and 82% on test data sets. This study points out the fact that the model can, to a considerable extent accurately identify *T. absoluta* infestation in tomato plants. In-depth discussion of the technique and future direction is provided in the paper.

Keywords: Machine vision, Deep Learning, Neural Networks, Lepidoptera, Artificial Intelligence

Youth Agribusiness in Tanzania: Success Factors, Opportunities, Challenges and Impact of Project Interventions

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Abstract

One of the reasons cited for the low of youth participation in agribusiness is that youth dislike agriculture and rural life. This paper examines the impact of capacity building activities of the Young Innovators in Entrepreneurship and Leadership Development (YIELD) project on agri-entrepreneurs' enterprises in Tanzania. YIELD sought to assist young entrepreneurs to access and maximize opportunities in Africa's agri-food system through an integrated approach that combines actionable research with capacity development. The research involved review of existing literature and two surveys while capacity building involved two convening meetings, webinars and capacity building grants. The survey data were analyzed descriptively. The findings from the action research show that young agri-entrepreneurs perform various activities at all segments of the agricultural value chains. The agri-entrepreneurs' enterprises were found to have high income and employment generation potential. The YIELD project interventions had positive impact on the enterprises. Factors considered key to becoming successful in agri-entrepreneurship include but not limited to management/leadership skills, capital, education and innovativeness. Opportunities for enterprise growth available to the agri-entrepreneurs include but not limited to high demand for products due to increase in population, availability of export market for the products and favorable policy environment. Nevertheless the agri-entrepreneurs have been facing several challenges that have affected growth of their enterprises including but not limited to access to finance/capital and land, tax related issues and government bureaucratic procedures. Addressing these challenges would enable youth exploit the opportunity in the growing food market and expand employment opportunities in agribusiness.

Keywords: Young agri-entrepreneurs, employment, success factors, opportunities, challenges

Supervised Enterprise Projects as Innovative Agricultural Extension Education Approach: Opportunities, Challenges and Way Forward Towards Improved Extension Service Delivery in Tanzania

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Abstract
This paper responds to the widely shared concerns and debate over the declining quality of extension service delivery in Tanzania, which has contributed to the poor agricultural performance despite it being Tanzania's economic backbone. In this paper we argue that extension service delivery can be improved by adopting Supervised Enterprise Project (SEP) training approach in training extension staffs. In a nutshell, SEPs approach was first conceived and implemented in various African universities by Sasakawa Fund for Extension Education (SAFE) since 1994. At Sokoine University of Agriculture (SUA) the use of SEP approach started in 1998. The approach is built on experiential learning theory and action research. In this approach, the student is required to identify farmers' needs using participatory methods and then develop and implement plans to meet such needs, and then assess the outcomes of the implemented plans. In this way SEPs differs from other agricultural training approaches, which do not necessarily focus on the practical and professional needs of the students. Since its adoption at SUA very little has been documented on the nature and practice of SEPs, especially its opportunities and challenges. The critical understanding of SEPs approach is important for improving the training approach and for enriching the ongoing discussions on declining quality of extension service delivery. In this paper, we have highlighted the philosophy of SEPs compared to other training approach and reflected on the extent to which SEPs have contributed to the extension agents' ability to properly design and implement agricultural extension intervention programmes that respond to practical farmers' agricultural related needs. We have used the descriptively and thematically analyzed data collected through survey, focus group discussion, and documentary review involving SEPs field reports and the 2011 review report of the BSc programme. Stakeholders contacted include farmers, graduates, selected on-station instructors, local field supervisors and employers. The results show that SEPs training approach has overtime improved graduates' knowledge and power in advising farmers on the improved farm practices and innovations, and in turn farmers have improved their farm production. In addition to the signified increase in peer to peer influence on extension practice contributed by this approach, SEPs have also contributed to the generation of new cadres of extension administrators and managers who embraced innovation system thinking in addressing management challenges. Whilst we reveal that the sustainability of SEPs outcomes depend on the willingness and motivation of important stakeholders to continue learning from their practice as per the experiential learning theory underpinning SEPs, the limited awareness of nature of SEPs among important stakeholders is revealed to be the setback for SEPs smooth implementation. Furthermore, SEPs implementation demands a careful planning and engagement of all the necessary stakeholders including farmers, students, policy makers, agricultural-institution managers and relevant university professionals in all the cycles of SEPs planning, implementation and evaluation process.

Keywords: SEPs planning, SEPs implementation, extension service delivery, Sasakawa, Tanzania

Human Capital Development Programme for Agricultural Extension workers for Improved Technology and Innovation Dissemination: The SUA mid-career Training Programme

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Abstract

Currently, agricultural extension workers operate under multi-stakeholder phenomenon; therefore, the importance of human capital development for improved agricultural technology and innovation dissemination in Tanzania cannot be over emphasized. Facilitating the multi-stakeholder processes requires competent agricultural extension workers. It also requires someone who is well-versed in human relations. The study assessed the impact of the Sokoine University of Agriculture (SUA) mid-career agricultural extension training programme on human capital development. Data were collected from 100 respondents through a questionnaire that covered set of competences through analysis of the mid-career demand driven agricultural extension curriculum. In addition, literature review, Focus Group Discussion (FGDs) and observations were used to supplement the collected information. Findings indicate a strong link between human capital development and job performance of agricultural extension workers in improved agricultural technology and innovation dissemination. In addition, findings indicate that the agricultural training programme at Sokoine University of Agriculture (SUA) is deemed an investment, equipping graduates with appropriate knowledge and competencies/skills that improve their productive capacities which are in line with the purpose of establishing the programme. Finally, the results from the field and literature reviews point to the need for continuous human capital re-building and motivations of agricultural extension workers for improvement of their performance for improved agricultural technology and innovation diffusion

Keywords: Demand driven curriculum; mid-career agricultural extension programme; SUA; human capital development, agricultural extension worker

Influence of Exogenous Variables on Interaction between Farmers and Other Actors in Agricultural Projects

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Abstract

Studies have reported on the importance of the interaction of farmers with other actors on their participation in agricultural projects and subsequent adoption of agricultural technologies. Exogenous variables have the potential to influence the interactions; however, this has received little attention in the literature. Guided by Ostrom's Institutional Analysis and Development (IAD) framework and social exchange theory, the study sought to describe the patterns of interactions between farmers and other actors, and determine exogenous factors influencing farmers' interactions using the RIPAT-SUA project as a case study. Quantitative data were collected through a questionnaire survey. Qualitative data were collected using Focus Group Discussion (FGD) and key informant interview. Descriptive or multiple regression and content analysis were used to analyse quantitative and qualitative data respectively. Farmers' interactions with other actors in agricultural projects increase with a decrease in distance from the crop market. Also, the diversity of crops/livestock produced and the number of resources shared by the actors showed a statistically significant influence on farmers' interactions. The RIPAT approach plays a crucial role in shaping farmers-other actors' interactions; it influences the type of actors the farmers interact with as well as the pattern of interactions. The findings support the IAD and the social exchange theory, which,

respectively, postulate that biophysical conditions (in this case proximity to crop market), and cost and rewards (in this case resources shared) are important driving forces for farmers' interactions. Rather than referring to it just as cost and rewards, it should be explicit in the social exchange theory that both material and social benefits are important when it comes to motivating actors' interactions. The study recommends the establishment of market infrastructures in strategic locations and ensuring that agricultural interventions are rewarding to farmers. Designing and implementation of agricultural projects ought to employ the RIPAT approach to spur fruitful farmers-other actors' interactions
***Keywords**:* Interactions, farmers, agricultural projects, actors, RIPAT approach

Relationship among Farmers' Climate Change Knowledge, Scientific Climate Change Record and Coffee Production Records in the Main Arabica Coffee Growing Areas of Tanzania

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Abstract

Majority of coffee farmers in Tanzania consider that the climate has already changed, with more hot days, unpredictable rainfall patterns and in general lack of rainfall. Therefore, the aim of this study was to determine the relationship among farmers' climate change knowledge, scientific climate change records and coffee production in the major coffee growing areas of Tanzania. A list of farmers growing coffee was obtained from AMCOS and a structured questionnaire was designed and administered to the randomly selected household heads. Rainfall and temperature data were acquired from TMA offices and NASA. Data were analysed using STATA (version 13.0) software and SPSS (Version 21). Multiple imputation method was chosen as the method to impute the missing values due to its characteristics to account for uncertainty about the imputed values. Prior to applying MK tests to identify trends over the time series, data were tested for the presence of autocorrelation coefficient (r_1) at a 5% significance level, using a two-tailed test. Trend free prewhitening (TFPW) approach was applied to remove the correlation for Mann Kendall trend test. Correlation analysis was then used to examine the relationship of rainfall and temperature on coffee production in the two zones. Over 80% of the farmers believed that coffee production has been declining over the past 30-40 years as a result of decrease in rainfall and increase in temperature. This is comparable to the total percentage change calculated from the trends of coffee production in the Northern zone, which indicated the change of about 94.52 % and 82.37 % in Kilimanjaro and Arusha regions respectively There was also a strong relationship between temperature data recorded from TMA and coffee production records. However, the relationships differ between the zones and among the regions. In the Northern Highlands zone there were significant ($p<0.05$) negative correlation of coffee production records with temperature data from TMA. This implies that the present temperatures in the Northern Highlands zone are already slightly higher than the optimum values (18-21^{o}C) for coffee production. Therefore any increment in temperature would cause a drop in the productivity of current coffee production. On the other hand, in the Southern Highlands zone, some of the recorded temperature positively correlated ($p<0.05$) with coffee production. The study therefore reveals that, climate change is a reality and may cause serious effects for coffee production in the Northern Highlands zone. The study thus recommends enhancement of the adaptive capacity of the coffee farmers through awareness creation about the actual and potential effects

of climate change on coffee.

Keywords: Coffea arabica, farmers' climate change knowledge, scientific climate change record, Tanzania

Perception of SMEs in Pre-packaged Food Products on Product Innovation in Tanzania

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Abstract

The study aimed at investigating the perception of product liability rules (i.e. manufacture, design, and failure to warn defects) on pre-packed food product innovation in Tanzania. A randomly selected sample of 100 respondents was involved in the study. Data were analyzed through Exploratory Factor Analysis in SPSS version 21. Four factors namely defective manufacturing, design defect, failure to warn and product liability costs emerged to be important. Thus, the three dimensions of product liability and one dimension of product innovation emerged from the data. Research results infer that the development of new and safer food products is the primary outcome engineered by the recent growth in the cost of product liability to SMEs. In the end, the study concludes that the product liability-product innovation relationship is much stronger for design defects than the manufacturing and failure to warn (labelling) defects.

Effectiveness of Different Extension Methods in Scaling up Innovations among Small-scale Farmers in Muleba District

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Abstract

The objective of this study was to examine the effectiveness of different extension methods used by AGRA's Kilimo TIJA project in scaling up JESCA bean variety in Muleba District. A quasi experimental survey was used and questionnaires were administered to 200 respondents at household level selected through multi-stage sampling techniques. The Tobit regression model was used to assess the effectiveness of various extension methods in increasing smallholder farmers' awareness, willingness, and adoption of this variety, as well as the influence of farmers' socio-economic characteristics on the adoption of the variety. The results show that 44.5% of the project participants and 19.1% of non-project participants were aware of the full package of the variety. While only 24.5% of the project participants and 9.6% of non-project participants were willing to adopt full package of the variety. But adoption levels remain very low at 2.6% for project participants and 1.5% for non-project participants. Demonstration plots, input suppliers and extension workers were more effective sources of information which led to the adoption of JESCA bean variety. Furthermore, education level, and marital status of the household head significantly influenced the adoption of the variety in the study area. It is concluded that households' agricultural technology adoption decisions depend on their socio-economic circumstances and institutional effectiveness. It is therefore recommended that, policies should be formulated to take advantage of the factors which positively influence farmers' adoption of modern agricultural production technologies and to mitigate the negative ones.

Keywords: Innovations, scaling-up, bean variety, farmer participation, diffusion methods

Assembling 'Mkulima Agricultural Knowledge Hub' For Up-Scaling the Adoption of Agricultural Innovations among Farmers in Tanzania

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Abstract

Agricultural sector plays a very important role in the economy as it employs more than 75% of the total population, contributes about 25% to the GDP, brings about 66% of the foreign exchange, and provides raw materials for local industries. For optimal agricultural production and post-harvest handling, farmers need timely access to relevant knowledge. Inopportunely, agricultural knowledge is mainly accessed through print media, agricultural extension and advisory system. However, the accessibility of print media in most rural areas in Tanzania is very low. Likewise, there is a limited number of agricultural extension staff and inadequate resources to facilitate the provision of agricultural extension services. ICTs facilitate access to agricultural information services along the value chain. Empirical evidences from India, South Africa and Ghana show that ICTs enhance access to agricultural knowledge and cut down costs associated with accessing knowledge. Tanzania can do better by leveraging on high level of ownership of mobile phones among farmers, as currently the ownership of mobile phones has not resulted in increased access to agricultural knowledge. This paper draws experience of Mkulima Resource Centre of the Sokoine National Agricultural Library and proposes a prototype to develop the centre into the national agricultural knowledge hub for enhancing knowledge accessibility and adoption of agricultural innovations among farmers in Tanzania.

Determinants of Smallholder Farmers' Adoption of and Willingness to Pay for Improved Legume Technologies in Tanzania

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Abstract

Legumes are critical in improving nutritional status, enhancing ecosystem resilience and reducing poverty among rural households. However, limited information is available in relation to smallholder farmers' adoption of and willingness to pay for improved legume technologies in Tanzania. This study assessed the determinants of smallholder farmers' adoption of and willingness to pay for improved legume technologies. The study adopted a cross-sectional research design whereby data from 400 respondents were collected once from Gairo and Mvomero districts, Tanzania through a questionnaire survey, key informant interviews and focus group discussions.. Quantitative data were analysed using SPSS whereby descriptive and inferential statistics were estimated. Qualitative data were analysed using content analysis technique. The results show that, there were statistically significant associations between adoption of improved common bean seeds and availability of legume technology intervention (P=0.000), total area cultivated (P=0.000), revenue from other income generating activities (P=0.005) and household size (P=0.022). In addition, availability of legume technologies (P=0.002) and being a member of a farmers' association (P=0.023) were statistically significantly associated with willingness to pay for at least one or more improved legume technologies in the study areas. Generally, it can be concluded that availability of legume technology interventions and being member of farmers' association influence the adoption of and willingness to pay for improved legume technologies. Therefore, the government and other stakeholders need to further promote improved legume technologies' intervention as well as formation of farmers association to enhance the adoption and willingness to pay for improved legume technologies.

Keywords: Smallholder farmers, willingness to adopt/pay, improved legume technologies, Tanzania

Conditions for a Successful Use of Mobile Phones to Access Agricultural Information: Smallholder Farmers' perspective

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Abstract

A glut of literature indicates that mobile phone technology has a wide range of applications and that seems to be a good medium of information dissemination in various business undertakings. Certainly, a mobile phone is a valuable infrastructure, which gives people access to the services they need. Luckily, the penetration and subscription of the technology is ubiquitous and is ever growing including in Tanzania. Even so, many of the Tanzanian farmers are not fully utilizing the potential that the technology avails in agriculture. Literature shows that farmers in Tanzania suffer from inadequate and ill-timed access to agricultural information. The main question this research addresses is; why is mobile phone technology not bridging information needs among Tanzanian farmers? Overall, the study sought to establish conditions for a successful use of mobile phones in accessing agricultural information. Specifically, the study determined the way mobile phones are used to access agricultural information, type of information gathered through phones, and respondents' opinion for the technology to be successfully used for agricultural purposes. A simple random sampling technique was used to get 240 respondents from two study districts i.e., Kilolo and Kilosa. Interviews with farmer respondents were the main data collection method complemented with Focus Group Discussions (FGDs) and Key Informants Interviews. Both quantitative and qualitative data were gathered. Quantitative data were analyzed into some expressive statistics such as frequencies, means, percentages, chi-square tests and regression. The statistics assisted the researchers to decide on levels of mobile phone use among farmers, type of use, accessibility to agricultural information, and the extent and conditions for a successful mobile phone use in accessing agricultural information. As per the smallholder farmers' perspective, the study concludes and recommends on four conditions being farmers' characteristics f such as age, literacy levels, farm sizes and their distance to markets; stakeholders support; nature of interaction among stakeholders; and the type farming systems farmers involved with.

Keywords:

Information and Communication Technology in the Forest Sector of Tanzania: Applications and Challenges

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Abstract

Information and Communication Technologies (ICT) is the catch-all phrase used to describe a range of technologies for gathering, storing, retrieving, processing, analyzing and transmitting information. Over the last 15 years there had been a tremendous increase in the use of Information Communication Technologies (ICT) in Tanzania. Irrespective of all these efforts, there is a lack of information on the status and applications of ICT in forest sector of Tanzania and other allied sciences. Many of the uses of ICT on the forest sector are relatively new or still on the horizon and majority are not documented. Therefore, this study was conducted to document the current application of ICT in forest sector of Tanzania. Data were obtained from different forest institutions located in Morogoro region using checklists and questionnaires. The results indicate that, there is a promising trend for applications of ICT in forest sector where about 75% of the respondents seemed to be aware, while 25% of them were not aware of the ICT applications in forest sector. About eight types of professionals in forest were having background in ICT based

technology with higher application on data storage and analysis, documentation and forest inventory. The main challenges observed were related to the availability of infrastructures, internet connectivity and competent personnel.
Keywords: Information, Communication, Technologies, Forestry

Push and Pull Factors for Establishing or Joining Self-created Grassroots Networks: The case of Village Community Networks (VCONEs) in Mkalama District, Tanzania

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Abstract

Although community members initiate community networks, such networks remain complex social structures that require good entrepreneurial and management skills. Some of them fail to sustain their existence. Self-created community networks face similar challenges as it is the case with any other social entrepreneurial venture or organization. Apart from entrepreneurial and management challenges, today's Tanzania networks hardly cope with the shortfalls emanating from the market economy. Despite the challenges, grassroots people continue to either form or join a variety of community networks voluntarily. Using a qualitative and longitudinal methodology, the article explores "push and pull" factors for establishing or joining a strand of self-created community networks known as Village Community Networks (VCONEs). VCONEs are created by the members, with minimum or without external support. The primary purpose of VCONEs is to provide microloans, simple savings, and self-insurance to the members who are predominantly women. Although VCONEs have adopted some of the features of the conventional rotating and saving collectives, they tend to avoid external interference from local governments, donor and NGOs. The mentioned feature makes VCONEs more sustainable than other strands of Rotating, Savings and Credit Associations (ROSCAs). The findings of the study further suggest that although the market economy disproportionately affects marginalized communities including women, it pushes them to join VCONEs. The push enables women to access some protection against the negative forces of the market. VCONEs further pull women to opportunities including accessing funds for investing in agricultural production and petty businesses. VCONEs can serve as vehicle towards the Transformation of Lower Middle Income Countries.
Keywords: Push-Pull Factors, Village Community Networks (VCONEs), Gender, Tanzania

Roles of Lead Farmers and Extension Officers in Facilitating Uptake of Agricultural Technologies in Projects that Apply the RIPAT Approach in Tanzania

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Abstract

Low agricultural productivity in sub-Saharan Africa is mainly caused by low uptake of agricultural technologies resulting from the declining role of public extension services. For example, existence of wide extension officers-farmers ratio in Tanzania has limited access to new agricultural technologies and capacity to turn the knowledge into actual development. In order to contribute to narrowing the ratio, the Rural Initiatives for Participatory Agricultural Transformation (RIPAT) approach has been adopted to bridge agricultural technology gaps through promoting the use of lead farmers (LFs) as the principal agents of change in their communities. This study assesses the roles

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played by LFs in the uptake of agricultural technologies and how they fill the gap of inadequate extension staff. The study involved 384 LFs and non-LFs who were randomly selected from a population of 1800 farmers in Karatu and Singida Districts in 2018. The findings show that the use of LFs has narrowed extension officer: farmers ratio tenfold at the village level and facilitated the uptake of technologies at reduced costs since they are from within the community and are not necessarily paid. It is concluded that LFs play an important role in bridging agricultural technology gaps. It is recommended that formalization of the use of LFs should be integrated into Tanzania's public extension system. In addition, there is a need for further research on the performance of LFs.

Keywords: Uptake of technologies, Lead farmers (LF), Extension staff, RIPAT, technology gaps

Water Resources Sensitivity: The Impacts of Forest Losses from Human Activities in Morogoro

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Abstract

Water is a critical natural resource, essential for the wellbeing of communities. Globally, availability and quality of fresh water is increasingly endangered by overuse, misuse, salinization and pollution. Such problems occur also in Tanzania, including Morogoro Municipality. The growing gap between water supply and demand in the Municipality suggests that there is a serious need for ensuring adequate water quality and quantity. Forests play a vital role in water resources management, which is crucial for sustainable water supply. Thus, proper forest management focusing on water resources is of vital importance for supplying good-quality fresh water, and protecting the resources against natural hazards like floods, landslides, and drought. Besides, studies show that forests are an integral part of the water cycle, supporting uninterrupted and timely rainfalls that feed the water resources. Unfortunately, forests located along the water catchment and recharge areas have continually been cleared due to urbanization, and various income generating activities including agriculture. Such activities are bringing a potential worry for the sustainability of the water resources. Studies indicate that the miombo woodlands amidst savanna grassland in the lowlands of the Ruvu basin were degraded by 43% between 1970 and 1990s, with a continuing trend. Without taking appropriate measures, the water resources such as Ruvu river, Ngerengere River, Mindu dam, Morogoro river, and Vituli river will be at high risk and fail to meet the water demands, not only for Morogoro residents but also Dar es Salaam and the Coast regions. Such problems suggest that the implementation of the WRMA 2019 – *control of urbanization* - is compromised; consequently, the long-term achievement of the SDG 6.1, *accessibility of fresh*, will not be realistic. For instance, the capacity of Mindu Dam, the main water source of Morogoro Municipality, has dwindled by 30% due to siltation from agricultural activities undertaken within 60m. Also, the average total annual rainfall has changed, whereby it increased by 6.7mm between 1966 to 2000 and decreased by 61.3mm between 2001 to 2013. Therefore, the current study attempts to assess the sensitivity of the water resources in Morogoro, through historical forest cover losses due to human activities. The rainfall trend and withdrawal monitoring data are also used to complement the discussion. A further expert validation process will be employed for ascertaining the findings. Findings of this study will create awareness amongst the water resources management stakeholders regarding the impacts of forests losses on the water supply systems in Morogoro. The study contributes an approach for water resources sensitivity assessment that would be applied in other water supply systems.

Visitation Rates and Population Abundance of Hoverflies Foraging Cultivated Cucurbit Crops in Morogoro, Tanzania

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Abstract

Several research evidences show that hoverflies is becoming increasing important for maintaining the production of many important agricultural crops. However, relatively little research on abundance and visitation rates of hoverflies associated with cultivated cucurbit crops has been conducted in Tanzania. Hoverflies provide among other ecosystem services, pollination service to a wide range of flowering plants. The goal of this study was to evaluate the seasonal visitation rates and population abundance of hoverflies associated with cucurbit crops in the plateau and mountainous zone of the Morogoro region from the month of March to July 2020. Data were obtained by conducting observational count of flower visits of hoverflies on cucurbit crop flowers along a 15m transects. About 332 hoverfly specimens belonging to eight genera: Eristalinus (Merodonoides Curran), Paragus (Afroparagus Vujic and Radenkovic), Allograpta Osten Sacken, Eumerus Meigen, Mesembriussensu stricto, Phytomia Guérin-Méneville, Toxomerus Macquart, and Syritta Le Pelletier and Serville were collected from two cucurbit growing seasons. Among these, Eristalinus megacephalus, Mesembrius caffer and Toxomerus floralis were further examined because they were most the abundant species and showed significant variation in visitation rate, foraging time and abundance across the two agroecological zones, season and sampling weeks. The floral visitation rates varied substantially among the dominant hoverfly species but were not influenced by seasons and the most abundant hoverfly flies contributed more on visitation activities compared to the least abundant one.

Keywords: Visitation rate, Hoverflies, Cucurbit crop, Foraging time

Training Needs Assessment in Inventory Based Participatory Forest Management Planning: A case of Community Based Forest Management in Tunduru District Tanzania

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Abstract

In the implementation of the community forestry, a Forest Management Plan serves as a pre-requisite for transferring forest management authority to local communities. Its preparation requires participation of the local community. However, it is a technical activity, which is beyond general knowledge of local communities. Thus, forest bureaucracies have been providing trainings that aim to empower forest committee members to be able to acquire necessary skills and knowledge. This study therefore aims to assess and understand the strength and weaknesses of trainings provided in inventory based participatory forest management planning in the study area. The study was conducted in three villages of Tunduru District, Southern Tanzania; Mindu, Songambele and Namakambale. Primary data were collected through participant observations for six months, in-depth interviews with forest committee members and professional foresters, and face-to-face interview with forest committee members. The results show that forest committee members were trained for half a day on inventory methods, materials used in the forest inventory, and how to measure tree circumference. During fieldwork, the roles of forest committee members were to identify, measure and record tree circumferences in notebooks. The results show that none of the committee member was

capable to plan forest inventory, use GPS receiver, analyze inventory data and estimate sustained yield. Therefore, committee members were trained to do manual work, which demand limited skills and knowledge in a return for remuneration which seems contrary to the objectives of the training. To make planning process less costly, participatory and empowering there is a need to allow more time in training and providing sufficient resources for trainings the forest committee for them to effectively carry out the inventories thereby contributing to sustainable forest management at local village level and national at large.

Keywords: Forest inventory, sustained yield, community forestry, forest committee, Southern Tanzania

The Economics of Implementing Community-Based Forest Management (CBFM): A case of Lindi and Ruvuma Regions, Tanzania

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Abstract

This study was carried out to document village forest-based enterprises and to undertake economic analyses as a benchmark to propose a better forest based local economy business model and management strategy (s) for promoting the villages' sustainable forest based business. Specifically, this study strove to analyse economic data on established community-based forest enterprises in villages VLFRs, and undertake Cost-benefit analysis of CBFM in relation to other land uses. Three villages were included in the study. Data collection techniques included household questionnaire, Key informants interviews, Focus group discussions, observation and market survey. Data were analysed using SPSS and Microsoft Excel computer programmes to establish measures of central tendency and other economic parameters. The findings revealed that in all the villages with VLFRs, there is reasonable un-marketed stocks of wood that need to be exploited for economic and sustainable forest management purposes. In the VLFR sampled, the harvestable volumes were 60147.6 m^3 (20), 179395.4 m^3 (17) and 77415.5 m^3 (7) for Nanjilinji B, Songambele and Mwahi VLFRs respectively with the numbers in the bracket indicating the amount so far harvested. This indicates that there is still a lot in terms of timber resources that is yet to be harvested and marketed. This somehow shades some light that more aggressive marketing need to be done and the need to develop better management strategy and business model to improve the benefit that communities accrue from managing the forests. There are also lesser utilized and lesser known species that may need to be exploited and be put into relevant use. The NPV for Nanjirinji B and Songambele were equally positive with 12,772,131.7 TZS and 2,959,225.0 TZS respectively. The finding implies that the investments in these VLFRs are economically worth, with more viability in Nanjirinji B and lastly Songambele. It is recommended that harvesting levels from the VLFRs need to be improved if the communities are getting meaningful benefits from the VLFRs. What is currently being exploited/harvested and sold out is based on the limited market available, implying the need to improve the marketing.

Keywords: Community-based, Village Land Forest Reserves (VLFR), Net Present Value (NPV)