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EGERTON UNIVERSITY

13TH BIENNIAL EGERTON UNIVERSITY INTERNATIONAL CONFERENCE

THEME:

Innovation, Research and Transformation
for Sustainable Development

24TH - 26TH NOVEMBER 2020

Programme and Book of Abstracts

Conference Via Zoom

Transforming Lives through Quality Education



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Sustainable Development**

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Welcoming Message



Prof. Rose A. Mwonja
Vice Chancellor
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I am very pleased to have all of you who have purposed to participate in this 13th International Conference being held virtually because of the COVID 19 Pandemic.

The theme for this conference is “Innovation, Research and Transformation for Sustainable Development”. You know that Sustainable Development is a global goal agenda blueprint to achieve a better and more sustainable future for all. There are 17 goals with 169 targets that address the current challenges we face. They leave no one behind and this is necessary to achieve inclusive development. At Egerton, it is our commitment to leave no one behind in development as we strive to “Transforming lives through quality education”.

During this conference, over 137 papers will be presented on six sub-themes: Natural Resources and Climate Change, Food Security, Geopolitics and Governance, Health, Science and Technology, History, Literature and Culture and Education and Change.

I thank the twenty four professionals who will be presenting papers orally in the joint plenary sessions. I urge all participants to engage these presenters in discussing how possible it is for the world not to leave anyone behind in attaining the development goals and the set targets.

I believe the papers to be presented will delve into how to we can attain the SDGs targets by year 2030. For Egerton, we are already making contributions towards the attainment of SDGs. The webometric ranking released in January 2020?, ranked Egerton top; overall position at global 1819; Africa 30 and in Kenya 3; but on the criteria of impact we have made on the society; we ranked 6th in Africa and FIRST in Kenya.

I thank the Technical Committee and the Secretariat that has organized this virtual conference. I trust that this conference will be successful in advancing **Innovation, Research and Transformation for Sustainable Development**.

Welcoming Message



Prof. Bockline O. Bebe
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On behalf of the University, the Division of Research and Extension has organized this 13th International Conference under the theme **Innovation, Research and Transformation for Sustainable Development**. The goal is to assemble academia and scientists, both young and senior, to share their knowledge advances towards leaving no one behind in attaining developmental changes.

Twenty one lead papers by eminent professionals and about 121 papers in diverse disciplines will be presented, shared and discussed under six subthemes. Please make choices wisely on which session you want to participate in. Two sessions will be held per day and the abstracts and posters will be available on the conference website for at least one month. This offers you good opportunity to engage with all

For presenters, a Digital Certificate will be sent to presenters/participants after the presentation.

Thank you all

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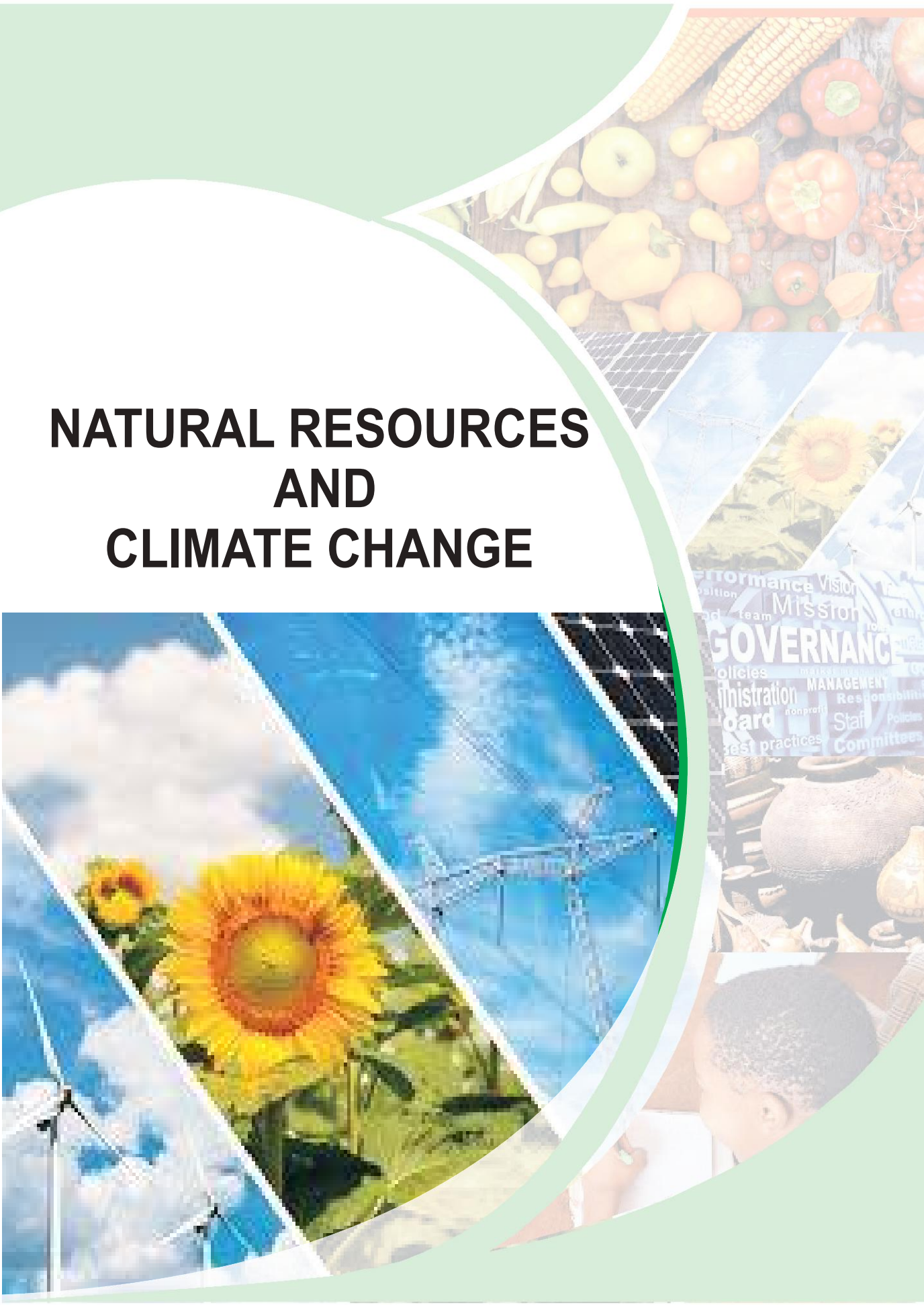
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NATURAL RESOURCES AND CLIMATE CHANGE



E-CONFERENCE PROGRAMME

13TH BIENNIAL INTERNATIONAL CONFERENCE

THEME: Innovation, Research and Transformation for Sustainable Development

24TH – 26TH November, 2020

VIA ZOOM

Programme Coordinators: Alex Mugambi/Prof. Mwangi Ndirangu/Prof. Nancy Mungai	
CONFERENCE DAY ONE TUESDAY 24TH NOVEMBER 2020	
MORNING SESSION	
Octo/Nov, 2020	E-REGISTRATION: Zoom Link/ euconference.egerton.ac.ke
Session chair: Prof. Nancy W. Mungai, Ag. Director (Research & Extension)	
Rapporteurs: Prof. W. Moturi, Dr. J Masika	
SESSION 1: NATURAL RESOURCES AND CLIMATE CHANGE	
09.30am-10.00am	Selected videos – Faculty of Environment and Resource Development Video Egerton Applications Video Egerton University Anthem
10.00am-10.15am	WELCOMING REMARKS: Prof. Bockline O. Bebe, Ag. Deputy Vice-Chancellor (Research and Extension)
10.15am-10.30am	CHIEF GUEST: Dr. Chris Kiptoo, Principal Secretary Ministry of Environment and Fisheries
10.30am-10:50am	Projections of climate change in Kenya and adaptation options Ms. P. Nying'uro, Principal Meteorologist, Kenya Meteorological Services
10.50am-11:10am	The Role of Selected animal species in regeneration of natural Forests Ms. N. Leley, Kenya Forest Research Institute,(KEFRI), Londiani/Gede
11.10am-11.30 am	Indigenous Marine Biohazard Knowledge and their Management among Intertidal Seascape Users along the Kenyan Indian Ocean Coast Dr. Charles Maina Kihia, <i>Department of Biological Sciences, Egerton University,</i>
11.30am-11:50am	Clean Cooking Energy: Options and Associated Costs W. B. Kisiangani, Egerton University, Department of Agricultural Economics and Agribusiness Management
11:50am-12.15pm	QUESTION AND ANSWER SESSION
12.15pm-12.20pm	Reflections Dr. Bernard Kirui, Chairman of Department, Natural Resources, Egerton University Dr. Okeyo Bernards, Snr. Lecturer, Pwani University
12.20pm-12.30pm	EXHIBITORS

LIST OF ALL OTHER PAPERS

CLIMATE CHANGE
<p>Climate Change Shocks Sensitivity Index of Smallholder Farmers Engaged in Farming and Non Farming Activities in Kinakoba Ward, Tana River County, Kenya P. G. Ndegwa*, A. W. Wamukota and A. H. Ong'ayo <i>Department of Environmental Studies-Community Development, Pwani University, P. O. Box 195, Kilifi: Tel No: 0729795331</i> Corresponding Author: <i>spirfathers@gmail.com</i></p>
<p>Ideal Hardening off Watering Interval of East African Greenheart (<i>Warburgiaugandensis</i>), Nursery Seedlings in East Mau Watershed, Njoro, Kenya S. K. Inoti, <i>Department of Natural Resources, Egerton University, PO Box 536-20115, Egerton,</i> Corresponding Author: <i>inotikinyua@yahoo.com; sinoti@egerton.ac.ke</i></p>
<p>Visitor's Perceptions towards the Causes of Seasonality in the Kenyan Tourism Industry: A Case of Nairobi National Park, Kenya D. Kambaga¹ and M. Omare² ¹<i>Technical University of Kenya, School of Business and Management Studies, Department of Business and Management Studies,</i> ²<i>Kisii University, School of Business and Economics, Department of Tourism and Hospitality, P.O. Box 408, Kisii;</i> Corresponding Author: <i>kambaga@tukenya.ac.ke / okambaga@gmail.com:</i></p>
<p>Gender Differences in Climate Change Adaptation among Potato farmers in Meru County S. M. Kimathi*, O. I. Ayuya and B. Mutai ¹<i>Department of Agricultural Economics and Agribusiness Management, Egerton University</i> ²<i>Department of Agricultural Economics and Agribusiness Management,</i> Corresponding Author: <i>sallymukami93@gmail.com</i></p>
<p>January 17, 2002 Nyiragongo Eruption and Climate Change A. H. Mvukiyehe <i>ISP Kinyatsi-Nyamitaba, DRC, University of Eastern Africa, Baraton</i> Corresponding Author: <i>athanasehabimana2014@gmail.com</i></p>
<p>Avian and Habitat Diversity in the Semi-Arid Lands: A Case of Chemeron, Baringo, Kenya R. N. Ondieki^{2*} and G. M. Ogendi^{1,2} ¹<i>Department of Environmental Science, Egerton University, Box 536 Egerton</i> ²<i>Dryland Research Training & Ecotourism Centre, Chemeron, Box 536 Egerton</i> *Corresponding Author: <i>gogendi@egerton.ac.ke</i></p>
<p>Opportunities for Practice Change in Climate Change Adaptation in Smallholder Dairy Farmers in Nandi County, Kenya J. Owino <i>Rift Valley Ecoregion Research Program, Kenya Forestry Research Institute, P.O. Box 382-20203, Londiani, Kenya,</i> Correspondence Author: <i>owinojesse@gmail.com</i></p>
NATURAL RESOURCES
<p>Does the Removal of Copper Leaf (<i>Acalypha fruticosa</i>) Influence Plant Species Diversity and Abundance? A Case of Chemeron, Baringo County, Kenya G. M., Ogendi^{*,1,2}, T.W. Njoroge¹, S. M.Morara¹ and R. N. Ondieki² ¹<i>Department of Environmental Science, Egerton University, Box 536 Egerton</i> ²<i>Dryland Research Training & Ecotourism Centre, Chemeron, Box 536 Egerton</i> *Corresponding Author: <i>gogendi@egerton.ac.ke ; gmorara2009@gmail.com</i></p>

<p>Towards Identification of Alternative Feeds for Mariculture; Preliminary Evaluation of Polychaete Based Giant Tiger Prawn Meal</p> <p>C. M. Kihia^{1*}, A. Muthumbi², J. Munguti³, B. M. Muli⁴, S. T. Ombati⁴ and E. Kanyeki⁴</p> <p>¹Department of Biological Sciences, Egerton University, P. O. Box 536 Egerton, Kenya; ²Department of Biological Sciences, University of Nairobi, P.O. Box 30197-00100 Nairobi Kenya, ³Kenya Marine & Fisheries Research Institute, P. O. Box 451, Sagana, Kenya, ⁴KWETU Training institute, P. O. Box 6856, Mombasa.</p> <p>Corresponding Author: charles.kihia@gmail.com</p>
<p>Prediction of Infiltration Rate in Different Land Use Types Using Modified Horton Equations in Upper Njoro River Catchment</p> <p>L. Amisi[*], R. M. Wambua and P. M. Kundu</p> <p>Department of Agricultural Engineering, Egerton University, Nakuru, Kenya</p> <p>Corresponding Author: amisileah@gmail.com</p>
<p>Provisioning of water ecosystem services in Kapingazi catchment, Embu County, Kenya. What are the anthropogenic activities impacting on their supply within the catchment?</p> <p>B. K. Ileri¹, P. M. Makenzi¹, S. M. Makindi², P. A. Minang³ and J.M. Mironga⁴</p> <p>¹Department of Environmental Science, Egerton University, Njoro, Kenya, ²Department of Environmental Science, Machakos University, Machakos, Kenya, ³World Agroforestry, Nairobi, Kenya, ⁴Department of Geography, Egerton University, Njoro, Kenya;</p> <p>Corresponding Author: burnice.karimi@gmail.com</p>
<p>Factors Influencing the Performance of Improved Pastures: A Case of Lake Bogoria Production Landscape, Kenya</p> <p>¹W.N. Nyamao, ¹²G. M. Ogendi and ²S. Kasitet</p> <p>¹Department of Environmental Science, Faculty of Environment and Resources Development, Egerton University, P.O. Box 536 Njoro. ²Dryland Research Training and Ecotourism Centre (DRTEC), Chemeron of Egerton University P.O. Box 536 Njoro</p> <p>Corresponding Author: wickynyamao@yahoo.com</p>
<p>Prospects of Willingness to Pay for Improved Water Provision Ecosystem Services in Kapingazi Catchment, Embu County, Kenya</p> <p>B. K. Ileri¹, P. M. Makenzi¹, S. M. Makindi², P. A. Minang³ and J.M. Mironga⁴</p> <p>¹Department of Environmental Science, Egerton University, Njoro, Kenya, ²Department of Environmental Science, Machakos University, Machakos, Kenya, ³World Agroforestry, Nairobi, Kenya, ⁴Department of Geography, Egerton University, Njoro, Kenya;</p> <p>Corresponding Author: burnice.karimi@gmail.com</p>
<p>Determination of Pollutants in Water based on Graphenated Polypyrrole-nanoalloys Nanocomposite</p> <p>Stephen N. Mailu</p> <p>Department of Physical Sciences, Machakos University, P.O Box 136-90100, Machakos, Kenya.</p> <p>Corresponding Author: smailu@mksu.ac.ke</p>
<p>Gender and Sustainable Water Management and Conservation: A Case of Tharaka Nithi County, Kenya</p> <p>M. K. Mugambi</p> <p>Kenyatta University, P.O. Box 109-60400 Chuka, Kenya. +254(20)707345246</p> <p>Corresponding Author: mercyjoymugambi@gmail.com</p>

Can Pastoral Communities Offer Sustainable Ecological Management Solutions? The case of Mwanda-Marungu Pastoral Commons in Taita Hills, Kenya

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Green Building Technology for Environmental Sustainability

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The Role of Sykes Monkeys (*Cercopithecus mitis albogularis*) in Natural Forest Regeneration in Gede, Coastal Dry Forest of Kenya

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Primates are known to maintain forest plant population and regeneration through seed dispersal. They swallow and defecate and or spit large quantities of viable seeds away from the parent plant. This study was conducted in Gede Ruins forest, a coastal dry forest of Kenya to establish the contribution of Sykes monkeys (*Cercopithecus mitis albogularis*) in maintenance of community structure and species composition through seed dispersal. The existing forest structure, species composition and seed dispersal as well as germination tests of monkey dispersed seeds were determined. The study was carried out in primary and secondary forest during rainy and dry periods for seasonal comparisons. Age classes in the forest exhibited a reversed exponential curve, a characteristic of a regenerating forest. There was no marked difference in vegetation structure and species composition between primary and secondary forest an indication that secondary forest had regained most of its structural complexity attributed to seed dispersal and successful regeneration and recruitment. The monkeys dispersed diverse seeds to at least 5 m from the canopy edge of mother tree which is crucial for escape of density dependent mortalities and species specific pathogens and fungi which occur in high densities beneath and near mother trees. Seasonality and provisioning by tourists were the key factors that significantly affected the potentiality of Sykes monkeys to disperse seeds and hence forest regeneration. Additionally, ingestion significantly reduced latency period and enhanced germination success implying that endozoochory was critical for regeneration of Gede Ruins Forest. Sykes monkeys were therefore, effective and efficient seed dispersers because they; moved large number of seeds, did not decrease seed viability and dispersed array of species. This suggests that enhancing population of Sykes monkeys in fragmented and degraded Coastal dry forests of Kenya is critical for natural forest regeneration and restoration.

Key words: Seed Dispersal, Forest Regeneration, Sykes Monkeys, Dung Beetles, Gede Ruins Forest

Indigenous Marine Biohazard Knowledge and their Management among Intertidal Seascape Users along the Kenyan Indian Ocean Coast

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The serene, biodiverse and stunning Indian Ocean seascapes are widely appreciated, but inherent dangers, remain largely ignored or the stuff of folklore and fiction. A cross-sectional survey of dangerous marine organism knowledge and management among typical seascape users along the Kenyan coast, was undertaken among fishing communities at the North and South coast. Demographics, coupled with knowledge and management of marine biohazards, were obtained from over 112 respondents (fishers, gleaners, boatmen, beach boys) in March 2019. Results indicate irrespective of demographic profile, seascape users were familiar with a diverse array of traumatogenic (<24), envenomating (<12) and toxic (<5) taxa, with differing lethality ($P < 0.05$). Highly lethal traumatogenic fauna were dominated by sharks (<80%), while lionfish (<53%), and puffers (60%) were most familiar envenomating and lethal fauna, respectively. High biohazard encounters (94%) and attacks (81%) occurred in reefs (49%), or while fishing (46%), attacked mainly by urchins, stingray, stonefish and lionfish (34, 18, 18 & 11 incidences, respectively). The most important first aid for injury was seawater cleansing (46%), while for envenomation; sucking (27%), bandaging (24%) and herbal poultice (18%), and milk (87%) was used for poisoning events. Conventional health facilities were only consulted for severe symptoms, such as severe haemorrhage and necrosis, others (31%) being tackled by self and local healers. Pawpaw and Sodom apple, are important local herbals that require further evaluation, but common precautions taken, include protective clothing and attention. In the absence of adequate documentation and appropriate conventional medical intervention, itinerant coastal visitors are advised to heed indigenous wisdom and intervention. Information on occurrence of potentially dangerous marine fauna, and respective intervention, should be incorporated into existing seascape use policy.

Keywords: Attack rate, envenomation, intervention, lethality, precaution, toxic, trauma

Clean Cooking Energy: Options and Associated Costs

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Over 8 million households in Kenya rely on wood and 1.3 million on charcoal while only 3% own electric cooking appliances. The impact of solid biomass fuel for cooking on households around the world is increasingly evident. Kenya is one of the most vulnerable countries and acutely experiencing the manifestations of the problem. Solid biomass has been found to expose the using families to household air pollution contributing to a range of acute chronic illnesses responsible for approximately 4 million premature deaths worldwide and 21,650 deaths in Kenya yearly. Despite these effects, around 80% of the households in Kenya have continued to rely on solid biomass as the primary cooking fuels. To this effect, the study sought to explore the determinants of rural households' willingness to adopt Direct Solar Electric Pressure Cooking unit (DSEPC) in Mbaruk and Mogotio locations, Nakuru County. Systematic random sampling technique was employed to obtain a sample of 516 households. Semi-structured questionnaires were administered through interview schedules with primary cooks and household heads. A bivariate Probit model was employed to examine households' willingness to pay for DSEPC unit. The empirical results indicated that the households' willingness to pay for DSEPC was influenced by the number of schooling years of the household head, gender of the HH, number of children under 5 years, members with health complications related to cooking within a household, and the cost of the current cooking fuel. The majority of the households (81.78%) were willing to pay for the DSEPC. The mostly used fuels were firewood, 50.78% followed by charcoal and Liquefied Petroleum Gas (LPG) at 39.15% and 21.71% respectively. Therefore, the study recommends government agencies and other stakeholders to come up with policies that are geared towards development of clean and affordable energy with minimal or no impact on peoples' health. Based on the cost incurred on traditional fuels, the study further recommends the expansion of DSEPC program beyond the study areas.

Keywords: Bivariate Probit regression, clean cooking, DC pressure cooker, solar electric pressure cooking unit, solid biomass

Climate Change Shocks Sensitivity Index of Smallholder Farmers Engaged in Farming and Non Farming Activities in Kinakoba Ward, Tana River County, Kenya

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Understanding the future of smallholder farmers of Kinakomba Ward in Tana River is critical to the design and development of policies. One of the major concerns is establishing how sensitive these farmers are to climate change shocks. This study sought to determine sensitivity index of smallholder farmers that rely on rainfed agriculture and non-farming activities to climate change related shocks with the intent of formulating appropriate programmes and policies. A descriptive survey research design was used. Stratified random sampling was employed to select 390 households. The qualitative and quantitative data collected using questionnaires was analysed by use of metric of sensitivity and chi-square goodness of fit test. The study revealed that smallholder farmers who relied on farming activity alone had a sensitivity of 43.17% to climate change related shocks while those who rely on non-farming activities has a sensitivity of 36.40%. When the households engage in both farming and non-farming, the sensitivity will increase by 21.20% due to the interactions between the two activities. Although the sensitivity percentage for the farmers who engaged in the two activities is low, sensitivity was statistically significant at $P=0.00038$. Further findings showed that the ratio of farming to non-farming was 0.58 and those households dependent on farming and engaged in non-farming was 0.45 and when they engage in both activities at the same time, they were more sensitive at 0.942. Despite the significance sensitivity to climate change related shocks, farming sector was ranked as more important (81.5%) than other livelihood activities. The study concluded that sensitivity of the smallholder farmers to climate change related shocks had a significant influence on their livelihoods. The County Government in partnership with stakeholders develops interventions of adaptation options and empowerment of farmers with skills in diversification of livelihoods options.

Keywords: Climate change related shocks, farming, Sensitivity index, smallholder farmers

Ideal Hardening off Watering Interval of East African Greenheart (*Warburgiau gandensis*), Nursery Seedlings in East Mau Watershed, Njoro, Kenya

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Water is becoming an increasingly a scarce resource in most areas but yet essential in establishing nursery seedlings. This calls for the effective and efficient use of this important resource. Hardening off of nursery seedlings through reduction of watering regime is necessary before transplanting seedlings to the field. This leads to better survival yet the interval of watering is not well established and this might vary with species and locality. An experiment was set up during the dry season just before planting out to determine the best hardening off watering interval for East African greenheart (*Warburgiau gandensis*) seedlings in Egerton University, East Mau watershed, Njoro, Kenya. The experiment was laid down as a completely randomized design (CRD) with 5 treatments replicated 3 times. Treatments comprised of different watering intervals, which were as follows: twice daily, once daily, 2 days, 4 days and 6 days. These treatments were applied for 2 months on 9 months old seedlings during January to March 2018. Analysis of variance was used to determine treatment differences while DMRT was used to determine the significantly different treatment means at $p \leq 0.05$. The results revealed that the best growth was shown by twice daily, once daily, 2 days and 4 days intervals for shoot biomass, total plant biomass and total leaf area. However, the recommended watering interval is 4 days since it showed good growth for most of the variables with minimal water use equivalent to 12.5% of the water used by seedling watered twice daily which saves 87.5% of the water used. The results can be applied in the Kenyan highlands for East African greenheart and other leaf succulent plants. However more studies needs to be done for other non-succulent species using different pot sizes and soil mixtures.

Keywords: Nursery seedlings, East African greenheart, watering interval

Visitor's Perceptions towards the Causes of Seasonality in the Kenyan Tourism Industry: A Case of Nairobi National Park, Kenya

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Seasonality presents a number of issues that require special attention and strategies. In particular, seasonality affects the number of tourists to a region and therefore may threaten the viability of tourism enterprises and regions whether severely or mildly. Seasonality causes the fluctuation in tourists and visitor numbers to a destination. Consequently, some destinations at certain times have more tourists and visitors than they are able to accommodate, while other have few tourists and visitors to the region. Kenyan tourism industry has in recent years suffered low tourist receipts especially at the coast. The main objective is to establish the visitor's perceptions towards the causes of seasonality in the Kenyan tourism industry, specifically, the causes of seasonality at the Nairobi National Park (NNP). The target visitor population at the NNP was 448 visitors for August, 2017, (KWS, 2018). The formula by Miller and Brewer (2003) was used to get the sample size of 205 respondents. Data was collected using questionnaires and interviews, then cleaned, edited and analyzed. Statistical Package for Social Sciences (SPSS) was used to analyse quantitative data, while qualitative data was analysed by use of content analysis. Descriptive analysis test used means, percentages and frequency distributions and charts. Inferential analysis used correlation and regression analysis including ANOVA and X2-square test to establish the level of relationships between the research variables. The findings indicate that the NNP experiences seasonality. Out of 64 respondent's majority strongly agreed both natural and institutional seasonality that weather season both natural and institutionalized seasonality account for 80%; Calendar influence, natural and institutionalized seasonality 51%; Timing decision, natural and institutionalized seasonality 77% finally, Social pressures, natural and institutionally seasonality 50%. All the predictors were statistically significant at $\alpha=0.05$ since p-values are less than 0.05. The study recommends that the government to give incentives to domestic tourists to visit the park regularly, in order to reduce the negativity of institutionalized seasonality. Further studies be done on the strategies to mitigate the causes of seasonality at the NNP.

Keywords: Tourism, tourists, seasonality, Nairobi National Park

Gender Differences in Climate Change Adaptation among Potato farmers in Meru County

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The impact of climate change on natural resources has necessitated the need to adapt potato farming to increase farmers' resilience against climate change in Sub-Saharan Africa (SSA). Production of Potato (*Solanum tuberosum*. L) has been declining over the years in SSA due to climate change and variability. This has resulted to low food supply and low income among smallholder farmers exacerbating levels of food and nutrition insecurity, and poverty. For instance, in 2017, International Potato Center reported a tremendous reduction in potato yields by 56% due to reduced rainfall. The study used data from 384 randomly selected potato farmers from Meru County through field survey. Statistical analysis such as chi-square and t-tests were used. Out of 384 households, 135 were female-headed. The coping practices considered include; adoption of climate resilient potato varieties, crop rotation, irrigation, intercropping, soil conservation, increased use of pesticides and use of organic fertilizers. Climate resilient varieties have the potential of increasing farmers' resilience to climate change due to their desirable attributes of high yield, early maturity and resistance. The results showed that there was a significant difference between male and female headed households in terms of adoption of resilient varieties with males having an adoption level of 58.34% higher than the females who were constrained in terms of accessibility to resources such as land, information, seed, capital and collateral to secure credit. From the results above, there is need for government and non-governmental stakeholders to deploy extension officers in the area to ensure farmers are informed on climate change adaptation strategies such as improved varieties and are enabled to adopt them through proper dissemination and creation of strong seed systems. More so, collective action among female farmers should be encouraged to reap benefits of social networks and form a strong collateral base for credit.

Keywords: Adaptation, climate change, female farmers, potatoes.

January 17, 2002 Nyiragongo Eruption and Climate Change

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Nyiragongo volcano is the most active of the Virunga mountains located in the Western part of the Eastern Africa Rift system. From the historical volcanic records, two recent eruptions January 10, 1977 and January 17, 2002 impacted heavily the environment where soil, forests, drainage system, settlement, farming and livestock were affected. Another major impact of volcano eruption is reported from world's volcanoes (Laki, Krakatoa, Pinatubo...), where ash, dust, carbon dioxide, sulfur dioxide and other greenhouse gas are released into the atmosphere affecting the regime of temperature and rainfall, hence the overall climatic system. To establish such impact of Nyiragongo volcano eruption in 2002, data from six meteorological stations accessed for some physically and for others through online retrieval from www.infoclimat, were collected and analyzed using a Statistical Software Package for Social Scientist (SPSS), in which the two sample t-test was applied, and involving the comparison of two sets of parameters (temperature, rainfall, humidity, saturation point, wind speed, air pressure, and visibility) before and after the 2002 eruption. The results reveal a significant difference at .05 significant level of Nyiragongo volcano on the regime of rainfall (p value.007) air saturation (p value: .010) and air pressure (p value .000). However, a no significant difference between the four other meteorological parameters: Temperature (p value.335), humidity (p value.869), wind speed (p value .660) and visibility (p value.144) was mentioned. The mean temperature raised at 0.55 after the eruption due probably to the CO₂ emissions. Further investigation of the impact of volcano eruptions on the farming and livestock in surrounding areas of the volcano, will prevent any crisis of food supply.

Keywords: Climate change, meteorological parameters, Nyiragongo volcano

Avian and Habitat Diversity in the Semi-Arid Lands: A Case of Chemeron, Baringo, Kenya

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Semi-arid woodlands are important and critical habitats that provide breeding and feeding grounds for a variety of bird species, some of which are endangered or threatened with extinction. Habitat type and size influences abundance and diversity of birds globally and particularly in developing countries that are characterized by rapid human population growth and haphazard urban, agricultural and industrial development. The objective of this study was to assess avian and habitat diversity at Chemeron, a semi-arid land in Baringo County, Kenya. Four 2-km long transects radiating from a central point within the study area were selected for a ground survey of birds that was conducted on foot. The surveys were conducted between 6 and 10 a.m and between 4 and 6p.m for two weeks in October 2020. Bird species were observed and identified to the species level using high resolution binoculars, field guide books and available taxonomic keys. There were two main habitat types: *Acacia-Balanites-Boscia* woodlands dominated by *Acacia senegal*, *Acacia mellifera*, *Acacia nilotica* and *Balanites aegyptica*. The second kind of habitat consisted of the invasive *Acalypha fruticosa* and *Indigofera arrecta* with *Acacia reficiens-Acacia brevispica* overstorey. A total of 24 bird species were sighted and identified to the species level including the endangered Clarke's weaver (*Ploceus golandi*) and the vulnerable Yellow necked spurfowl (*Francolinus leucoscepus*). 79% of the birds were sighted as singles or in pairs except for the gregarious white browed sparrow weaver (*Plocepasser mahali*) and Clark's weaver (*Ploceus bicolor*). Approximately 80% of the birds are insectivorous; 13% frugivore and 7% nectarivores. The high diversity of bird species in the study area can be attributed to the varied diversity of habitats that provide feeding, nesting, refuge and breeding grounds for the birds. From the foregoing findings, we can conclude that ASALs offer ample habitat for birds including some of which face global extinction. We recommend that sustainable utilization of rangeland resources so as to protect such critical avian habitats.

Keywords: Acacia woodlands, Avian diversity, extinction, habitat diversity, rangelands

Opportunities for Practice Change in Climate Change Adaptation in Smallholder Dairy Farmers in Nandi County, Kenya

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Increase in population is driving increase in agricultural production and this is majorly experienced with smallholder farmers who are always engaging in diverse agricultural practices. This paper analyses smallholder dairy farmers farm utilization and relates this utilisation to constraints affecting smallholder dairy farmers capacity to improve manure management. Improved manure management would be useful for nutrient retention and minimizing GHG emissions. The study aims (i) To enumerate the different farm utilization by small holder dairy farmers; (ii) to analyze the different sources and utilization of manure by the smallholder dairy farmers and (iii) highlight the gaps that offer opportunities for climate change adaptation by the smallholder dairy farmers. Through use of farm survey using Open Data Kit and meta-analysis of the relationships in the variables, the farmers are characterized by; gender, age, education level, total available household labour, grazing acreage, total acreage, total number of dairy livestock available in the household, main income category of the household and number of manure management systems in the household. The study showed crop farmers who were males in Lower Highland 1 (LH1) Agro-ecological Zones had large 'household area' (1.3 ± 0.41 acres) and the largest acreage for cash crop (5.9 ± 1.49 acres). In terms of acreage available for grazing LH1 males with income from 'Other' sources had largest acreage (5.6 ± 4.88 acres). Upper Midlands males with dairy income had the largest (16.6 ± 16.34 acres) acreage for trees as well as the largest total farm acreage (26.1 ± 18.53 acres). Male farmers in LH1 and LH2 had more acreage available for agricultural use while female crop farmers in Upper Midlands (UM) had more acreage available for agricultural use. The paper offers a characterization of farm uses that would be useful for policy makers in designing climate adaptation programs as well as opportunities for further research.

Key Words: Climate Change Adaptation, Smallholder dairy farmers, Sub-saharan Africa, Opportunities for practice change

Does the Removal of Copper Leaf (*Acalypha fruticosa*) Influence Plant Species Diversity and Abundance? A Case of Chemeron, Baringo County, Kenya

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Studies on invasive plant species have gained prominence owing to their potential to significantly alter plant species community composition and structure thereby negatively impacting on ecosystem services. The effects may include a reduction in the abundance of palatable plant species that constitute important forage for livestock, and medicines for the local communities. The aim of this study was to assess the impacts of copper leaf (*Acalypha fruticosa*) on plant species diversity and abundance at Chemeron, Baringo County in Kenya. Two sites (one with *A. fruticosa* and the other without this invasive species) were selected within the Chemeron Research Centre. Two transects measuring 100m X 20m on each site were laid parallel to each other. Plant samples were collected from five 1m X 1m quadrats that were laid at intervals of 20m. The plant samples were identified to the species level using available taxonomic keys. Various indices including Shannon-Wiener (H'), Evenness Index, Richness Index and Simpson's Index of Diversity Index (1-D) were calculated. All the diversity, richness and evenness indices were considerably higher in the site without *A. fruticosa* compared to that where this invasive species was present. The H' and D ranged from 2.34 to 3.28, and 0.87 to 0.94 in site without and with *A. fruticosa*, respectively. Out of the 47 plant species identified, 37 and 18 of them occurred in the in site without and with *A. fruticosa*, respectively. The plants were also evenly distributed in the site without *A. fruticosa* compared to that with the invasive plant present. We conclude that *A. fruticosa* has a significant influence on plant species abundance and diversity as well as distribution. We therefore recommend to the pastoralists and rangeland managers that copper leaf be removed from grazing lands to stimulate the growth of palatable plant species that support livestock production.

Keywords: Baringo, Copper leaf, Plant Diversity, Diversity Indices, Invasive Species

Towards Identification of Alternative Feeds for Mariculture; Preliminary Evaluation of Polychaete Based Giant Tiger Prawn Meal

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Aquaculture development in Kenya and elsewhere, is frequently hampered by lack of suitable, affordable and sustainable feed sources. This is especially so for mariculture, where cultured organisms are commonly at higher trophic levels, requiring protein and lipiddense formulations. Fish meal and oils are frequently incorporated into mariculture feeds contributing to overfishing and unsustainability. Marine intertidal polychaetes, have been explored as suitable mariculture feeds and cultured as superior alternative feeds for critical growth stages. *Marphysa mosambica* is a tropical intertidal polychaete, commonly exploited as a bait in artisanal fishery. This study compares nutritional content of known quantities of cultured and wild polychaete, with locally available feeds (catfish& tilapia meals, Kamuthanga growers & pellets, Skretting) and feed ingredients (earthworm, soya). Subsequently, efficacy of polychaete based feed formulations on hapa net cultured giant black tiger prawn (*Penaeus monodon*), growth is compared to commercial feeds. Preliminary results suggest cultured polychaete protein content (79.96%) is comparable to earthworm meal, but significantly ($P < 0.001$) higher than the commercial feeds (38.75%) and soya (42.02%). Similarly cultured polychaete lipid content (6.78%) was also comparable earthworm and commercial meal, but significantly ($P < 0.05$) higher than soya (2.59%) or wild polychaetes (1.92%). Differences were attributed to variation in quantity and quality of feed ingredients available to local formulators. Significantly ($P < 0.001$) higher shrimp weight, were recorded on polychaete meal formulation (3.40 ± 0.09 g), with correspondingly higher growth rate ($0.22 \text{ g} \cdot \text{d}^{-1}$) than on either commercial ($0.15 \text{ g} \cdot \text{d}^{-1}$) or mix diet ($0.13 \text{ g} \cdot \text{d}^{-1}$). Despite bottlenecks in the culture of this tropical marine polychaetes, they are superior alternative tiger prawn feed sources compared to locally available commercial feed. However, earthworm based meals require further evaluation as mariculture feeds. Nonetheless, further elaboration of polychaete amino and fatty acid profiles, is recommended.

Keywords: Commercial feeds, growth rate, lipid, *Marphysa* meal, protein

Prediction of Infiltration Rate in Different Land Use Types Using Modified Horton Equations in Upper Njoro River Catchment

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Infiltration rate is a fundamental parameter in understanding a wide range of soil functions. The determination of the infiltration rate in the field usually requires a lot of time. Horton's equation is a viable option when measuring ground infiltration rates or volumes since it provides a good fit to data. However it is cumbersome in practice since it contains three constants that must be evaluated experimentally. The study aimed at developing equations that can be used to predict infiltration rate in different land use types based on Horton equations. The in-situ measurements of infiltration rate of the soil were done by a double ring infiltrometer in the upper part of Njoro River catchment. Tests were carried out four times in four land use types that included grassland, natural forest land, deforested and fallow agricultural land from May to December 2017. The field collected infiltration data was used to determine the constants of Horton's equation. The models describing data in various land use types were developed through regression analysis. Horton function was adapted to develop new infiltration rate equations for natural, fallow agricultural land, grassland and deforested land respectively. The study recommends the models to be applied to the other similar land use types where tests were not conducted. The equations can also be used to check the accuracy and reliability of automated soil water movement systems at defined intervals.

Keywords: Infiltration rate, In-situ measurements, Land use types, Horton function, Regression analysis

Provisioning of Water Ecosystem Services in Kapingazi Catchment, Embu County, Kenya. What are the Anthropogenic Activities Impacting on their Supply within the Catchment?

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Ecosystems provide valuable ecosystem services which are the foundation of man's sustainable development such as water provision. However, when humans exploit ecosystems in providing for their own sustenance, they also affect ecosystem services intensively and consequently degrade the environment, endangering man's survival and development. Kapingazi catchment is home to various ecosystem services mainly water provision to downstream users. Kapingazi River flowing from this catchment contributes to Tana River with several national hydroelectric power stations that contribute to 52.1% of hydro-electric power of Kenya's electricity. Destruction of the catchment area through anthropogenic activities, have threatened Kapingazi River with its water flows and quality fluctuating significantly. The aim of this research was therefore to assess the anthropogenic activities impacting on water service provision in Kapingazi catchment in Embu County, Kenya. Data collection was conducted between March and May, 2018. The study adopted cross sectional research design. Primary and secondary data were collected from Kapingazi catchment. Various anthropogenic activities were analysed based on catchment users who caused them including; cultivation at the riparian area, availability of eucalyptus trees at the riparian area, chemical control of pests and diseases, water abstraction, washing in the river, deforestation, quarrying, soil erosion, poor waste disposal and management. Logistic regression analysis showed that farmers' activities ($p = 0.002$) had significant impact on changes in water quality while farmers' activities ($p = 0.036$) and industrial activities by tea factories ($p = 0.014$) and coffee factories ($p = 0.013$) had significant impact on changes in water quantity at 95% confidence level. Negative impacts weaken water provision ecosystem service through changing ecosystem structure hence the need to reverse them in Kapingazi catchment. This can be achieved through proper waste management, soil and water conservation measures and enforcement of water regulations in order to provide improved water services of Kapingazi River.

Keywords: Anthropogenic activities, catchment, ecosystem, ecosystem services, water

Factors Influencing the Performance of Improved Pastures: A Case of Lake Bogoria Production Landscape, Kenya

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Internationally, Lake Bogoria Production Landscape (LBPL) is important for wildlife species, biodiversity content and livestock feeds. However, it is at risk from degradation arising from unsustainable exploitation resources due to overstocking and inadequate natural pasture. Information on pasture species, places of planting and production capacity are well documented. However, there is limited research on the factors influencing the performance of improved pastures and impacts on environment and people. This study assessed the factors influencing the performance of improved pasture production in LBPL. A descriptive research design targeting 5,000 households spread within five administrative locations in the Baringo South Sub County was applied. Using multi-stage sampling techniques, 300 households and 12 key informants from the major stakeholder organizations were interviewed in September 2019. The instruments were reviewed by Dryland Research Training and Ecotourism Centre (DRTEC) of Egerton University for expert judgment, review of content and face validity. A sample of 10 questionnaire was used for pilot survey in Majimoto. Reliability analysis produced an alpha of 0.77. Data analysis used SPSS as percentages, means and SD and findings presented in tables and graphs. Pearson's Product Moment Correlations was done through percentage scores from addition of scores of Likert-like scale items to determine the relationships between variables. The study established that strong cultures ($r=0.65$; $p=0.0002$) and limited awareness ($r=0.55$; $p=0.0001$) influenced improved pasture production. The study recommends that the community to be trained to scale up efforts to mobilize adequate resources. The training should be on both financial and human resources to strengthen the other factors that rely on them. This will promote the realization of the goals of biodiversity conservation, which will assist in improved, pasture production.

Keywords: Culture, influence, pasture, performance, resources.

Prospects of Willingness to Pay for Improved Water Provision Ecosystem Services in Kapingazi Catchment, Embu County, Kenya

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Ecosystem services are biological foundations essential to economic prosperity and development of human beings for example water provision. However, when ecosystems are exploited for human sustenance, they affect water provision intensively. Kapingazi catchment provides various ecosystem services mainly water provision to downstream users including national hydroelectric power stations that contribute to 52.1% of hydro-electric power of Kenya's electricity. Agricultural and industrial activities have changed the ecosystem structure of the catchment leading to fluctuation of water quality and quantity of Kapingazi River. Payment for ecosystem services is one of the approaches which can enhance adoption of sustainable land management practices leading to improved water quality and water quantity in Kapingazi catchment. The aim of this research was therefore to assess the willingness to pay in improved water service provision in Kapingazi catchment in Embu County, Kenya. Household questionnaires, key informants schedules and focus group discussions were used to collect data from households, institutions and stakeholder associations respectively between March and May, 2018. The results showed that 67% of the respondents were willing to pay for improved water services in terms of water quality and water quantity within the catchment. The respondents were willing to pay an average of USD 9.10 per annum in addition to the average water user fee of USD 4.19 per month for improved water services in Kapingazi catchment. Logistic regression analysis revealed that age ($p=0.005$), education ($p=0.025$) and household size ($p=0.05$) were the factors influencing respondents' willingness to pay (WTP) for improved water service in the study area. Positive WTP for improved water service provision shows the need for improved water service provision in Kapingazi catchment. Thus, decision makers should create enabling policy for implementation of payment for ecosystem services (PES) programme for improved of water services provision in Kapingazi catchment.

Keywords: Catchment, ecosystem, ecosystem services, water, willingness to pay

Determination of Pollutants in Water based on Graphenated Polypyrrole-nanoalloys Nanocomposite

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In Kenya, Cancer is estimated to be the second leading cause of non-communicable diseases related deaths after cardiovascular diseases and accounting for 7% of overall national mortality. Hydrazine has been classified as human carcinogen by the Environmental Protection Agency (EPA). It has been reported that its exposure to humans causes damage to liver, kidney, lungs and respiratory tract system and has long-term effects on the central nervous system. Due to these side-effects, it is highly desirable to fabricate portable, economical, sensitive and rapid methodologies for the determination of hydrazine. This work focuses on the methodologies of harnessing the unique properties of electroconductive polymers and nanomaterials and their application in sensor technology. A highly sensitive, rapid and simple electrochemical sensor for the detection of hydrazine has been developed using graphenated polypyrrole-Ag-Au nanoalloys nanocomposite. The electrocatalysis of hydrazine on the synthesized nanocomposite was investigated in aqueous medium using cyclic voltammetry (CV) and square wave voltammetry (SWV). An increased current density, decreased oxidation over potential and low detection limits were observed. The results showed that the synthesized nanocomposite exhibited excellent characteristics for their application in the development of highly sensitive, cheap and easy to use electrochemical sensors for hydrazine detection.

Key words: Hydrazine, Nanoalloys, Cyclic voltammetry, Carcinogen, Overpotential.

Gender and Sustainable Water Management and Conservation: A Case of Tharaka Nithi County, Kenya

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Gender equity and women's empowerment are prerequisites to effective conservation, climate action and meeting the Sustainable Development Goals. In view of its ecological, social and economic value, water is an important renewable natural resource. Its significance is felt in areas such as rural development, land-use planning, food supply, tourism, scientific research and cultural heritage. A better understanding of the different roles, knowledge, needs and aspirations of women and men with regard to water management and conservation can help us achieve the twin goals of better conservation outcomes and increased gender equity. This study aimed at assessing the gender and sustainable water management and conservation in Tharaka Nithi County, Kenya. The study was carried out in four selected water projects in Tharaka Nithi County. Descriptive survey and sequential explanatory mixed method approach were adopted for the study. A sample size of 167 respondents comprising of water managers, staff in water projects, water users and local water committees participated in the study. Data was collected using questionnaires, interview schedule and focused group discussion. The findings showed that there were gender disparities in water management and conservation in Tharaka Nithi County. Women were underrepresented as staff, water managers and local water committee members in the selected water projects. The study further found that these disparities impacted negatively on sustainable water management and conservation. Conflict over water resources, delayed installation, repairs, maintenance and reporting leakages as well as cultivation in river banks were reported as trickle down effects of gender inequalities in sustainable water management and conservation. The study recommends that the water projects and institutions should incorporate more women into water management and conservation projects as well as employ gender advocacy and empowerment programs to facilitate gender equity in water management and conservation.

Key words: Gender, Dynamics, Sustainable water management, Conservation

Can Pastoral Communities Offer Sustainable Ecological Management Solutions? The Case of Mwanda-Marungu Pastoral Commons in Taita Hills, Kenya

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There has been increased interest over the last decades on community based management of natural resources (CBMNR) and their relation to environmental sustainability. Insufficient studies dedicated in Kenya to understand pastoral communities' management is striking, considering the importance of communal management for pastoralism and of pastoralism in Kenya. This research has been set up to conduct a study of customary management of relatively well functioning pastoral commons of East Africa, the Mwanda-Marungu commons which borders Tsavo west national park in Taita hills, south-west of Kenya. Through ethnographic approaches such as participant observation, semi-structured interviews and focus group with discussions of up to 234 respondents, it was examined whether customary management systems of Mwanda-Marungu would offer sustainable model that conforms to the IUCN's Other Effective area-based Conservation Measures (OECMs) and where not, as well as why and which were the sources of possible malfunctioning. Among others the results showed that these pastoral commons assure a generalized local rule requiring that all herders and livestock should have left water points and salt lick areas by 3pm so as to pave way for the wildlife to drink water and lick salt as well in order to avoid illnesses transmission and favoring humans-wildlife co-existence within the commons. Also there are important restrictions on charcoal burning and fires within commons as well as the use of religious shrines called *fighis* that all together help to conserve forests and pastoral habitats, which are absent in other areas where private plot selling and mining has started to come in and degradation is much stronger. This study demonstrates that pastoral communities in this area have devised ingenious measures that prove good management of natural resources within their commons aligned to the principals of OECMs and they could be considered for support, since where they disappear environmental degradation tends to appear.

Key Words: Pastoralism, Commons, Natural Resources, Fragile ecosystems, OECMs.

Green Building Technology for Environmental Sustainability

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The sustainability of eco concrete blocks industries is imperative to the well-being of our planet and to human development. However, the production of conventional cement, an essential constituent of eco concrete blocks leads to the release of a significant amount of carbon dioxide and other greenhouse gases. Conventional cement is not an environmentally friendly material due to the fact that its manufacture creates greenhouse gas emissions and leads to reduced supply of good-quality limestone and clay. The most energy-intensive stage of conventional cement production is during clinker production. It accounts for all but about 10% of the energy use and nearly all of the greenhouse gases produced by cement production. A good way to achieve sustainable development and sought a balance between socio-economic as well as environmental concerns in promoting green building and construction projects considered an important part of environmental sustainability. The study research objective was to explain the significance of eco-concrete blocks in the building industry for environmental sustainability. This study was exploratory in nature since the literature review and primary data were gathered from relevant documents published by individual researchers and the National Construction Authority were the main sources of data for this paper. Organizations are working to produce better eco-friendly green building products such as eco-concrete blocks and developing new ways of reuse and recycling products. Eco-concrete blocks are highly recommended for their durability, resource efficiency & minimize wastage.

Keywords: Cement, construction, reuse, recycling, environment.

FOOD SECURITY



Performance Vision
Mission
GOVERNANCE
MANAGEMENT
Administration
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Committees

Programme Coordinators: Alex Mugambi/Prof. Mwangi Ndirangu/Prof. Nancy Mungai	
CONFERENCE DAY ONE TUESDAY 24TH NOVEMBER 2020	
AFTERNOON SESSION	
Session Chair: Prof. Bockline O. Bebe , Acting Deputy Vice-Chancellor (Research & Extension)	
Rapporteurs: Dr. J. Anyango , Senior Lecturer/ Prof. R. Mulwa , Senior Lecturer	
SESSION 2: FOOD SECURITY	
13.30pm-14.00pm	Selected videos - CARP - TAGDev Video - Egerton University Anthem
14.00pm-14.15pm	WELCOMING REMARKS: Prof. Rose A. Mwonja , Vice-Chancellor
14.15pm-14.30pm	CHIEF GUEST: Hon. Peter Munya , Cabinet Secretary Ministry of Agriculture, Livestock and Fisheries
14.30pm-14:50pm	Agricultural Productivity Fails to Grow in East Africa: Urgent Action Needed to Change Course Prof. T Thompson , Virginia Tech College of Agriculture and Life Sciences, USA
14.50pm-15:10pm	Managing Agricultural and Food Production Residuals: Innovations for Value-Added Products Recovery and Improving Household Air Quality to Enhance the Economies of Rural Communities J. A. Ogejo , Biological Systems Engineering, Virginia Tech College of Agric, USA
15.10pm-15.30 pm	Aquaculture productivity in Kenya Dr. P. S. Orina , KEMFRI, Kenya Marine & Fisheries Research Institute
15.30pm-15:50pm	Developing Youth Agribusiness Opportunities for attaining the SDG targets: Experience from Egerton University Prof. P. Mshenga , Chairperson, Department of Agricultural Economics and Agribusiness Management, Egerton University.
15:50pm-16.15pm	QUESTION AND ANSWER SESSION
16.15pm-16.20pm	Reflections Prof. Richard Mulwa , Snr Lecturer, Egerton University Prof. Timothy Sulo , Moi University
16.20pm-16.30pm	SELECTED VIDEOS/EXHIBITORS

LIST OF ALL OTHER PAPERS

CROP PRODUCTION/ SOIL SCIENCE
<p>Evaluation of Tomato Water Productivity under the Effect of Deficit Drip Irrigation and Mulching in Njoro Sub County, Nakuru H. J. Sang^{1*}, R. M Wambua¹ and J. M. Raude² ¹Agricultural Engineering Department, Egerton University. P.O. Box 536-20115 Egerton, Kenya ²Soil, Water and Environmental Engineering Department, Jomo Kenyatta University of Agriculture and Technology (JKUAT). P.O Box 62000 – 00200 Nairobi Kenya *Corresponding Author: hellensang19@gmail.com</p>
<p>Exploring the Potential of Soybean [<i>Glycine max</i> (L.) Merrill] Production under Overhead Irrigation in Kerio Valley, Kenya J.N. Njoroge^{1*}, J. K. B. Kiplagat² and F. C. Kipkech² ¹Kenya Agricultural & Livestock research organization, P.O. Private Bag-20107, Njoro, Kenya. ²Kerio Valley Development Authority, P.O Box 2660-30100, Eldoret, Kenya; *Corresponding Author: jamnjos@gmail.com</p>
<p>Field Assessment of Adult Plant Resistance in Wheat (<i>Triticum aestivum</i> L.) Mutants to Stem Rust (<i>Puccinia graminis</i> f.sp <i>tritici</i>) across Three Different Locations E. A. Ogutu* and M. K. Charimbu ¹Egerton University, Dept of Crops, Horticulture and Soils, P.O Box 536-20115 Egerton, Kenya. *Corresponding Author: emmaculateogutu@gmail.com</p>
<p>Efficacy of <i>Trichoderma asperellum</i> Seed Treatment and Ridomil® Application Regime in Managing Late Blight (<i>Phytophthora infestans</i>) on Potato (<i>Solanum tuberosum</i>) J. M. Kilonzi^{1*}, J. J. Mafurah² and Nyongesa, M.W³ ^{1,2}Egerton university, Department of Crops, Horticulture and Soil, P.O Box 536, Njoro ³Kenya Agricultural Livestock and Research Organization- Tigoni, P.O Box 338-0217, Limuru *Corresponding Authors: kilonzijack@gmail.com</p>
<p>Effect of Processing Methods and Variety on Nutritional Quality of Ready-To-Eat Potato (<i>Solanum tuberosum</i> L.) Products M. W. Muthee*, J. O. Anyango and J. W. Matofari ¹Department of Dairy and Food Science Technology, Egerton University, P.O Box 536, Egerton: +254705554038 *Corresponding Author: muthee173@gmail.com</p>
<p>Physical – Chemical Characterization of Soils in Selected Potato Growing Areas of Molo, Nakuru County Kenya F. M. Maingi^{1*}, ²H. M. Mbuvi, and ²A. Abdulhameed ¹Science Technology and Engineering Department, Kibabii University Bungoma, Kenya ²Chemistry Department, Kenyatta University Nairobi, Kenya *Correspondence Author: mukoramaingi@yahoo.com</p>
<p>A Review on Climate Resilience Strategies in Sorghum (<i>Sorghum bicolor</i> (L.) Moench) Production for Food Security V.W. Njuguna^{1*} and J. M. Ouma¹ ¹Egerton University, Department of Crops, Horticulture and Soil, P.O Box 536-20115, Njoro, Kenya *Corresponding Author: vwanjiku89@yahoo.com</p>

<p>Relevance of Coat Colour in Beef Cattle Adaptation to Climate Change in Kenya: A Review P. K. Kirui^{1*}, T. K. Muasya¹, K. Ngeno¹ and I. Tura² ¹Animal Breeding and Genomics Group, Department of Animal Science Egerton University, P.o.Box 536 - 20115, Egerton, Kenya ²Beef Research Institute, KALRO – Lanet, P. o. Box 3840 - 20100, Nakuru, Kenya Correspondence to: Kirui, P. K¹, ¹Animal Breeding and Genomics Group, Department of Animal Sciences, Egerton University, P.O. Box 536 -20115 Egerton, Kenya, *Corresponding Author: kiprokirui@gmail.com: 0728468723</p>
<p>Diversity and Abundance of Invertebrate Taxa in Smallholder Farms in Nakuru County: Effect of Dolichos Based Cropping System and Field Margin Vegetation J. N. Obanyi^{1,2}, J. O. Ogendo^{2*}, R. S. Mulwa², and J. G. Nyaanga² ¹Kenya Agricultural and Livestock Research Organization, KALRO Njoro, Nakuru, Kenya ²Department of Crops, Horticulture and Soils, Egerton University, P.O. Box 536-20115, Kenya Corresponding Author: jogendo@egerton.ac.ke</p>
<p>Growth, Yield and Phosphorus Use Efficiency of Potato Varieties under Variable Phosphorus Rates P. Aarakit¹, J. P. Ouma¹ and J. J. Lelei¹ ¹Department of Crops, Horticulture and Soils, Egerton University, P.O Box 536 -20115, Egerton Njoro, Kenya Corresponding Author: Paulinearakit14@gmail.com</p>
<p>Effect of Variety and Insecticide Seed-Dress on Russian Wheat Aphid (<i>Diuraphis noxia</i>) Population, Damage and Yield of Wheat (<i>Triticum aestivum</i> L.) M. W. Karue, A. W. Kamau and S.O. Owuoche Department of Crops, Horticulture and Soils, Egerton University, Njoro, Kenya *Corresponding Author: milkakarue@yahoo.com; 0711801631</p>
<p>Effect of Dolichos (<i>Lablab purpureus</i> L.) Genotypes and Field Margin Species on Bean Aphids' Population and their Natural Enemies J. M. Karimi¹, R. M.S. Mulwa¹, J. G. Nyaanga¹, J. O. Ogendo^{1*}, E. Cheruiyot¹ and P. Bett² ¹Department of Crops, Horticulture and Soils, Egerton University, P.O. Box 536-20115, Egerton, Kenya. ²Department of Biological Sciences, Egerton University, P.O. Box 536-20115 Egerton, *Corresponding Author: jogendo@egerton.ac.ke</p>
<p>Host Plant Resistance to Blast Disease (<i>Pyricularia grisea</i>) in Selected Finger Millet (<i>Eleusine coracana</i> L. Gaertn) Genotypes J. T. Manyasi¹, P. K. Kimurto¹ and J. J. Mafurah¹ Department of Crops, Horticulture and Soils, Egerton University Corresponding Author: tracyjayo@gmail.com</p>

ANIMAL PRODUCTION/SCIENCE
<p>Estimating Prevalence of Endometritis in Smallholder Zero-Grazed Dairy Cows in Rwanda P. Nyabinwa^{1,3}, O. B. Kashongwe³, J. P. Habimana², C. d'Andre Hirwa¹, and B. O. Bebe³ ¹Rwanda Agriculture and Animal Resources Development Board, P.O. Box 5016, Kigali-Rwanda. ²School of Animal Sciences and Veterinary Medicine, University of Rwanda, P.O. Box 57, Nyagatare, Rwanda. ³Department of Animal Sciences, Faculty of Agriculture, Egerton University, P.O. Box 536, 20115 Egerton, Kenya *Corresponding Author: bbebe@egerton.ac.ke</p>
<p>Growth Performance of Mixed Sex and Monosex Male Tilapia (<i>Oreochromis niloticus</i>) Reared in Cages, Lake Victoria, Kenya *E. M. Kembanya^{1,2}, R. N. Ondiba^{1,2}, M. B. Angima² ¹Kenya Marine and Fisheries Research Institute, P.O Box 136, 40111, Pap Onditi, Kenya ²Kisii University P.O Box 402, 40200, Kisii, Kenya: +54720592917 *Corresponding Author: kembanyaelijah@gmail.com</p>
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<p>Forage and <i>In Vitro</i> Dry Matter Digestibility Quality of Native Species in Coastal Lowlands of Kenya L. M. Mburu^{1*} and C. K. Gachui² ¹Kenyatta University, Department of Animal Science, P.O Box 43844-00100, Nairobi, Kenya. ²University of Nairobi, College of Agriculture and Veterinary Sciences, P.O. Box 29053-00625, Nairobi, Kenya. ckgachui@gmail.com *Corresponding Author: mburu.leonard@ku.ac.ke</p>
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<p>Drivers and Responses to Climate Variability by Agropastoralists in Kenya: The Case of Laikipia County</p> <p>G. O. Atsiaya, O. I. Ayuya, L. W. Nakhone, J. K. Lagat</p> <p>¹Department of Agricultural Economics and Agribusiness Management, Egerton University, ²Department of Crops Horticulture and Soils, Egerton University, Njoro, Kenya</p> <p>Corresponding Author: godfrey.atsiaya@egerton.ac.ke</p>
<p>SOIL SCIENCE</p>
<p>Effect of Tractor Wheel Traffic Compaction on Selected Soil Physical Properties</p> <p>W. F. Okinda^{1*}, D. M. Nyaanga¹, and S. Nyakach²</p> <p>Department of Agricultural Engineering, Egerton University, Box 536 -20115, Egerton, Kenya</p> <p>Corresponding Author: wetaba@kisiipoly.ac.ke</p>
<p>Impact of Water-related Collective Action on Rural Household Welfare in the Upper Ewaso Ng'iro North Catchment Area: The Application of the Endogenous Switching Regression</p> <p>S. N. Mwaura^{1*}, I. M. Kariuki², S. Kiprop³, A. S. Muluvi³, B. Kiteme⁴, and P. Mshenga²</p> <p>¹Department of Economics, Maasai Mara University, P.O Box 861 Narok, Kenya. ²Department of Agricultural Economics and Agribusiness Management, Egerton University, Njoro, Kenya. ³Department of Economics, Egerton University, Njoro, Kenya. ⁴Centre for Training and Integrated Research in ASAL Development (CETRAD), Nanyuki, Kenya.</p> <p>*Corresponding Author: ngangamwaura09@gmail.com; smwaura@mmarau.ac.ke</p>
<p>The Seed Cotton Industry in Kenya; Production and Marketing Status</p> <p>D.K.L. Rutto¹, E.O. Auma¹ and L. Ngode¹</p> <p>¹Department of Seed, Crop and Horticultural Sciences, School of Agriculture and Biotechnology, University of Eldoret, P.O. Box 1125-30100, Eldoret, Kenya</p> <p>Corresponding Author: ruttodkl@gmail.com</p>

Agricultural Productivity Fails to Grow in East Africa: Urgent Action Needed to Change Course

Prof. Tom Thompson

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The United Nations Sustainable Development Goal 2 calls for doubling agricultural productivity of the world's smallholder farmers. Productivity growth – increasing the output of crops and livestock using fewer resources – is critical for food and nutrition security, rural development, and climate change adaptation. Despite positive trends in productivity growth during the 1980s and 1990s, much of East Africa has experienced negative productivity growth during the past 15 years. East Africa's farmers need affordable, reliable access to inputs that increase crop and livestock productivity, including fertilizer, mechanization, improved seeds, agronomic knowledge, and veterinary services. Without adequate access to these inputs, farmers will use more land and livestock to increase output, an expensive and unsustainable solution. We will use data and insights from Virginia Tech's Global Agricultural Productivity Report (GAP Report), to review the latest productivity data for Kenya and the region and outline approaches to reverse current trends, including investing in agricultural research and extension, embracing science-based technology, improving market access for inputs and outputs, cultivating public-private-producer partnerships, and increasing regional and global trade.

Managing Agricultural and Food Production Residuals: Innovations for Value-Added Products Recovery and Improving Household Air Quality to Enhance the Economies of Rural Communities

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Open-air markets are outlets for most agri-food products. The markets provide convenience and competitive pricing for agricultural products, but more importantly, they play a role in ensuring food availability and accessibility. However, huge amounts of agricultural production and food waste generated at these open-air markets present a health risk to users and surrounding communities, if not managed properly. Proper management of the refuse needs no emphasis. Many examples abound in several localities where the typical open-air markets refuse management is dumping in heaps. The heaps' attract vermins and pests as they rot, and on occasion, grazing spots for livestock. This practice is untenable and undesirable, given the important role of these markets to the economies of their rural communities. Another separate but critical issue related to agricultural residues is their use as solid fuel in homes. Using unprocessed biomass such as wood, crop residues, and unprocessed organic waste as fuel for cooking creates household air pollution linked to several respiratory disorders and a major cause of morbidity and mortality globally in developing economies. These household air pollutants present a health risk to those responsible for preparing food (commonly, women and children). Despite efforts by several organizations to promote alternative energy-efficient stoves, the adoption of these technologies is still very low. This presentation explores innovations to (1) manage agricultural residuals to make value-added products, e.g., soil amendments and recycling to improve soil health to increase or improve yields of locally grown foods and (2) develop an agricultural air quality education program to increase awareness and knowledge about household air quality. Implemented simultaneously, providing education, and introducing technology increase the chance of adoption, resulting in improved human health. The presentation takes a systems-based approach that connects new scientific insights and engineering solutions with inputs (and feedback) from decision making organs and the public (users of technology or information) to develop holistic solutions to complex challenges. The ultimate goal is to meet the challenge of providing enough, safe, and accessible food to a growing population in an environmentally sustainable manner.

Aquaculture Productivity in Kenya

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Kenya's aquaculture dates back to 1920s and in the 1960s, deliberate efforts to develop the sector were seen through international agencies, bilateral donor programs and the Kenyan government but has experienced slowed growth just like in many other developing countries despite immense water resource and an array of potential aquaculture fish species. Aquaculture in Kenya has in the past traditionally been characterized by earthen ponds located by the riversides with *O. niloticus* and *Clarias gariepinus* being the widely cultured species predominantly under extensive system. *Ochorychus mykiss* though highly priced has been limited to high altitudes along the Mount Kenya regions depending on raceways under semi-intensive system. Similarly mariculture limited to the coastal region a more recent approach has experienced slowed uptake with *Chanos chanos*, *Mugil cephalus* and *Scylla serrata* being the main culture species. The mainly extensive approach to aquaculture resulted in low production upto most recently (2007; 4,240MT and 2009; 4,895MT) despite several promotions by government and private agencies. However, in 2009, the government sub-sector support through the Economic Stimulus Programme (ESP), aquaculture production rose from 4,895MT in 2009 to 12,154MT in 2010 and heat the peak in 2014 at 24,098MT. Unfortunately a slowed production was once again experienced from 2015 to date with pond based production currently estimated at 15,124MT. The ESP multiplier effect includes adoption of Re-circulative aquaculture system (RAS) and now the rapidly growing cage culture in L. Victoria and in small water bodies of central Kenya. Cage culture though a recent approach has experienced rapid expansion and production from 3,180MT in 2017 to the current 15,000MT. This overally places aquaculture production in Kenya at an estimated 30,000MT. This is under production considering the immense potential along the coastal EEZ and conducive environment across most inland Counties. There is need for County Governments to refocus on aquaculture as a potential source of employment, food security and nutrition an approach successfully achieved by Asian countries. Further there is need for technology and innovation approach to ensure aquaculture production intensification with diminishing land and water resource.

Key Words: Aquaculture, Species, Production, Innovation, Technology, Kenya

Developing Youth Agribusiness Opportunities for attaining the SDG targets: Experience from Egerton University

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Africa has great potential to realize food security, poverty reduction as well as reduce youth unemployment through the agricultural sector. Consequently, many African governments have emphasized the importance of agricultural productivity and competitiveness in achieving the SDG “to create conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all, taking into account different levels of national development and capacities.” However, this potential is marred by several challenges such as low value addition, limited access to high value markets as well as mismatch between the skill requirements of the agri-food sector employers and graduates, with universities often accused of producing graduates without the requisite skills for innovation, entrepreneurship and community transformation. Most graduates have a mindset of white collar employment as opposed to self-employment and working with smallholder farmers for rural development. Changing this calls for new approaches in delivering agricultural science curricula to inculcate entrepreneurship, innovativeness and community engagement competencies amongst the students for agribusiness development. Developing youth agribusinesses is in line with African leaders’ vision of ‘a socially inclusive and sustainably development of Africa’ as given in Agenda 2063 of the African Union, the Science, Technology and Innovation Strategy for Africa (STISA) 2024 as well as the Comprehensive Africa Agriculture Development Program (CAADP), Africa’s Agenda 2030 and the African Development Banks’ Feed Africa strategy. Moreover, the African Development Bank has initiated the ENABLE Youth programme. These programmes support young African graduates to become entrepreneurs in agriculture. They focus on providing support, skills, knowledge and access to funds that enable the creation of viable agribusinesses for economic growth and employment. This paper aims at sharing insights on how African Universities can provide opportunities to students to develop agribusinesses and realize Africa’s Agenda 2063 as well as the sustainable Development Goals.

Key Words: Sustainable Development Goals, Agri-food sector, agripreneurship

Evaluation of Tomato Water Productivity under the Effect of Deficit Drip Irrigation and Mulching in Njoro Sub County, Nakuru

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The greatest challenge in the agriculture is to produce more food with little water. The challenge facing tomato farmers in Njoro Sub County is the unfavourable conditions for tomato growth which includes very low rainfall during the dry periods. This therefore needs increasing tomato yield per volume of water used. However, there is limited information on water management practices, or deficit irrigation that would increase tomato crop yield and additionally improve on the tomato quality when drip irrigation is used. The objective of this study was to evaluate the effect of deficit sub-surface drip irrigation and mulching systems on water productivity of tomato (*Lycopersicon esculentum* Mill) crop in Njoro Sub County. The study was carried out on experimental plots measuring 4 m² in a shade at Egerton University, Njoro campus. Factorial experimental design was used in this study where the treatments were three water levels (100 % ET_c, 80% ET_c and 60 % ET_c) and four grass mulch densities (0, 0.5, 1.0 and 1.5 kg/m²) replicated three times. The driplines were laid at a depth of 5.0 cm below the ground surface. An estimated water depth was applied to the respective experimental plots based on the various irrigation levels as guided by the four main tomato crop development stages. The agronomic parameters and yield was monitored on weekly basis over a period of twenty weeks. The tomato crop water productivity under the interactive effect of deficit sub-surface drip irrigation and grass mulch densities was determined to be highest at 60 % ET_c and 1.0 kg/m² of grass mulch and lowest at 100 % ET_c and 1.5 kg/m². The study provides information on optimum application rates that can be adopted for production of more tomato yields by farmers with less water thus leading to poverty reduction by improving the agri-business in Njoro Sub County.

Keywords: Water management, deficit irrigation, water productivity, sub-surface drip irrigation

Exploring the Potential of Soybean [*Glycine max* (L.) Merrill] Production under Overhead Irrigation in Kerio Valley, Kenya

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Soybean (*Glycine max* L. Merrill) has great potential for production under irrigation in various agro-ecological zones in Kenya. The study was designed to identify high yielding soybean genotypes of high quality among released and promising genotypes under overhead irrigation for Kerio Valley of Kenya. The trial was set in a randomized complete block design replicated thrice at Sigor in West Pokot County and Arorr in Elgeyo Marakwet County in Kerio Valley, Kenya. The number of seeds pod⁻¹, pods plant⁻¹, nodes plant⁻¹, plant height, a 100 seed weight and oil content were higher in Arorr than Sigor. Variety Kensoy009 had the highest seed size at Arorr and Sigor where it recorded 100seed weight of 22.6g and 19.4 g, respectively. Mean maturity days were fewer at Arorr (91days) than Sigor (100 days). The highest yield was recorded at Arorr on variety DBSB 8(3222kg ha⁻¹) while the least was recorded on kalrosoy1 (1057kg ha⁻¹). The mean yield was 2683 and 2515 kg ha⁻¹ for DPSB 8 and DPSB 19, respectively while the mean protein (41.7%, 40.7%) and oil (20.6%, 20.9%) content was observed on DPSB 8 and DPSB 19, respectively. Variety DPSB 8 had the highest protein content (41.7%) while variety SCS1 recorded the highest oil content (26.5%). Correlation analysis indicated that seed yield was strongly and positively correlated to plant height ($r = 0.74$), number of pods plant⁻¹($r = 0.78$) and nodes plant⁻¹($r=0.71$). Strong negative correlation was observed between protein content and oil content ($r = -0.87$). Varieties DPSB 8 and DPSB 19, due their high seed yield, protein and oil content are recommended for production in Kerio valley and other regions with similar climatic conditions under overhead irrigation.

Keywords: Oil, overhead irrigation, protein, soybean, yield

Field Assessment of Adult Plant Resistance in Wheat (*Triticum aestivum* L.) Mutants to Stem Rust (*Puccinia graminis* f.sp *tritici*) across Three Different Locations

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Stem rust (*Puccinia graminis* f. sp *tritici*) is a destructive disease of wheat (*Triticum aestivum* L.) making it a major challenge to wheat production in Kenya as well as other wheat growing countries. Due to this, mutation breeding has been as a source of increasing variability and confers specific improvement to the Kenyan varieties without significantly altering its phenotype. The objective of this study was to determine adult plant resistance of wheat mutant lines to stem rust across three different locations. The study area was in three locations, Nakuru County (Njoro and Mau Narok) and Meru County (Timau) during 2015-2016 cropping season. Sixty three mutant lines and six checks (NJBWII, Duma and Kwale, Kingbird, Robin and Cacuke) were evaluated under field conditions with three replications in an alpha lattice (23 rows by 3 columns) design. Mean for area under disease progress curve and coefficient of infection revealed that Duma200gry (1026), Duma200gry (1124) were best disease performers. The calculated variance (*Si*) distinguished stable genotypes in terms of disease and yield which included Duma100gry (995) and Kwale100gry (1483), respectively. There was positive effect of dosage 400gry on the mutant lines in terms of disease, yield and 1000 kernel weight, mostly with the Duma mutant lines. The mean grain yield for the genotypes ranged from 5.5 to 14.1 t ha⁻¹. Genotype, location and genotype by location interaction for the area under disease progress curve, coefficient of infection and yield were significant at P< 0.01 and P<0.001. There was a negative correlation displayed between yield and disease components. R-Square values revealed 0.1508 and 0.3911 of the variation in yield was contributed by the disease severity and area under disease progress curve, respectively. Considering the best lines both in disease and yield can be taken for further screening in breeding programmes.

Keywords: Adult plant resistance; Multi-locations; Stem rust; Wheat.

Efficacy of *Trichoderma asperellum* Seed Treatment and Ridomil® Application Regime in Managing Late Blight (*Phytophthora infestans*) on Potato (*Solanum tuberosum*)

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The overuse of fungicides to manage late blight has led to emergence of more aggressive strains raising environmental, economic and health concerns. The objectives of the study were to determine the cost benefit and efficacy of *T. asperellum* (3×10^6 , 7×10^6 and 1×10^6 CFU/mL) seed treatment and Ridomil® (Metalaxyl 4% + Mancozeb 64%) application interval (21, 14 and 7 days interval) in managing late blight on potato tuber and apical cutting seed crop by either peridermal injection or dipping. Costs and benefits associated with apical cutting and tuber seed treatment were analyzed using partial budgeting to calculate marginal rate of return percent (MRR %). Results showed that there was no significant difference between 7 and 14 days interval in terms of yield and disease severity. Apical cuttings were highly infected by late blight resulting to lower yield and net loss compared to tuber seed crop. *T. asperellum* at 33% concentration was ineffective in managing *P. infestans*. *T. asperellum* at 66% and 100% concentration reduced early late blight infection and were not significantly different in terms of disease severity and yield in all Ridomil® application regimes. Combination of *T. asperellum* at 66% concentration with 14 days interval had the highest (969%) MRR% compared to any other combination. Peridermal injection had significantly higher yield and benefits than dipping. The results of the study suggest that *T. asperellum* seed treatment at 66% concentration can increase fungicide application interval by 7 days while effectively managing late blight. This will not only reduce the amount of fungicides applied and their negative effects but also will contribute to improved yield as well improve farm net income.

Keywords: Apical cuttings, Efficacy, Ridomil® *Trichoderma asperellum*

Effect of Processing Methods and Variety on Nutritional Quality of Ready-To-Eat Potato (*Solanum tuberosum* L.) Products

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Over the recent years, there has been a change in consumption patterns. As a result, consumers are gearing towards convenience foods. This has led to the rise in demand for ready-to-eat (RTE) foods. Potato has been found to be a preferred crop for ready-to-eat foods, for instance, potato chips and crisps because of its ease of preparation and convenience. These are prepared from different varieties, and different processing methods. Research shows that processing methods and variety have an effect on the physicochemical properties such as the size and structure of the starch, gelatinization temperatures, viscosity and starch composition, which affects starch digestibility which is a nutritional quality parameter. Starch digestibility influences the glycaemic index (GI) of foods, which is an indicator of the potential of a food to raise blood glucose. RTE foods in Kenya have been found to have a high glycaemic index (>70%) which may be associated with the high type 2 diabetes prevalence in Kenya (5.6%), where potato is the third most consumed staple crop. Nyandarua County, being a major producer and consumer has a high type 2 diabetes prevalence at 10.8%. Different ready-to-eat potato products exhibit different glycemic responses once consumed since processing methods employed affect the amount of resistant starch formed, rate and extent of starch digestibility, and amylase inhibition. Continued intake of high GI foods has been reported to increase the risk of contracting cardiovascular diseases and conditions such as type 2 diabetes and obesity. Boiled and mashed potatoes have been found to have a higher glycaemic index, 78% and 70% respectively. Fried potatoes have been found to have high resistant starch (7%) as a result of formation of amylose-lipid complexes which hinder enzymatic digestion, hence reduced starch digestibility. However, there is limited information on the effect of combining a particular variety and processing method.

Keywords: Nyandarua, ready-to-eat, potato, starch digestibility

Physical – Chemical Characterization of Soils in Selected Potato Growing Areas of Molo, Nakuru County Kenya

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Characterization of soils in selected potato growing areas of Molo, Nakuru County in Kenya was necessitated by the observed decline in potatoes acreage yields over the years despite the use of phosphorus and nitrogenous fertilizers. In this study, levels of some key soil fertility indices were determined. Four farms that have been in intensive potatoes farming were selected. Soil samples were randomly collected at a depth of 0-10 cm separately for all the investigated sites. Site-wise composite samples were prepared, air-dried, grinded and passed through a 2 mm sieve size and stored in plastic containers ready for laboratory analysis. Analytical techniques employed were Walkley black for carbon, Kjeldahl for nitrogen, standard wet chem soil analysis, saturation method for water porosity, glass electrode determined soil pH, bulk density, particle density and water holding capacity were determined by methods of Keen box. From the study, the mean levels of essential soil fertility indices obtained were; soils pH (5.46 ± 0.43), soil bulk density (g/cm^3) (1.03 ± 0.01), particle density (2.51 ± 0.08), water holding capacity (%) (36.07 ± 2.57), porosity (0.59 ± 0.01), exchangeable cations ($\mu\text{S/cm}$) (83.63 ± 14.22), cation exchange capacity ($\text{meq}/100\text{g}$) (18.48 ± 0.89), organic carbon (%) (3.50 ± 0.24), total nitrogen (%) (0.17 ± 0.03). Mean micro and macronutrients available (mg/Kg) were; phosphorous (7.11 ± 2.77), potassium (100.27 ± 8.32), calcium (198.2 ± 35.1), magnesium (20.97 ± 4.28), manganese (15.26 ± 1.12), sulphur (2.31 ± 1.88), copper (0.59 ± 0.12), boron (0.38 ± 0.07), zinc (12.96 ± 2.04), sodium (8.61 ± 0.51), iron (147.92 ± 4.10). These findings reveal the extent of some fertility indices depletion in the soils and will form a baseline for decreased yield of potatoes in this region. The results further forms the base for future research on working acreage of key soil fertility indices required for remediation.

Keywords: Baseline, Characterization, Depletion, Fertility indices, Potatoes farming

A Review on Climate Resilience Strategies in Sorghum (*Sorghum bicolor* (L.) Moench) Production for Food Security

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Sorghum (*Sorghum bicolor* (L.) Moench) is a promising food security crop due to its ability to tolerate drought. A literature review was carried out with an aim of highlighting strategies that sorghum farmers could adopt in the wake of changing climate for improved crop production and livelihoods. The review focussed on sorghum production trends, opportunities and challenges in sorghum production, overview of effect of climate change on agriculture among others in order to highlight some of the strategies that farmers could adopt to enhance sorghum production in a changing climate. Approaches for the sustainable intensification of sorghum production that can support climate change adaptation and mitigation include: the use of quality seeds and planting materials of well-adapted varieties; the cultivation of a diverse suite of crop species and varieties in associations and/or rotations; the use of integrated pest management practices; the implementation of conservation agriculture and the adoption of sustainable mechanization to maintain healthy soils and manage water efficiently. Identification of potentially useful practices by farmers is important to estimate future adaptation to climate change impacts. This will contribute to enhanced food security and livelihoods of farming communities through improved crop production despite the variability in abiotic factors of crop production.

Key words: Sorghum, food security, climate

Relevance of Coat Colour in Beef Cattle Adaptation to Climate Change in Kenya: A Review

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Beef sector contributes significantly to Kenya's economy. A large proportion of beef cattle is found in arid and semi-arid lands (ASALs) and is the main source of livelihood supplying 80-90% of the total beef consumed in the country. However, resulting from the rising human population coupled with changes in consumer preference, the high demand for beef cannot be met by the country's supply. This shortage is further aggravated by a myriad of challenges facing the beef sector in addition to impeding negative effects of climate change. The current beef breeding programmes emphasize on production traits with little attention given to adaptive traits. More so, animal's coat colour, which has been found to play a role in animal adaptation has been neglected in beef breeding programmes. Animal's coat colour is a polygenic trait with pleiotropic effects, implying that it could be having unknown genetic and phenotypic influence in other traits. The inclusion of this trait in breeding programmes could, therefore, help ameliorate the challenges facing the beef sector. The objective of this review is to bring into attention the role of animal's coat colour in helping animals abate the thermal stress as a result of climate change and therefore the need for its inclusion in beef cattle breeding programmes. The information is based on previous published studies on the same subject in various animal species from different regions.

Keywords: Animal's coat colour, cattle adaptation, climate change

Diversity and Abundance of Invertebrate Taxa in Smallholder Farms in Nakuru County: Effect of Dolichos-Based Cropping System and Field Margin Vegetation

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Biological control by use of natural enemies is an emerging eco-friendly pest management method which can provide a sustainable alternative option of controlling pest. However, the conservation of these natural enemies within agricultural production systems is a challenge. Field studies were conducted in smallholder farms in Nakuru County to determine the effect of field margin vegetation in supporting the diversity and abundance of invertebrate taxa. Two cropping systems, dolichos monocrop and maize-dolichos intercrop, were planted in farmers' fields with or without field margin vegetation in Njoro and Rongai sub-counties of Nakuru County during the long rains of 2019 and 2020. The treatments were arranged in randomized complete block design (RCBD) with eight (8) replicates per locality. The abundance and diversity of field margin vegetation in each farm, was determined by throwing a 1 m² quadrat thrice per field margin and counting all plant species present and converting them to percent abundance. Invertebrate taxa were trapped using yellow sticky cards, pan traps and sweep netting three times during the cropping season. Trappings were grouped, counted and morphologically identified using taxonomic keys. All data on counts were transformed using square root transformation ($\sqrt{X+0.5}$) before being subjected to analysis of variance using PROC GLM in SAS software and treatment means separated using Tukey's HSD test at $P \leq 0.05$. Results showed that there were a total of eighteen (18) perennial species; 8 in Njoro and 10 in Rongai. There were more weeds species in Rongai (17%) compared to Njoro (14%) and more perennial weeds (21%) compared to annual weeds (13%). Mean abundance of invertebrate taxa was higher in Rongai (7.2) farms compared to Njoro (6.8) farms. Across the two environments the invertebrate taxa collected were composed of pests and their natural enemies and other insects like flies. The results further showed that invertebrate taxa were significantly higher in the Dolichos monocrop (3.6) than in the maize-dolichos intercrop (2.2). These results show that inclusion of field margin vegetation around smallholder farms enhances the conservation of diverse invertebrate taxa which is an important functional mechanism of managing different pests in integrated pest management.

Keywords: biological control, conservation, invertebrate taxa, natural enemies, plant diversity

Growth, Yield and Phosphorus Use Efficiency of Potato Varieties under Variable Phosphorus Rates

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The use of poor quality potato seeds as well as low soil fertility majorly limit potato production in Kenya. The objective of the study was to determine effect of phosphorus rates on growth, yield and phosphorus use efficiency of potato (*Solanum tuberosum* L.) varieties propagated from rooted apical cuttings. Field experiments were conducted at the research fields of Egerton University, Njoro and the Kenya Agricultural and Livestock Research organization (KALRO), Molo. A split plot arrangement in randomized complete block design with three replicates was used. Main plot factors were four potato varieties (Shangi, Dutch Robyjn, Unica and Wanjiku) and sub plot factors were four P levels (0, 30, 60, 90 kg P ha⁻¹). Data on growth, yield and phosphorus use efficiency of potato were collected. Phosphorus rates had significant effect ($P < 0.05$) on plant survival, number of stems and marketable tuber yield. The interaction effects of phosphorus rates and varieties on plant survival, plant height, shoot biomass, number of eyes and tuber size was significant ($P < 0.05$). The rates of 60, 90, and 30 kg P ha⁻¹ recorded 16, 15 and 14 tubers per hill, respectively, which were not significantly different but higher than control that recorded 11 tubers. The interaction of Wanjiku and 30 kg P ha⁻¹ gave the highest shoot biomass of 0.42g and the highest number of large sized tubers (<60mm diameter). The main effects of variety ($P < 0.01$) and phosphorus rates ($P < 0.05$) significantly affected days to physiological maturity and marketable tuber yield. Main effect of phosphorus application rate on P uptake and PUE was significant ($P < 0.001$). Unica variety showed high PUE at both study sites. Rooted apical cuttings of Wanjiku, Shangi and Unica varieties with application of 30 kg P ha⁻¹ is recommended in the study areas and other areas with similar agro ecological zones.

Keywords: Phosphorus, potato, rooted apical cuttings, nutrient use efficiency

Effect of Variety and Insecticide Seed-Dress on Russian Wheat Aphid (*Diuraphis noxia*) Population, Damage and Yield of Wheat (*Triticum aestivum* L.)

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Russian wheat aphid (*Diuraphis noxia*) is one of the most important pest of wheat (*Triticum aestivum*) and other cereals worldwide. It has been reported to cause up to 95% yield loss when poorly controlled. Therefore, there is need to develop effective Russian Wheat Aphid (RWA) control methods to reduce wheat yield losses. The objective of this study was to determine the effect of variety and insecticide seed dress on RWA population and damage on wheat. The experiment was carried out in the field cage using Randomized Complete Block Design (RCBD) replicated three times. The treatments included nine bread wheat varieties (*Kwale*, *K. Wren*, *K. Kingbird*, *Robin*, *K. Tai*, *K. Sunbird*, *Eagle 10*, *K. Korongo* and *K. Hawk*) and insecticide seed dress (Cruiser at 1.5 ml/kg of seeds and JOCII at 25ml/kg of seeds). There were significant differences ($P \leq 0.05$) in plant height, aphid population and damage (leaf chlorosis and leaf rolling) among the varieties. *Eagle* variety consistently recorded the longest height compared to all the other varieties and also recorded the least aphid population. The most infested variety was *Korongo* which was not significantly different from *Kwale* ($P \leq 0.05$). Variation in plant height over time after infestation was due to interaction between RWA damage and genetic potential of each variety. Cruiser insecticide seed dress gave the best control by reducing aphid population and its damage significantly ($P \leq 0.05$) compared to control and jocii seed treatment. The results of this study shows that *Eagle* variety is resistant to RWA and seed dressing the variety with cruiser promotes vigor and resistance during the early stages of growth resulting to high yield.

Key words: *Diuraphis noxia*, *Triticum aestivum*, variety

Effect of Dolichos (*Lablab purpureus* L.) Genotypes and Field Margin Species on Bean Aphids' Population and their Natural Enemies

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Plant genotypes vary in influencing predatory activity and suppression of population development of aphids. Host plant resistance plays a key role in managing pests and conserving of natural enemies in an agroecosystem. Field evaluations were conducted to determine the effect of various genotypes on abundance of aphids and their natural enemies in Dolichos bean (*Lablab purpureus* L.). Eighteen (18) genotypes were planted at Egerton University, with and without the field margin vegetation, in a randomized complete block design (RCBD) replicated four times. Data on abundance, severity and incidence of aphids were collected at five different crop growth stages: seedling, early vegetative, late vegetative, flowering and podding. Population of natural enemies was monitored and trapping was done by use of pan traps and sticky traps. Data on counts were transformed using log transformation $\log_{10}(x+2)$ before being subjected to analysis of variance using **PROC GLM** in SAS software and treatment means separated using **Tukey's** Honest Significance Difference test (**$P \leq 0.05$**). Results showed that aphid incidence was significantly different at seedling and late vegetative stages across the genotypes. Genotypes EUD12 and EUD1 had the highest aphid incidences of 36.25% and 35.00%, respectively, at seedling stage as well as 10.0% and 3.75%, respectively, at late vegetative stage. Ten families of natural enemies were identified with Tachnidae having the highest proportion (52.97%) followed by Braconidae (22.68%), Coccinellidae (10.32%) and Syrphidae (4.48%) in decreasing order. Population of natural enemies was significantly different within the crops (81.7%) and along the field margin vegetation (18.3%). Specifically, 88% tachnids, 81% braconids, 62% coccinellids and 85% syrphids were found within the crops as compared to the field margins (12-18%). These findings show that genotype and field margin vegetation directly influence a sustainable natural pest regulation system in Dolichos bean.

Keywords: aphids, Dolichos, genotypes, field margin vegetation, natural enemies.

Host Plant Resistance to Blast Disease (*Pyricularia grisea*) in Selected Finger Millet (*Eleusine coracana* L. Gaertn) Genotypes

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Pyricularia grisea (anamorph *Magnaporthe grisea*) is the most destructive fungal pathogen causing blast disease in finger millet (*Eleusine coracana*) causing significant yield loss ranging from 28-100% and most cultivars grown by farmers are susceptible to the disease. Host plant resistance is a good alternative and most effective method for control of blast since no additional costs to the farmer once the variety has been adopted. Twelve diverse genotypes from ICRISAT, Kenya Gene Bank and local accessions and selected from field screening of 25 lines were evaluated for blast resistance, in inoculated trials for leaf and neck blast resistance and severity under greenhouse conditions for two seasons. The trials were evaluated in a Randomized complete block design (RCBD) with 3 replications. Resistant check (Gulu E) and susceptible check (KNE 741) were used as controls. Data on leaf and neck blast damage and severity was done using Disease Severity Index (DSI) scale of 0-100% at 7 day interval and AUDPC. Results from ANOVA revealed that days to heading, maturity, height, finger number, panicle weight, 1000 kernel weight, neck AUDPC, finger length, yield and biomass of genotypes differed significantly ($P < 0.001$). DSI on neck blast showed that 3 genotypes were resistant (SMDF 1702, IE2183 and snapping purple variety), 4 were moderately resistant with 13% (U15, KNE 1034, KNE1124x796 and KatFm1xu151.6.6.3.1.1). DSI on leaf blast showed that 4 genotypes were resistant (Gulu E, KatFm1xu151.6.6.3.1.1, KNE 1034 and SMDF 1702). Two were moderately resistant (KNE 629 and Kal Pader). Result from AUDPC showed that head blast differed significantly ($P < 0.05$) among genotypes while leaf blast was not significantly ($P > 0.05$) different among the finger millet genotypes. Pearson's correlation coefficient indicated that there was a significant ($P < 0.01$) negative correlation of neck blast to 1000 kernel weight and yield. Leaf blast had a significant positive correlation with 1000 kernel weight which had a significant positive correlation with yield ($P < 0.001$). Panicle weight had a significant ($P < 0.05$) positive correlation with yield. This results indicated that Kenyan germplasm has high potential for blast resistant breeding.

Keywords: Host plant resistance, Genotypes, Leaf and neck blast resistance.

Estimating Prevalence of Endometritis in Smallholder Zero-Grazed Dairy Cows in Rwanda

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Endometritis is a postpartum uterine disease of cows that interrupts reproductive cycles resulting in suboptimal fertility, reduced performance, and profitability of the dairy herd. The objective of the study was to estimate the perceived and observed prevalence of endometritis among zero-grazed dairy cows in smallholder farms in Rwanda. A snowball sampling method was applied in cross-sectional survey to obtain data from 370 farms on 466 cows within their 21-60 days postpartum (dpp). The survey, conducted from September 2018 to March 2019, simultaneously examined cows using the Metricheck Device (MED) to determine the presence and type of vaginal mucus character (VMC) based on a score scale of 0 to 3. Cows scoring VMC ≥ 1 were recorded clinical endometritis (CLE) positive. Cytotape (CYT) was used to determine the percentages of polymorphonuclear cells (PMN) in endometrial cytology sample. Cows with $\geq 5\%$ of PMN were recorded subclinical endometritis (SCLE) positive. At cow-level, endometritis prevalence was 70.2% with 67.2% CLE and 31.8% SCLE while at the herd-level, prevalence was 71.1% with 68.1% CLE and 34.4% SCLE. The differences between the diagnostic performance of the MED and CYT were significantly ($p < 0.001$). Perceived prevalence by farmers was much lower (3.2%) and without agreement with the observed prevalence (Kappa = -0.02, $p > 0.05$). The high-observed prevalence and farmer underestimation of endometritis prevalence indicate knowledge gaps about endometritis. The extension service therefore needs to increase awareness and education among smallholder farmers about detection and management of endometritis.

Keywords: Crossbreds; Cytotape; Dairy cows; Exotic breeds; Metricheck.

Growth Performance of Mixed Sex and Monosex Male Tilapia (*Oreochromis niloticus*) Reared in Cages, Lake Victoria, Kenya

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Growth performance of mixed sex and male monosex *O. niloticus* was done in cages at LwandaDisi beach, Lake Victoria, Kenya. Male monosex fingerlings were sex reversed by feeding newly hatched larvae on feed laced with 17- α -methyl testosterone hormone (MT) for 28 days. Mixed sex fingerlings were collected from nursery ponds and fed MT hormone free starter mash before stocking. A total of 6 cages (2x2x2m) were randomly stocked with 1000 monosex fingerlings (mean weight 9.5 \pm 0.01g) and mixed sex fingerlings (mean weight 8.6 \pm 0.04g). The fish in cages were fed starter mash 40% Crude Protein (CP) at 10% of body weight for first two months. In the second month till the end of the experiment the fish were fed 30% CP 3% of the body weight. Measurement of fish length weight and selected water quality variables was done once a month for a period of six months. Specific Growth Rate (SGR), Feed Conversion Ratio (FCR), Relative Condition Factor (Kn) and survival rate (%) was calculated at the end of the experiment. The male monosex *O. niloticus* attained a high final length and weight, SGR, FCR than the mixed sex *O. niloticus* ($p < 0.05$). Survival rates were similar in both male monosex and mixed sex *O. niloticus* ($p > 0.05$). There were no significant differences in mean water quality parameters between male monosex and mixed sex in cages ($p > 0.05$). Though the mixed sex *O. niloticus* did not reproduce in cages they performed poorly as compared to male monosex. This is attributed to the fact that Nile tilapia exhibit a sexually dimorphic growth pattern in which males grow faster and bigger than females. This study recommends all male *O. niloticus* for cage culture.

Keywords: Cages, Nile tilapia, mixed sex, monosex

Combination of Scrotal and Semen Characteristics is more Informative when Selecting Dairy Goat Bucks for Breeding

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Breeding of goats requires proper selection of breeding bucks through consideration of their breeding soundness. Selection of breeding bucks is the most critical decision for improvement of a flock, and it largely depends on factors like scrotal circumference and semen quality. The objective of this study was to evaluate the effect of breed and age on scrotal measurements, semen characteristics and the correlations among these traits in dairy bucks raised under extensive system. Total of twelve (12) bucks were used for this study, six (6) from each breed of Toggenburg and Saanen and within each breed the bucks were further subdivided into two group based on age (young and adults) in 2 x 2 factorial design. Body weight, scrotal circumference and scrotal length were measured. Additionally, semen volume, mass motility and spermatozoa concentration were also evaluated. The data were analysed using analysis of variance with General Linear Model and correlation analysis was conducted using Pearson's product-moment procedures of SAS (Version 9.0). The findings demonstrated that breed of bucks had no effect on body weight, scrotal circumference, scrotal length, volume and motility. However, Toggenburg bucks had higher spermatozoa concentration compared to Saanen bucks. Also the study found that, there was significant effect of age on all the parameters measured with exception of semen volume. In terms of correlations, there was significant positive correlation among body weight, scrotal circumference and scrotal length. There was however, low positive correlation between body weight and scrotal parameters with semen characteristics. It could be concluded therefore, that Toggenburg bucks could produce high number of total spermatozoa and as a result higher semen doses for artificial insemination purposes compared to Saanen bucks under extensive system. Also age should be taken into consideration when selecting breeding bucks. Moreover, selection of breeding bucks should not be based on scrotal traits only, but semen characteristics should also be considered.

Keywords: Toggenburg, Saanen, bucks, scrotal parameters, semen characteristics

Farmers' Opinion on the Effectiveness of Management Interventions for Endometritis in Smallholder Zero-grazed Dairy Farms in Rwanda

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Endometritis is a prevalent disease in postpartum cows resulting in substantial economic losses due to decreases in productivity and profitability of the dairy farms. Therefore, knowledge on effectiveness of management interventions (MIs) towards endometritis are essential to make good decisions on its preventive measures and improve dairy cow's productivity. The objective of this study was to gather opinion from smallholder dairy farmers in Rwanda on the effectiveness of different MIs implemented when an endometritis positive case was observed in their herd two years preceding the survey. In this cross-sectional study, the best-worst scaling technique was performed from September 2018 to March 2019, and included responses from 154 dairy farmers identified through snowball sampling method. Results indicate that 12 out of 20 MIs were scored highly for effectiveness and the top three were avoiding equipment-sharing with neighbouring farms, followed by consultation of veterinarian about treatment of endometritis case and washing the hands and udder before each milking. MIs related to equipment sharing into or with neighbouring farms and hygiene in cowshed, control of reproduction traits and breeding services and reduce the risks of contamination within and between farms were scored most effective, whereas MIs related to veterinary intervention and metabolic diseases management were scored least effective. These findings lead to greater understanding of farmer perceptions on the effectiveness of implemented MIs that they believed a priori that were important on their dairy farms. This is serving as an indicator of future levels of MIs adoption once the awareness and capacity building to increase knowledge about the MIs and endometritis among smallholder dairy farmers are prioritized by decision-makers.

Keywords: Best-worst, implementation, disease prevention, scores, reproduction traits

Forage and *In Vitro* Dry Matter Digestibility Quality of Native Species in Coastal Lowlands of Kenya

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In the Coastal Lowlands of Kenya, small-scale mixed crop-livestock system is the dominant form of agricultural production. Feed quantity and quality are inadequate and rarely meets the nutrient demands of growing heifers and lactating cows especially in the dry seasons. The objective of the study was to determine the chemical composition and *in vitro* dry matter digestibility (IVDMD) of some native species forage species in Kwale and Kilifi Counties. A cross-sectional survey was conducted for 3 months on a random sample of 415 small-scale dairy cattle producers' to determine the main basal feed resources. Thereafter, feed samples were collected during a longitudinal survey on a purposive sample of 32 farms from the main cross-sectional sample for 12 months. Chemical composition of the forages varied considerably. The mean CP and NDF of grasses ranged from 84.1±10.9 - 97.1±13.5 and 603.8±57.0 - 724.8±45.1 g/kg DM respectively. *Leucaena leucocephala* had the highest CP of 270.8±74.0 g/kg DM while natural pastures mixture had the lowest of 84.1±10.9 g/kg DM. *Asystaciagangetica* and *Commelina benghalensis* had a CP content of 131.8±26.7 and 162.7±22.6 g/kg DM respectively. Napier grass had a CP of 86.4±11.3 g/kg DM while dry maize stover and green maize stover had CP of 72.2±10.4 and 112.8±13.6 g/kg DM respectively. *A. gangetica*, *C. benghalensis*, *L. leucocephala* and green maize stover had higher *in vitro* dry matter digestibility (> 50%) compared to dry maize stover, pastures grasses and napier grass. Pastures grasses *in vitro* dry matter digestibility ranged from 40.3±7.31 – 44.7±5.48%. Therefore, the available forages were of moderate quality with average to high nutrient content and *in vitro* dry matter digestibility. Farmers' should be encouraged to harvest pasture grasses at bloom-milk stage in order to take advantage of their rich nutrient supply.

Keywords: Chemical composition, forages, *in vitro* digestibility, native species

Ecotype of Indigenous Chicken Contributes to External and Internal Egg Quality Characteristics

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We aimed to characterize important external and internal egg quality traits of indigenous chicken and determine whether significant differences exist between ecotypes. A total of 262 eggs were collected in 5 consecutive days from mature indigenous chicken (IC) hens sourced from Bomet (n=43), Homabay (n=16), Siaya (n=36), Kakamega (n=26), Bungoma (n=27), Busia (n=18), Laikipia (n=52) and Kwale (n=44) counties. The birds were maintained in an intensive system at the Naivasha Poultry Research Unit and housed in deep litter pens in groups of between 5 and 10 hens from the same source per pen (Bomet=14, Homabay=16, Siaya=14, Kakamega=18, Bungoma=13, Busia=15, Laikipia=26 and Kwale=24). The external quality traits measured were egg weight (EW), egg length (EL), egg diameter (ED) and shape index (SI). Internal quality traits were albumen weight (AW), yolk weight (YW), Haugh units (HU) and yolk colour (YC). The overall mean EW, EL, ED, SI, AW, YW, HU and YC were 49.3 g, 53.6 mm, 40.7 mm, 76.0 %, 25.9 g, 17.2 g, 73.7 units and 10.9 points on the Roche scale, respectively. All traits displayed significant differences between ecotypes ($P < 0.05$). The EW of Kwale ecotype (42.4 g) was significantly lower than the rest while EL of Busia and Kwale ecotypes were longest (56.1 mm) and shortest (50.4 mm), respectively. Siaya ecotype had the widest eggs (41.3 mm), while Kwale had the narrowest (39.1 mm). Kwale ecotype, however, had the highest SI (77.7 %) while Busia had the least (73.1 %). Busia ecotype had the heaviest albumen and yolk (29.1 and 19.3 g, respectively) while Kwale had the lightest (22.3 and 15.8 g, respectively). On the other hand, whereas Bomet ecotype had the highest HU (79.8 units) and YC (12.8 points), Kakamega had the lowest HU (65.3 units) and Siaya the least YC (9.1 points). These differences may be exploited in breeding programs to improve IC egg quality.

Keywords: Ecotypes; Egg quality; Indigenous chicken

Use of Pooled Genetic Parameters Minimizes Biasness when Evaluating Response to Selection in Indigenous Chicken Breeding Programs

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This study hypothesized that use of genetic parameters from different studies to evaluate overall genetic and economic gains of livestock breeding programmes could over and under estimate response to selection. This is because genetic parameters are affected by data sample size, environmental conditions and evaluation models. This premise was tested by deterministic simulation of breeding schemes that resemble that used in indigenous chicken in Kenya. Rates of genetic gain and inbreeding were estimated when non-pooled (NPP) and pooled (PP) genetic parameters were adopted. The NPP represented the conventional evaluation model where genetic parameters for traits are sourced from different studies assuming factors affecting their predictions. The PP strategy mimicked an alternative model cognizant of the factors affecting the parameters and therefore parameters from different studies were subjected to meta-analysis to obtain consensus estimates. Response to selection after one round of selection in the two strategies was compared assuming a single tier nucleus breeding scheme with 480 breeding candidates with mating ratio of 1:5 for cocks and hens. The rates of genetic gain and inbreeding were KES 40.50 and 0.68% and KES 61.10 and 0.49% for PP and NPP, respectively. Rate of genetic gain and inbreeding realized in PP was 1.5 times lower and 38% higher than that realized in NPP, respectively. The findings in this study confirm the premise that, accounting for variations through meta-analysis in estimation of input genetic parameters minimizes the over and under estimation of genetic gain and inbreeding.

Keywords: Indigenous chicken, Meta-analysis, Response to selection

Effect of Cropping System and Field Margin Vegetation on Population of Aphids and their Natural Enemies in Lablab Beans in Nakuru County, Kenya

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Dolichos bean (*Lablab purpureus* L.) is a pulse crop that is resilient to soil moisture deficit and provides food and nutrition security to most communities in Kenya. However, insect pests such as aphids limit its production. Field trials were conducted to determine the effect of dolichos-based cropping system and field margin vegetation on aphids and their natural enemies in Dolichos bean under low and high plant diversity environments. Dolichos monocrop and maize-dolichos intercrop were planted in farmers' fields with and without field margin vegetation in Njoro and Rongai sub-counties of Nakuru County, Kenya. A 2 x 2 factorial treatment combinations were arranged in a randomised complete block design (RCBD) replicated eight times in each plant diversity environment. Data were collected on aphid incidence, severity and abundance (scoring scale: 1-6) and the natural enemies of aphids monitored using yellow sticky cards, sweep nets and direct observation. Data on the insect counts were first transformed using $\sqrt{(x + 1)}$. All data were then subjected to analysis of variance using PROC GLM in SAS software and treatment means separated using Tukey's HSD test at $P \leq 0.05$. Results showed that the Njoro ecosystem significantly had higher aphid incidence (av. 55.01%), severity (2.0) and abundance (av. Score: 1.82) than the Rongai ecosystem. With respect to cropping system, Dolichos monocrop recorded higher aphid incidence (av. 63.51%), severity (av. 2.19) and abundance (av. 2.08) compared to the maize- dolichos intercrop with 32.89, 1.41 and 1.27, respectively. In conformity with aphid data, the field margin vegetation in the Rongai ecosystem had significantly higher population of natural enemies than in the Njoro ecosystem. These findings have demonstrated that a maize-dolichos intercrop under the Rongai ecosystem, which has a high plant diversity, impacts positively on management of aphids in Dolichos beans.

Key words: aphids, dolichos, natural enemy

Growth and Egg Production Performances of Indigenous Chicken Hybrids in Kenya

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The study aimed at evaluating growth and egg performances of two synthetic chicken lines KC1 and KC2 developed in KALRO-Naivasha. Body weight was measured on 684 birds every four weeks from hatch to week 20 and subjected to Gompertz-Laird function to model growth curves. Egg production data at group level was recorded from 25 groups (10 birds/group) on weekly basis from age at first egg to 60 weeks of age and subjected to segmented polynomial and persistence models to model laying curves. A general linear model was fitted to determine the effect of KC line on curve parameters. Results indicate significant variation ($p < 0.05$) in curve estimates between the two KC lines. On growth, KC1 had a higher modelled hatch weight (24.63g) accompanied by lower initial growth rate (0.77g/d) and decay rate (0.18g/d) resulting in higher asymptotic weight (1,775g) at an earlier age (28weeks) compared to KC2. Regarding egg curve estimates, KC1 matured earlier (23weeks) but KC2 took a shorter time (8weeks) to attain higher peak production (81%). KC1 maintained peak for a longer time (6weeks) and thereafter gradually declined in production (-0.28egg/day). It was concluded that the KC1 and KC2 would be suitable for meat eggs production while KC2. The differences in growth and egg curves between the two KC lines indicate that KC1 would be best suited for meat production given the high growth rate (9.02g/d) while KC2 would be suitable for egg production as supported by high cumulative egg number at 44 weeks into production (247eggs/hen). This information could therefore be utilized in developing the KC lines into specialized breeds.

Keywords: Egg production; growth; synthetic chicken

Improving Food and Income Security through Production of Improved Kari-Kienyeji Chicken

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The importance of indigenous chicken has been rising over the years with most organizations recognizing it as an important enterprise for the resource poor farmers. A study was carried out in two model villages in Machakos and Kiambu Counties to evaluate whether a 3 year project on production of KARI-Improved Kienyeji chicken enhanced food and income security. A total of 135 poultry farmers were interviewed; 62 in Karai and 73 in Mbiuni and data was summarised using descriptive statistics. In both counties, the percent adoption rose from as low as 2% in 2008, climaxed in 2016 when 59% of the farmer in Machakos had adopted and 39% in Kiambu. Eggs and chicken meat is a major source of animal protein. Eggs consumed per household per month in Kiambu increased from 20 pieces in 2015 to 34 pieces in 2018 recording a 70% increment. Consumption of birds did not change much in the three years for Kiambu with a 25% increment recorded. In Machakos, egg and chicken consumption increased by 42% and 55% respectively. Most of the income in Kiambu was used to purchase chicken feed (38%) while in Machakos was for school fee payment (29%). Other income uses in Kiambu were; purchasing of food stuff (17%), individual savings and paying school fees (7%) and social welfare. For Machakos, the scenario was a bit different where the 2nd highest proportion was used to buy food stuff and chicken feed (20%). It was clear that the project contributed to improved food and income security in the two model villages.

Keywords: Indigenous chicken, KARI-Improved Kienyeji chicken, model village, poor, productivity, resource

Effect of Replacing Fish Meal with *Prosopis juliflora* Seed Meal on Growth Performance of *Clarias gariepinus* Fingerlings

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Scarcity and costly aquafeeds are a setback to sustainable aquaculture in developing countries. Fishmeal (FM) which is preferred for fish feeds is costly and scarce due to competition from livestock and poultry feed industries. Though use of plant-based ingredients for fish feeds is a strategy to reduce the cost, demand for conventional ingredients such as soy, cottonseed among others, is as high as that of fishmeal. Therefore, it is necessary to explore use of non-conventional feedstuffs (NCPF) which are less costly, locally available and have good nutritional profiles. For instance, *Prosopis juliflora* seed meal (PSM) has crude protein (CP) ranging between 27-65.2%. The plant is abundant in arid and semi-arid areas and the seeds have successfully been included in *Labeo rohita* and *Oreochromis niloticus* diets, but not in *Clarias gariepinus* diets. In this study we evaluated the proximate composition of PSM and performance of *C. gariepinus* fed PSM based diets. Proximate composition of PSM was determined using standard methods. The test diets PSM0, PSM1, PSM2 and PSM3 were based on replacement of FM at 0, 15, 30 and 50%, respectively. A total of 12 hapas in a pond at KMFRI Sangoro were each stocked with 50 *C. gariepinus* fingerlings of average weight 1.9 ± 0.8 gm. The diets were randomly administered to the hapas in triplicates, for 6 months. The fish were fed at 9am and 3pm daily at 10% body weight and sampled fortnightly, during which body weight and total length were measured. The CP for PSM was 42.5 ± 1.07 . One-Way ANOVA comparison of means indicated that fish fed control (PSM0) and PSM based diets had similar weights. Thus, there was no significant difference in growth for fish in all treatments. Therefore, PSM can replace FM up to 50% in *C. gariepinus* diets in a semi-intensive system without compromising growth.

Key words: Prosopis seed meal (PSM); Fishmeal (FM); Growth performance; *Clarias gariepinus*

Technology of Milk Whey Proteins and their Emerging Products: A Review

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Milk proteins are categorized as caseins and whey proteins, based on their differences in solubility at a pH of 4.6, an isoelectric point. Casein and whey proteins constitute approximately 2.6% and 0.7%, respectively, of bovine milk. Casein exists in fresh milk in the form of a “micelle” structure, which is a complex aggregate of proteins (α -, β -, and κ -casein) and colloidal calcium phosphate. Whey proteins are a group of globular proteins, which consist mainly of β -lactoglobulin, α -lactalbumin, and bovine serum albumin (BSA). Both caseins and whey proteins exhibit unique polymer properties. The several types of casein proteins, which are highly diverse both across and within mammal species, are essentially to provide mammal infants with the amino acids needed for growth and development. The properties of casein and whey protein have been extensively studied over the time and new emerging products have been established. In addition, recent advances in processing technologies have expanded the commercial use of whey proteins and their products. As a result, whey proteins are used as common ingredients in various products including infant formulas, protein supplements and weight management products. This review intends to focus on familiarization of various whey protein products and their manufacturing processes. It also intends to enhance production and consumption of similar products in Africa.

Keywords: Caseins, milk proteins, processing, whey

Functional Characteristics of *Lactobacillus plantarum* in African Fermented Foods: A Review

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Fermented foods have been associated with probiotic bacteria hence, are considered as functional foods since they provide health beneficial effects to the body. Functional foods are gaining popularity in the world, as people are becoming aware of their eating habits. In most African traditional fermented foods *Lactobacillus plantarum* has been found to be the most predominant microorganism. *Lactobacillus plantarum* (widespread member of the genus *Lactobacillus*) is one of the most studied species used in food industry as probiotic microorganisms and/or microbial starters. *Lactobacillus plantarum* has been isolated in most of traditional fermented foods because of its versatility and metabolic capabilities hence able to survive in various environmental niches. Their long history in food fermentation forms an emerging field of value addition using *L. plantarum* strains. Its functional properties especially probiotic properties have been studied. This enables it to be used to produce new functional (traditional and novel) foods and beverages with improved nutritional value and potential health benefits. This review captures the functional characteristics of the *L. plantarum* strains with their probiotic properties, ability to remove cholesterol, increase food safety, digestibility and shelf-life of African fermented foods especially in food product development thereby contributing to food security.

Keywords: Fermentation, Functional characteristics, *Lactobacillus plantarum*

Insects as Sustainable Source of Human Food: A Review

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Entomophagy, consumption of insects, is an age old practice with more than 2100 insect species categorized as edible and relished by more than 2 billion people globally. Despite having been a common practice in Africa, Asia and Latin America, entomophagy has only recently gained more attention in the wake of looming food scarcity due to the effects of climate change on agricultural productivity. Insects have been getting the special attention due to their competitive advantage as a sustainable source of high quality protein with little carbon foot print than the conventional sources of proteins such as beef and poultry. In addition to offsetting the greenhouse gas emissions, insects are also cheaper to produce, are less vulnerable to diseases, have high feed conversion ratio and multiply fast. Many studies have been done to assess the acceptability of insects as human food. Other researchers have also conducted studies on the use of insects as animal feed versus the conventional feeds and how these affect the quality of the carcass that is ultimately used as human food. This paper reviews published works in the recent times to consolidate research findings on the nutritional benefits of insects in human diet, functional properties and application of insect products in food product development as well as the food safety concerns associated with such use.

Key words: Entomophagy, insects, insect protein, sustainability

Optimization of Protein Content and Dietary Fibre in a Composite Flour Blend containing Rice (*Oryza sativa*), Sorghum [*Sorghum bicolor* (L.) Moench] and Bamboo (*Yushania alpina*) Shoots

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Initiatives on tackling food insecurity among global emerging economies are being focused on enriching native staple foods with locally available nutritious underutilized crops. The objective of this study was to optimize protein content and dietary fibre in rice (*Oryza sativa*) flour using Sorghum (*Sorghum bicolor* L.) and Bamboo shoots (*Yushania alpina*). An extreme vertices design of mixture approach with 11 runs was employed in the study using MINITAB® software. The 11 blends from 11 generated runs and individual ingredient samples were analysed for nutritional composition. Energy value and energy-to-protein ratio for the samples was calculated. Bamboo shoots flour (BSF) had highest content for all proximate components except total carbohydrates on dry weight basis. Rice had highest content of total carbohydrates at 77.71% and energy to protein ratio of 53.72 kcal/g. Sorghum had highest mean total phenolic and condensed tannins of 45.512 (mg GAE/kg) and 2.512 (mg CE/g) while rice the least with 0.042 (mg GAE/kg) and 0.102 (mg CE/g), respectively. Fresh bamboo shoots had highest level content of HCN of 117.81 mg/kg. Other dried ingredients had a mean HCN content of 2.313, 1.584 and 0.066 mg/kg for dried BSF, sorghum and rice respectively. Increasing the quantity of BSF and sorghum flour in the blends consequentially increased the protein content, dietary fibre and total minerals. Optimum blend was established to be 50:27:23 for rice, sorghum and BSF, respectively. This blend had 13.4% protein, 6.2% dietary fibre and 3.9% total minerals. Regression analysis showed that apart from dry matter, all other constituents were significantly predictable during optimization with $R^2 > 0.7530$. Cluster analysis showed that the nutritional components analyzed are in four main clusters. Cluster 1: Dry matter and protein digestibility, cluster 2: Carbohydrates, energy value and energy ratio, cluster 3: Protein, fibre and ash while cluster 4: Crude fat only. These findings of the optimum composite ratio and other blends could contribute in addressing the food insecurity for low income countries.

Key words: Optimization, Protein, Dietary fibre, Bamboo shoots, mixture analysis

The Global SCOPE Project: Applying Global Indices to Reduce Food Supply Chain Losses and Improve Nutritional Security

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The application of global indices of nutrition and food sustainability in public health and the improvement of product profiles has facilitated effective actions that increase food security. The use of established indices of sustainability and security enable comparisons that encourage knowledge transfer and the establishment of cross-functional indices that quantify national food nutrition, security and sustainability. The objectives of this research project are therefore to: develop index measurements for food processors and manufacturers for specific food supply chains; demonstrate how the indices can be used to assess the sustainability of supply chain operations by stimulating more incisive food loss and waste reduction planning; determine how an index driven approach focussed on improving both nutritional delivery and reducing food waste results in improved food security and sustainability. These indices will be applied to specific food supply chains for food processors and manufacturers. Nutritional improvements focussed on protein supply and reduction of food waste on supply chain losses will be tested using the food systems of India, Kenya and the United Kingdom. It is envisaged that by taking a holistic view, the food ecosystem approach can inter-connect requirements using innovative technology, digital and externally linked platforms. This will fundamentally change the way future food systems operate and the emerging innovative practices will result in the co-development of food manufacturing infrastructure and innovation programmes.

Keywords: Food; Indices, Loss Nutrition; Loss Security; Supply Chain; Sustainability

Old is Gold: Chia Seed (*Salvia Hispanica*) an Ancient Seed in Today's Management of Type 2 Diabetes: A Review

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Chia seed (*Salvia hispanica*) has been known for over 5,500 years and was used as a food for the Mayas and Aztec tribes. It is now fast gaining popularity worldwide due to the health benefits associated with it at a time where there is an increasing desire to change to healthier lifestyles. This is due to the increasing incidences of non-communicable diseases. A major concern in this paper is type 2 diabetes and its complications. Diabetes is one of the most common chronic diseases and approximately 424.9 of the world's population is now living with diabetes. By 2045, projections show that this number will rise to approximately 629 million diabetics globally. Progression of type 2 diabetes results in other associated complications and the management imposes social, medical, and economic burdens. Concerning its nutritional composition, chia seeds contain the highest known content of healthy α -linolenic acid (ω -3) compared to other natural sources. It also contains an appreciable amounts of dietary fibre, bioactive compounds, proteins, vitamins and minerals. It is because of its nutritional composition that chia has been used to manage various chronic diseases and of concern in this review paper being type 2 diabetes. This review paper is thus going to look into detail how this ancient grain is contributing to today's management of type 2 diabetes.

Keywords: Chia seeds, chronic diseases, healthier lifestyles, *Salvia hispanica*, type 2 diabetes

Nutritional and Medicinal Properties of Bioactive Compounds in Cape Gooseberry *Physalis peruviana* Fruits: A Review

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Cape gooseberry, *Physalis peruviana*, is a nutritionally important underutilized fruit with great therapeutic potential attributed to its rich macro and micronutrient content. It is laden with anti-inflammatory phytochemicals that contribute to its medicinal value as an antidiabetic, anticancer, and anti-hypertensive agent. *P. peruviana* is promoted for inclusion in human diets for a disease-free healthy life and general well-being. Nutritionally, the fruit is highly valued for phytochemicals, such as antioxidants and vitamins E and C as well as its unique flavor, texture, and color. The diversity of applications to which *P. peruviana* can be put gives this fruit great economic importance. The food industry uses Cape gooseberry in different value-added products, including beverages, yoghurts, and jams. With the rapidly growing popularity of this unique fruit, it is important to have a comprehensive reference to its nutritional benefits, medicinal value, and phytochemical composition. This paper involves an in-depth review of important dietary nutrient types with pharmacological properties and their concentrations in *P. peruviana* that account for its nutritional and health benefits.

Keywords: Cape gooseberry, *Physalis peruviana*, underutilized fruit, phytochemical, value-added

Factors influencing Tea Farmers' Decisions to Utilize Sources of Credit in Nyaruguru District, Rwanda: A Multivariate Probit Regression Analysis

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Credit access is among key determinants to increase level of tea production and income of small scale-farmers in Rwanda and its demand has been increasing with the time. Accessed credit help farmers to meet costs of farm inputs such as fertilizers, seedlings and labour as well. Factors to access credit have been discussed in various studies, and despite the fact that credit seekers obtain credits only when they are eligible by complying with the requirements such as the interest rate to pay, tea farm size and collateral of the lending institutions. However, available findings have missed information on how farmers choose a potential source of credit to utilize and inducing factors. This article tries to understand other side of credit seekers' decisions leading to choosing a particular source of credit and the determinant factors. A survey was conducted to 358 tea growers selected randomly in two cooperatives that operating in Nyaruguru district. A multivariate probit model was used to examine factors influencing tea households' decisions to choosing source of credit. Borrowing from formal source (commercial banks) increased if borrower was having collateral asset (85.5%), interest rate (85.0%) large size of tea plantation (24.8%) and household composition (10.5%). Using informal sources increased if a farmer looked for small size of credit (83.2%), participated in technical trainings (76.9%) shared credit product (46.9%), while a farmer was less likely to use informal sources if his/her farm size (39.9%) and household income (29.2%) were small. However, combining sources of credit was used by farmers as a safeguard strategy to acquire desired loan. A government policy which aims to increase productive investment should emphasize integrating agricultural loans in financial system targeting small holder farmers through their organizations where they can relax credit constraints.

Keywords: Credit, formal source, informal source, Nyaruguru, Tea farmers, Rwanda Utilization,

The Effect of Land Fragmentation on Returns to Factors of Production in Selected Agro-Ecological Zones in Embu County, Kenya

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Declining farm size as a result of continuing land fragmentation as population increases is a major policy concern in Sub-Saharan Africa in general and Kenya in particular. The government efforts to address land fragmentation in Kenya have been hampered by lack of adequate and reliable research-based information to guide policy formulation on land management and its impact on food security. Most of the studies conducted have focused on the effect of land fragmentation on land productivity and limited attention is given to productivity of labour and that of other key factors of production across different farm-size categories and different agro-ecological zones. It is against this backdrop that this study was conducted to evaluate the effect of land fragmentation on the returns to the key farm resources in different agro-ecological zones using the case of Embu County in Kenya. The data was collected from a sample comprising 384 farms that were selected from three agro-ecological zones in Embu County using multistage stratified sampling technique. The three agro-ecological zones were the Sunflower, Coffee and the Tea zones, based on the official AEZs classification system in Kenya. A stochastic Cobb-Douglas production function was used to determine the production relationship between farm output and the key farm inputs used. The effect of land fragmentation on return to land was found to be positive in all the three agro-ecological zones. The effects of land fragmentation on return to fertilizer and labour were however found to be negative in the Sunflower and Coffee zones, but the effect was insignificant in the Tea Zone. The study thus recommends that measures to increase the return to labour and fertilizer in the land fragmented areas in Kenya be undertaken.

Keywords: Cobb-Douglas production function, food security, land fragmentation, land reform policies, return to resources, resource productivity

Role of African Leafy Vegetables as Health Boosters among Students and Potential for Improved Livelihoods of Smallholder Farmers in Busia County, Western Kenya

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The African indigenous vegetables (AIVs) are a major source of essential nutrients critical in providing a balanced diet. They are rich in micronutrients such as iron, zinc, vitamin A, and contain bioactive phytochemicals, which provide protection to the body against disease. Incorporation of African indigenous vegetables into mainstream diets has remained a common practice for meeting cultural, medicinal and nutritional needs. The study conducted between 2015 and 2018 assessed the values of a wide range of African indigenous Vegetables towards the improvement of diets and nutrition among school going age groups within Busia County through a farmer business school (FBS) model. Women and youth headed households that solely depend on smallholder farming for livelihoods were considered. Schools were randomly selected within Busia County on the basis of their willingness to participate in the project. Sensitization in 540 households and 14 schools was carried out to promote the importance of cultivation and consumption of AIVs for improved nutrition and health. A total of 14 smallholder farmer groups with at least 60% women or youths each were trained on improved cooking methods, entrepreneurship and linkages to the markets. Schools and communities were made aware on good agricultural practices, seed production and developing different recipes for incorporation in school meals. Nutrient composition data was used in sensitization activities to raise awareness of their values compared to imported vegetables, cabbages and kales in school feeding programs. In addition, capacity building of farmers and linkage to schools has increased production and consumption of AIVs in households and schools. These have led to increased income at household level from sale of AIVs and improved health in the community and school children. As a result of this training and use of the FBS model, 12 smallholder farmer groups have been linked to 14 schools for the supply of African indigenous under a mutually agreed memorandum of understanding. In addition, in one school, 450 students are feeding on AIVs for lunch 4 times a week one up from none before BFN project intervention.

Keywords: African indigenous vegetables, biodiversity, farmer business model, livelihoods, nutrition and health.

Characterization of Vegetable Farmers in Western Kenya and the Economic Implication

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Vegetables contribute significantly to the Kenyan horticultural Gross Domestic Product (GDP). Vegetable farmers however face various constraints during production and marketing thus affecting their productivity. Malnutrition is a key challenge in Western Kenya where over 50 % of the children lack a diversified diet. Both chili and spider plant are rich in vitamins and minerals, hence important components for a nutritionally diversified diet. Due to the economic, social and nutritional importance of these vegetables, this paper therefore characterizes chili and spider plant farmers basing on their socio-economic and institutional characteristics. This study is based on qualitative and quantitative data collected from 300 smallholder vegetable farmers in Bungoma and Busia Counties, Kenya. Results show that, about half of the respondents participated in vegetable contract farming. Farmers are motivated to participate in contract farming by the desire to access farm inputs in form of credit, market, technical expertise and stable market for their produce. It was revealed that, for both chili and spider plant farmers, the proportion of farmers who accessed agricultural credit was slightly higher among contract participants (62 %) as compared to non-participants (60 %). A bigger proportion of contracted vegetable farmers (37 %) are motivated to participate in contract farming by expectation of an assured market. This percentage was higher in Busia (41%) than Bungoma (35%). This is explained by the desire to access stable market linkages by smallholder vegetable farmers. To improve the welfare of vegetable producers, the county governments and private sector should invest more in agricultural extension services to boost productivity of smallholder producers through dissemination of good agricultural practices. Contract farming as an institution should be strengthened in order to create efficiency in production and marketing of vegetable and vegetable products as well as enhance input supply, market linkages and high incomes among smallholder farmers.

Keywords: Contract farming, farmers, Vegetables

Review of Strategic Marketing Options to be Employed in the Implementation of Dairy Value Chain for Sustainable Development

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Dairy farming is ranked highly among the agricultural enterprises due to its potential to enhance food security and alleviate poverty. Various technologies have been adopted in breeding, feeding and disease control which has enhanced productivity. However, market returns have remained unattractive to small-scale farmers thereby hindering the development of sustainable dairy farming. This paper brings into context various strategic marketing options to be implemented for increased dairy returns and sustainability. This is borne out of overconcentration of strategies on productivity at the expense of milk returns from sales. A number of marketing strategic options such as policies, capacity building, coordination, infrastructure development and product diversification/ differentiation have been identified with details on actors involved, their activities and expected outcomes if implemented successfully. At the focal point of the strategic options, are policies that drive other aforementioned dairy marketing strategies. Capacity building entails training and market identification that will require coordination in form of informal market integration as well as integration of all actors in dairy value chain. With proper policies on coordination, development of infrastructure such as road networks, milk collection centers and cooling equipment would enhance quantity and quality of milk available in the market. This would drive product diversification through value addition which would involve pasteurization, packaging and branding thereby increasing returns from dairy value chain. Finally, the study has recommended an overall strategic dairy marketing option showing interrelationship among the options.

Keywords: Capacity building, coordination, dairy value chain, infrastructural development, product diversification, strategic marketing options

Does Tobacco Growing Guarantee Household Food Security?

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This paper examines the relationship between tobacco growing and food security in Malakisi region in Bumula Sub-county of Bungoma County, with a view of establishing its effect on household food security. Tobacco, being a non-food crop, does not contribute to physical food availability in the household. The crop is grown with the hope that it would fetch enough money to meet the farmers financial needs including purchasing food in the household. The main aim of this study was to investigate the effect of tobacco production on household food security in the sub-county and its effect on nutrition. Malakisi is one of the two tobacco growing regions in Bungoma County, which has been food insecure raising questions as to whether tobacco growing is beneficial to the farmers. In this study, data was collected from 138 farmers who grew tobacco together with food crops and those who grew tobacco only in order to make a comparison on their household food security status. Data was collected using questionnaires, oral interviews, direct observation and focus group discussion (FGDs). From the study results, it was clear that about 95% of the tobacco farmers in the region were food insecure with majority of them living below the poverty line as a result of low returns from tobacco growing. The results also indicate that farmers grow tobacco because of the farm inputs that are given on credit basis by the tobacco companies which is later deducted from the farmers' payment when the cured tobacco leaves are delivered to the contracting companies. The study recommends that tobacco farmers should form cooperatives that would push for better producer prices and this would improve their financial status and consequently their household food security.

Keywords: Cash crop growing, food production, household food security, tobacco production

Green Leafy Vegetables' Self-Provisioning among Urban Consumers in Nakuru County: What is the Motive?

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Green leafy vegetables' self-provisioning is an informal means of vegetables production with the major part of it used for own-consumption. In Kenya, self-provisioning is taking place in both urban and peri-urban areas. However, the motives of engaging in this practice, and of the choice of commodities to focus in, are not clear. Existing studies have provided mixed reasons for engaging in self-provisioning such as; economic hardships, improving household food security, source of employment, cultural reasons or leisure/hobby. The study, therefore, aimed at determining the concrete reason for green leafy vegetables' self-provisioning in urban areas. Probit model was used to analyze data from a random sample of 387 households drawn from urban areas within Nakuru Municipality, Kenya. Results indicated that 45% of urban households were engaging in green leafy vegetables' self-provisioning. Out of those self-provisioning, 53.8% were driven by food safety and health concerns, 23.04% by food security reasons and 23.16% by economic reasons. Some of major challenges reported by those self-provisioning included: inadequate water supply (27.91%), pest and diseases (24.42%), lack of skills and knowledge about self-provisioning (22.67%), lack of enough space (11.63%), and lack of government support (2.91%). Factors significantly influencing green leafy vegetables self-provisioning were: perception towards safety of green leafy vegetables, access to green leafy vegetables safety information, household income, age of household head, perceived behavioral control, social norms, and the size of household. To improve green leafy vegetables self-provisioning in urban areas, there is need for policies that improve access to clean and adequate water, facilitate access to food safety information, and ensure consumers are trained on food self-provisioning practices.

Keywords: Green leafy Vegetables, Self-provisioning, Food safety concerns, Consumers

“One Acre Model” Effect on Maize Productivity among Smallholder Maize-Bean Farmers in Kimilili Sub-County, Kenya

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This study aims to examine the effect of the one-acre model on maize productivity in Kimilili Sub-County, Kenya. One acre fund is a non-governmental organization operating in western Kenya offering comprehensive credit-in-kind bundle of seeds, fertilizer, training and market facilitation. A systematic sampling technique will be used to select 384 smallholder maize farmers. A semi-structured questionnaire will be administered to collect cross-sectional data for the study. Endogenous switching regression models will be used to analyze the one acre fund effects on maize productivity among smallholder farmers. Although smallholder farmers participating in the one-acre fund model can access credit-in-kind inputs, it is unclear whether it has any significant effect on their productivity.

Key words: One Acre Fund, Productivity and Credit-in-kind inputs

Antibiotic Resistance of Foodborne Pathogens in Ready-to-eat Meat Products: A Review of the Current Status

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Ready-To-Eat (RTE) meat products are consumed in the same state as it is sold without further preparation to ensure safety to the consumer. These foods normally include ingredients that may or may not be cooked and some are regarded as potentially hazardous therefore can support proliferation of food pathogens and should be kept at certain temperatures to reduce the growth of pathogens that may be present in the food. A number of food pathogens have been implicated with RTE foods beef products included and some of the pathogens that have been isolated include: *Bacillus cereus*, *Staphylococcus aureus*, *E. coli*, *Shigella* etc. The level of contamination varies with countries or regions and this is determined by a number of factors some of which are: method of preparation, type of food and possibility of post-processing contamination. In some studies, some of the isolates have been found to be resistant to commonly used antibiotics which are used in both human and veterinary medicine which are exemplified by tetracycline, penicillin, streptomycin and sulphamethoxazole. This phenomenon has been linked to improper use of antibiotics by humans in farming practices like using as growth promoters in domestic animals and application in sub-lethal doses while treating farm animals. Antibiotic resistance by food borne pathogens is due to various mechanisms and varies from organism to organism and various antibiotics. Emergence of antibiotic resistance has become a global problem and it is estimated if nothing is done to curb the situation, deaths will be 10 million annually by year 2050 as this result in inefficiency of antibiotics used for treatment of human diseases, patients have to purchase second or third generation drugs which are more expensive and economy losses. This study presentation reviews antibiotic resistance of foodborne pathogens in RTE foods therefore contributing to food safety.

Keywords: Ready-To-Eat, Meat products, food borne, Pathogens Antibiotics, Antibiotic resistance, food safety

Current Status of Food Poisoning and Foodborne Illness in Sub-Saharan Africa and the Way Forward: A Review

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In Sub Sahara Africa, food contamination continues to wreak havoc. In this region, ready-to-eat foods are majorly sold by street food vendors where hygiene becomes a major challenge given the inadequate supply of portable water. Large numbers of unlicensed vendors operating their businesses in hard to reach areas, mostly after-work hours, thwart the efforts by the public health inspectors to ensure safe food for the public. Agrochemical use in food production is at an all-time high posing the risk of pesticide residues in foods. As health records indicate, food poisoning and foodborne illness cases are on the rise in the region. These food safety challenges will only worsen the global food crisis given the food supply deficit in most parts of the world. This is a cross-sectional desktop review of peer-reviewed journals, survey reports, and records from both government and private health facilities documenting food poisoning and foodborne illness outbreaks in Sub-Saharan Africa. Books on microbial physiology and metabolism have been used to highlight how to deal with the causative microorganisms. Aetiological agents of food poisoning and foodborne illnesses can be broadly categorized as pathogenic and toxigenic bacteria, parasites and viruses. Incrementally, chemical contaminants and allergens that may find their way into food also play an important role. Unhygienic handling and deliberate contamination of food can be classified as human factors that also contribute to the problem. To address these issues, all the stakeholders in the food value chain should be involved. Food safety policies should promote surveillance and encourage players to adopt standards geared towards ensuring food safety. Training should be regularized to ensure players can monitor food safety and report outbreaks early for containment. Multi-sectorial approach should be adopted to address challenges of policy implementation. Inter-departmental synergy is instrumental in addressing the current challenges.

Keywords: Food safety, Food contamination, Risk factors

Role of Probiotics in Reduction of Cyanide, Tannins and Phytates in Cassava (*Manihot Esculenta* Crantz) Leaves: A Review

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Cassava is grown mostly for its tubers while the leaves are considered a byproduct. Cassava leaves constitute a very significant source of dietary protein, minerals and vitamins. However, they contain antinutrients and cyanide, notably the linamarin, which pose the risk of intoxication to the consumers when the leaves are not processed properly. Hence this should be addressed during cassava leaf processing before human consumption. Several processing methods have been developed but every method has its own limitations. Soaking and boiling has been seen to decrease the nutritive value of the leaves mostly the vitamins. Fermentation as a processing technique has also been used for detoxification of the cassava leaves. However this has been done traditionally (spontaneously) and occasionally using microorganisms. Spontaneous fermentation is not an entirely risk-free process due to the mixed culture fermentation, no standards and unhygienic methods of production. This process also harbour spoilage and pathogenic microorganisms that pose a health hazard to consumers. These food safety challenges calls for a new approach by being able to improve the quality and safety of our traditionally fermented foods by using pure starter cultures which have probiotic capabilities. Product development and product innovation based on locally available crops fermented using locally isolated probiotics will enhance nutrition and safety of original local foods. This is a cross sectional desktop review of peer-reviewed journals from different researchers that summarizes the nutrient, antinutrient and toxic composition of cassava leaves and the role of probiotics in reduction of these antinutrients and toxins. Furthermore, recommendations have been made in order to encourage the use of probiotics in fermentation as a safety measure and also as a way of impacting health benefits to consumers of fermented foods.

Keywords: Cassava Leaves, Fermentation, Food safety, Probiotics

Influence of Botanical Insecticides and Field Margin Vegetation on Aphids and their Natural Enemy Abundance in Dolichos Bean (*Lablab purpureus* L.)

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Insecticides of plant origin have been reported to be less harmful to the environment and beneficial insects. However, the effect of botanical insecticides on insect pests and their natural enemies in Dolichos bean (*Lablab purpureus* L.) under diverse environments is not well understood. A study was conducted to determine the effect of botanical insecticides and field margins on aphids and their natural enemies' abundance in Dolichos bean. Five treatments comprising three commercial botanical insecticides (Pyerin75EC[®], Nimbecidine[®] and Pyeneem 20EC[®]), a synthetic insecticide (Duduthrin 1.75EC[®]) and an untreated control were laid out in a randomized complete block design (RCBD) with four replicates either in the presence or absence of field margin plant species. Aphids' abundance, incidence and severity were influenced by the crop growth stage, treatment applied and presence or absence of field margins. Highest aphid abundance (2.1), severity (2.68) and percent incidence (52.92%) were recorded on untreated plots. The synthetic insecticide, Duduthrin, showed reduced levels of aphid infestation which was not significantly different from Pyeneem ($P < 0.05$). However, Duduthrin had a significant reduction in natural enemy populations which are natural biological control agents for bean aphids. Results showed that field margin plant species attracted parasitic wasps (56%), tachinid flies (56%) and Coccinellid beetles (58%). Of the 684 Coccinellid beetles that were collected, 397 were from plots with field margin species, showing that they had the greatest abundance. These findings have demonstrated that conservation of field margin plant species and use of botanical insecticides hold good promise as ecologically benign and viable alternatives to synthetic insecticides in the management of aphids in Dolichos beans.

Keywords: Aphids, field margins, *Lablab purpureus*, natural enemies,

Drivers and Responses to Climate Variability by Agropastoralists in Kenya: The Case of Laikipia County

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This paper examines factors influencing the choice of response strategies and the actual strategies smallholder farmers use to respond to the effects of climate variability in transitional climatic zones of Africa, specifically Laikipia West Sub-County in Kenya. Data for this study were collected from 392 randomly selected smallholder farmers, using a structured questionnaire. The study used principal component analysis to group together related strategies that farmers used to respond to the effects of climate variability, which resulted into seven groups of responses. Some 97.5%, 85% and 74.1% of the farmers used cultural practices, diversification practices and risk reduction practices, respectively. Intensification practices were adopted by 69.3% of the farmers while terraces crop and herd management and new breeds were the least practiced at 27%, 13.2% and 9%, respectively. Multivariate Probit model was then used to examine the factors influencing smallholder farmers' choice of response strategies to effects of climate change. The results indicated that access to weather information had a strong effect on use of risk management strategies at 74% and intensification strategies at 49%. Increase in level of education and exclusive dependence on agriculture increased the probability of introducing new breeds by 30% and 53%, respectively, while access to extension services increased use of terraces by 42%. Strong local institutions that facilitate access to information and credit are likely to initiate changes in key household characteristics, which positively affect response to effects of climate variability. Policies should aim to strengthen local institutions that enhance access to information and credit services. There is need for investment in the provision of affordable and quality education and relevant demand-driven extension services that provide localized response solutions.

Keywords: Multivariate Probit, Principal component analysis, Climate variability, Arid and semiarid lands, Agro pastoralism, Response

Effect of Tractor Wheel Traffic Compaction on Selected Soil Physical Properties

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The increasing use of different sizes of agricultural machines have led to amplified levels of soil compaction. Knowledge on the dynamics of different soil properties as a result of wheel traffic is crucial for formulation and adoption of proper soil and water conservation methods for improved crop production with increasing population. Since wheel traffic compaction is still underestimated, this study aimed at determining effect on the soil moisture retention, bulk density, water infiltration, hydraulic conductivity and soil penetration resistance (cone index) as applied at different locations. A walking tractor was used in a controlled environment experiment. Soil samples were collected and selected hydrological and hydraulic properties which included dry bulk density, porosity, soil texture, saturated hydraulic conductivity, soil penetration resistance and moisture retention were determined both in the field and soil laboratory. The effects of the treatments were studied using a completely randomized experimental design where three wheel traffic treatments (involving 1, 3 and 5 passes) and three compaction treatments (traffic on rows, traffic between rows and traffic on entire plot). The findings showed that the highest bulk density of 1.84g/cm³, porosity of 0.306, saturated hydraulic conductivity of 54.432cm/day and cone index of 1.9393Mpa were recorded after application of 5 wheel traffic passes.

Keywords: Wheel traffic compaction, soil resistance, walking tractor, hydrological properties, hydraulic properties

Impact of Water-related Collective Action on Rural Household Welfare in the Upper Ewaso Ng'iro North Catchment Area: The Application of the Endogenous Switching Regression

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Key among government strategies to promote efficient and participatory water management in Kenya is through empowering local communities to manage water resources through Water Resource Users' Associations (WRUAs) which is a collective action initiative. However, there is contrasting empirical evidence on the welfare benefits households derive from this water governance mechanism. The study applied the endogenous switching regression to estimate the causal impact on household consumption per adult equivalent and household income per adult equivalent. The results indicate that WRUA membership has a positive and significant effect on household consumption per adult equivalent and household income per adult equivalent. The results show that non-members would have significant welfare improvements in their household consumption and incomes if they undertook WRUA membership.

Key words: Water governance, collective action, welfare, Upper Ewaso Ng'iro North Catchment, Endogenous Switching Regression, JEL Classification: D71, Q01, Q25

The Seed Cotton Industry in Kenya; Production and Marketing Status

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The cotton industry in Kenya is looked right from production to marketing level in details. The background of cotton production and marketing from post-independence to present situation is highlighted. Various systems of cotton production that existed before the collapse of the industry are examined as well as marketing channels and markets. Primary data obtained through field survey using questionnaires and interviews by stratified random sampling method in cotton growing zones. Secondary data from various sources (KALRO, CODA and MoA reports) was looked at, compared and analyzed to come up with strategies for solving the production and marketing problems. The qualitative data analyzed showed farmers have problems of acquiring credit for use in production process of cotton, e.g. plowing, planting, weeding, pest control, harvesting and transportation of seed cotton to the marketing outlets. Various interventions are suggested by putting in place policy and regulatory framework to address the vacuum that has existed after the collapse of cotton board. Other measures include stream lining marketing system to solve price variation and fluctuations. This leads to maximization of the African Growth Opportunity Act initiative by United States government that was extended from 2015 to 2025 to make the local farmers benefit more. It was concluded that there was need to have investments being put in the cotton industry by government, private sector and international community to jump start sector.

Key words: Cotton industry, Production, Marketing

GEOPOLITICS AND GOVERNANCE



rogramme Coordinators: Alex Mugambi/Prof. Mwangi Ndirangu/Prof. Nancy Mungai	
CONFERENCE DAY TWO WEDNESDAY 25TH NOVEMBER 2020	
MORNING SESSION	
	E-REGISTRATION: Zoom Link
Session chair: Prof. F. Wako, Snr. Lecturer, Egerton University	
Rapporteurs: Dr. R. Mugo, Dr. D. Mituki	
SESSION 3:GEOPOLITICS AND GOVERNANCE	
09.30am-10.00am	Selected videos - LAPSSET video Egerton University Anthem
10.00am-10.15am	WELCOMING REMARKS: Prof. Alex Kahi Deputy Vice Chancellor, (AA) Egerton Univeristy
10.15am-10.30am	CHIEF GUEST: Hon. Lee Kinyanjui Governor, Nakuru County
10.30am-10:50am	Impact of China’s One Belt and Road Initiative: Evidence from Textile Sector Value Chain in East Africa Prof. C. Lagat, Moi University
10.50am-11:10am	Deconstructing the China Model: Analyzing China’s “Belt and Road Initiative” in Kenya and Pakistan Dr. S. Waweru Mwangi, Karatina University
11.10am-11.30 am	Kenya’s Foreign Policy towards the Horn of Africa: A Case of the Lamu Port-South Sudan Ethiopia Transport Corridor. C. C. O. Okwany, University of Nairobi
11.30am-11:50am	Review of Why Populist Policies Fail: A Public Policy Perspective Prof. M Ngigi, Egerton University
11:50am-12.15pm	Question and Answer session
12.15pm-12.20pm	Reflections - Dr. H. Wario/ Prof. J. Ogwen, Egerton University
12.20pm-12.30pm	Selected videos/exhibitors

LIST OF OTHER AUTHORS

<p>Effects of Perception of Men in Low Income Households on Frequencies of Use of Contraceptives in Kuresoi North Sub County, Nakuru County, Kenya</p> <p>J. G. Macharia¹ and C. K. Wambu²</p> <p>¹Institute of Women, Gender and Development Studies, Egerton University. P.O. BOX 536-20115, Egerton.</p> <p>²Department of Cooperatives and Community Development, Cooperative University of Kenya; chkamau06@yahoo.com</p> <p>Corresponding Author: jumajoss@yahoo.com</p>
<p>Evaluation of Social Protection Policy in Kenya: Are we on the Right Track?</p> <p>A. O. Dipto</p> <p>Assistant County Commissioner, Marigat Ministry of Interior and Coordination of National Government P. O. Box 1-30403, Marigat;: 0721965246</p> <p>Corresponding Author: dietoastine@gmail.com</p>
<p>Deconstructing the China Model: Analyzing China’s “Belt and Road Initiative” in Kenya and Pakistan</p> <p>S. Mwangi and S. Ali</p> <p>Karatina University, Department of Social Sciences</p> <p>Corresponding Author: swaweru@karu.ac.ke</p>
<p>Public Spending and Performance of County Economic Growth in Kenya</p> <p>N. Mose^{1*}, L. Kibet² and S. Kiprop²</p> <p>¹University of Eldoret, P.O. Box 1125, Eldoret, 30100, Kenya. ²Egerton University, P.O. Box 536, Egerton, 20115,</p> <p>Corresponding Author: ngmoce@gmail.com</p>
<p>Depth of outreach, staff productivity and financial sustainability on Microfinance Institutions in Kenya</p> <p>S. K. Bitok</p> <p>Moi University, Eldoret Kenya</p> <p>Corresponding Author: stephenkbitok@gmail.com</p>
<p>Implication of Microenterprises' and Entrepreneurs' Characteristics on Microfinance Credit Demand in Kakamega County, Kenya</p> <p>H. W. Obulinji,</p> <p>Department of Geography, Egerton University, P.O. Box 536-20112, Egerton, Kenya. 0721664266</p> <p>Corresponding Author: humphreysobulinji2015@gmail.com</p>
<p>Determinants of Women’s Collective Action in Marketing of Selected Vegetable Value Chains in Buuri-Sub County, Meru County, Kenya</p> <p>C. K. Wambu</p> <p>Corresponding Author: chkamau06@yahoo.com</p>
<p>Social and Cultural Factors Influencing Gender Disparity in Farmers Field Schools Approach among Smallholder Farmers in Kilifi Sub-County, Kilifi County</p> <p>A. H. Ong’ayo¹, J. B., Ndiso² and F.W. Namasaka³,</p> <p>¹Department of Environmental Studies-Community Development, ²Department of Crop Science, ³Department of Curriculum, Instruction and Education Technology, Pwani University, P. O. Box 195, Kilifi, f.namasak@pu.ac.ke; j.ndiso@pu.ac.ke</p> <p>Corresponding Author: aong_ayo@hotmail.com</p>

<p>The Effect of Kenya’s Ontological (in) Security in the Context of the Horn of Africa C. C. O. Okwany <i>Department of Political Science and Public Administration, The University of Nairobi. Postal address – 48171, 00100 Nairobi, Kenya: +254 729 226 64</i> Corresponding Author: <i>omondiokwany2000@gmail.com</i></p>
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<p>East African Community’s Response to Coronavirus: Old Habits Die Hard F. O. Nasubo*¹ D. Nyakwaka² and M. Kali¹ ^{*1}<i>Pan African University, Institute of Governance, Humanities and Social Sciences, Yaoundé, Cameroon;</i> ²<i>Department of Philosophy, History and Religion, Egerton University</i> Corresponding Author: <i>nasubof@gmail.com</i></p>

Impact of China's One Belt and Road Initiative: Evidence from Textile Sector Value Chain in East Africa

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The East African countries are faced with low levels of industrialization due to competitive disadvantages and yet their labour force continues to grow rapidly with the expansions in education sector. Since the Beijing Summit of FOCAC in 2006, trade and cooperation between China and Africa has grown rapidly, thanks to improved mechanisms for transport and business. This has brought about opportunities for growth in the textile sector in East Africa. China 'Belt and Road' signed in 2013 brings together the Silk Road Economic Belt and 21st century Maritime Silk Road into one global trade and development initiative. Although, East African region is not included in the Belt and Road route, Kenya recently made significant investments in the textile sector of which it has an impact on Chinese and global textile trading and economic growth. This paper discusses the status of East African Textile sector value chains and points out the opportunities in the Belt and Road initiative. We draw on previous studies and policy guidelines on industrialization of Africa and current performance of textiles firms. We analyze the models of supply chain linkages, value chains, competitive forces, technological innovations and management in the textile sector. This paper provides a foundation for further research in the textile sector as it seeks to advance the technological capabilities and competitiveness in both Africa and China. Further the 20+20 Cooperation Plan for Chinese and African Institutions of Higher Education encourages Universities to carry out joint research projects and training. The paper provides useful recommendations for stakeholders including small scale cotton farmers, textile manufacturers, academics and policy making.

Keywords: Populist policies, policy failure, policy context, formulation, implementation

Deconstructing the China Model: Analyzing China’s “Belt and Road Initiative” in Kenya and Pakistan

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The “Belt and Road Initiative (BRI)” has become a major hallmark of China’s overseas engagement in different regions of Asia, Middle East, Europe and Africa. China claims that the BRI presents an open and inclusive economic development model that emphasizes equality and mutual benefit, inclusiveness and mutual coordination, and win-win cooperation to promote the common development of all countries including China. In most of the participant countries, BRI projects have followed Chinese model of state-centric approach in their planning and execution. Accordingly, questions are being raised about the impact and implications that China’s development carries for the political and economic systems of host countries. Within this context, this paper compares and highlights the limitations of China’s development model in Kenya and Pakistan, two key BRI participant countries in South Asia and Africa. The study is based on going Chinese led infrastructural projects, and as such, will relay on secondary data from government and current affairs sources among others. The paper argues that, instead of becoming an inclusive model of economic development, the BRI has produced numerous implications for the political and economic systems of Kenya and Pakistan. Accordingly, this paper recommends for more inclusive, active and open public participation by various stakeholders in the planning and execution of these projects to overcome simmering discontents in Pakistan and Kenya and any other country witnessing China supported infrastructural projects. This will go along way addressing the limitation of Chinese BRI projects in political systems that are relatively democratic and open than China.

Key words: *BRI, China Model, Kenya, Limitations, Pakistan*

Kenya's Foreign Policy towards the Horn of Africa: A Case of the Lamu Port-South Sudan Ethiopia

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The paper examines and evaluates the multibillion-dollar project of road, railway, airports, and industries signed between Kenya, Ethiopia, and South Sudan – the Lamu Port South Sudan and Ethiopia Transport Corridor (LAPSSSET). It identifies how the northern transport corridor will impact Kenya's relation with her neighbors? A triangulation of Key Informants' interviews with government and academic documents led to a satisfactory conclusion. The paper demonstrates the role of personal rule and identity politics played in foreign policymaking; however, it confirms that identity is not static but reflexive and adaptive. Already having signed a US dollar 480 million agreement with Chinese Construction and Communication Company, LAPSSSET faces external competition from other projects like the upcoming Chinese backed, estimated US Dollar 10 billion Tanzanian port expansion in Dar Es Salaam, attracting Uganda's withdrawal, and the Djibouti-Ethiopia road and port. The Somalia auction of the Lamu seabed blocks creates further maritime disputes between Kenya and Somalia, risking the Lamu port. Despite LAPSSSET being a strategic project that raises Kenya's status, the paper points out that the institution of Kenya's foreign policy takes a tactical move towards the progress of the project.

Keywords: Foreign Policy, Kenya, LAPSSSET, Ontological Security, Horn of Africa.

Review of Why Populist Policies Fail: A Public Policy Perspective

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In today's world, it is imperative that countries or nations to involve policy experts to be included all through the policy formulation process. Knowledge of policy analysts cannot be underestimated in the 21st century since they have a vast understanding and know how to play a key role in the changes that occur in the recent time and also public problems will always continue to evolve with changes in time and environment surrounding the policy process. The scope of government involvement in social issues in Africa is also expanding with emerging trends in contemporary societies; it is thus relevant for government authority to have a clear course of action that has actually been critically assessed for the provision of maximal benefits to her citizens while reducing negative consequences that are attached to policies that are being implemented. In African countries, the greatest threat to policy policies sustainability is the implementation of policies through public declarations and thus contributing to policy failure. It should be noted that public policy is complex in nature, and the root of public problems does not have a single answer to induce an intervention. It is through only through a weak designing of policies that come along with implementation sought after a declaration from politicians that often leads to wastage of resources. When a decision chosen is not evaluated against other possible alternatives then failure is inevitable. It important to consider public opinions when engaging in policy implementation, It is in this context that policies made through declarations fail mostly through inability to capture public opinion and thus a course of action might not be illuminating to public priorities at hand thus leading to policy failure. This paper therefore seeks to insights on understanding why and how policies made through declarations often results to failure, thus being helpful to policy formulators, analysts' implementers against falling into this problem that is majorly associated with developing countries

Keywords: populist policies, policy failure, policy context, formulation, implementation

Effects of Perception of Men in Low Income Households on Frequencies of Use of Contraceptives in Kuresoi North Sub County, Nakuru County, Kenya

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Family planning is an important strategy towards achieving Sustainable Development Goal (SDG) three (3) which has been proven to reduce maternal mortality. Despite the expansive benefits of family planning services, its uptake of these services among men still remains low in Kuresoi North Sub-county. The study aim was to investigate how the perception of men in low income households affect the choice of contraceptives they use in Kuresoi North Sub-County in Nakuru County. The study was carried out in Kamara and Sirikwa wards in Kuresoi North Sub County. The study used planned behaviour theory. It employed cross-sectional survey research design. Sample size of 143 respondents was obtained using simple random sampling procedure. Questionnaires and interview schedules were used to collect data. The data was analyzed qualitatively and quantitatively. Findings of the study were presented using quotes, narratives, pie-charts, bar graphs and frequency tables. Most of respondents regarded use of male condoms as a safer method of contraception in prevention of HIV infection and unwanted pregnancies, while some preferred to know their HIV status thus determining their non-use or use of a condom. The finding indicates that although men were perceived to have an upper hand in negotiation of safer sex than women, there were views from the respondents that sexual partners plays a role in influencing contraceptive use. This study recommends that policy makers should deal with the attitudes and perception on the use of contraceptives based on gender differences. Thus improving its use in low income households.

Keywords: Contraceptives, low income households, men, perception

Evaluation of Social Protection Policy in Kenya: Are we on the Right Track?

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Kenya has for the last decade attempted to revitalize the structures for implementation of social protection programs through the formulation and implementation of the Kenyan Social Protection Policy, 2011. The policy was developed to provide a broader framework for design and execution of projects and programs that could address the needs of vulnerable groups such as, elderly persons, persons with disability and orphans and vulnerable children (OVCs). Despite the prolonged existence of the policy, there has been very limited discourse around monitoring and evaluation of social protection in Kenya. There has been very little endeavor to critically examine the impact of social protection policy on the livelihood the beneficiaries of the respective programs. Further, there has been no commissioned research to specifically interrogate the effectiveness and efficiency of programmes implemented under the social protection framework. This paper seeks to analyze the various components of Kenya's Social protection policy, status of implementation of the policy framework and to assess effectiveness of the policy in terms of meeting the standards contemplated under to broader international and domestic policy instruments such as the ILO recommendations 202 (National Floors of Social Protection); Livingstone Declaration of 2006; The Kenya Vision 2030 (Third Medium Term plan) and the Constitution of Kenya, 2010. This paper will further highlight the main findings from reviewed literature, identify policy gaps and make recommendations that can assist key stakeholders in spearheading social protection policy reforms.

Key words: Social protection, elderly persons, persons with disability, orphans and vulnerable children

Deconstructing the China Model: Analyzing China's "Belt and Road Initiative" in Kenya and Pakistan

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The "Belt and Road Initiative (BRI)" has become a major hallmark of China's overseas engagement in different regions of Asia, Middle East, Europe and Africa. China claims that the BRI presents an open and inclusive economic development model that emphasizes equality and mutual benefit, inclusiveness and mutual coordination, and win-win cooperation to promote the common development of all countries including China. In most of the participant countries, BRI projects have followed Chinese model of state-centric approach in their planning and execution. Accordingly, questions are being raised about the impact and implications that China's development carries for the political and economic systems of host countries. Within this context, this paper compares and highlights the limitations of China's development model in Kenya and Pakistan, two key BRI participant countries in South Asia and Africa. The study is based on going Chinese led infrastructural projects, and as such, will relay on secondary data from government and current affairs sources among others. The paper argues that, instead of becoming an inclusive model of economic development, the BRI has produced numerous implications for the political and economic systems of Kenya and Pakistan. Accordingly, this paper recommends for more inclusive, active and open public participation by various stakeholders in the planning and execution of these projects to overcome simmering discontents in Pakistan and Kenya and any other country witnessing China supported infrastructural projects. This will go along way addressing the limitation of Chinese BRI projects in political systems that are relatively democratic and open than China.

Key words: Pakistan, Kenya, BRI, China Model, Limitations.

Public Spending and Performance of County Economic Growth in Kenya

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From empirical studies, the effects of components of public expenditure on economic growth appear to provide mixed results. Despite this ambiguity, economic theory suggests that government expenditure induce economic growth. In Kenya, economic growth has been fluctuating despite the county and national spending increasing over time. It is against this background that this study was carried out to examine empirically the effect of components of spending on growth in Kenyan counties using panel data set over the period 2013 to 2017. The analysis techniques that were used in this study were descriptive and inferential statistics. Employing Harris–Tzavalis (HT) test, the study tested for the panel unit root and found that all variables were non-stationary at their level except GCP per capita and non-devolved expenditure. To check if the variables have long-run relationship, this study applied F bounds test. The result for this test revealed that there exists a long-run relationship among the real GCP per capita and regressors in the model. Once co integrating was confirmed using F-bound, the long-run and error correction estimates of the panel ARDL model were obtained. The findings revealed that the coefficient of recurrent and non-devolved expenditure were positive and significantly influence county growth in Kenya. However, capital expenditure was insignificant during the study period. The implications of this is that policy makers should focus more on how to enhance capital spending in order to enhance private capital accumulation and consequently county economic growth in long-run in Kenya.

Keywords: ARDL, counties, economic growth, expenditure, Kenya

Depth of Outreach, Staff Productivity and Financial Sustainability on Microfinance Institutions in Kenya

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Microfinance institution contributes significantly to economic development and the financial inclusion of the underprivileged population. However, financial sustainability of these institutions remains a major challenge largely because of the low deposits and high demand for micro loans. Though previous studies have shown that financial leverage influences financial sustainability of microfinance institutions, the findings are inconclusive and debatable. This study sought to investigate whether depth of outreach moderated the relationship between financial leverage and financial sustainability among MFIs in Kenya. The study was grounded on positivist paradigm and explanatory research design. The hypothesis was tested with a panel dataset drawn from 30 MFIs over the period 2010 to 2018. The data was analyzed through descriptive and inferential statistics. To control for endogeneity of the predictor variable, the Generalized Method of Moments was used. The study established that financial leverage had a negative and significant effect on financial sustainability. Further, depth of outreach had a moderating effect on the relationship between financial leverage and financial sustainability. The study recommends that managers of MFIs should maintain a balance between financial leverage and depth of outreach to attain financial sustainability.

Keywords: Depth of Outreach, financial leverage, financial sustainability, microfinance institutions

Implication of Microenterprises' and Entrepreneurs' Characteristics on Microfinance Credit Demand in Kakamega County, Kenya

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The microenterprise (ME) sector is key in Kenya's development process. In Kakamega County, the sector continues to register remarkable growth than agriculture and wage-employment sectors, employing 30% of the labour force and contributing significantly to households' incomes and livelihoods. The sector is characterized by variations in entrepreneurs' and MEs characteristics, making any stakeholders' intervention strategies in its development difficult without appropriate data. Entrepreneurs' inaccessibility to credit from mainstream financial institutions has been cited as one of the major constraints to the development of the sector. To address this, microfinance institutions (MFIs) have developed credit-friendly programmes, preferably for entrepreneurs in self-help groups (SHGs). This notwithstanding, there still exist variations in MFIs-credit demand and utilization levels among entrepreneurs. It is however, not clear to what extent entrepreneurs' and MEs characteristics vary and their role in influencing MFIs-credit demand and utilization levels among entrepreneurs in Kakamega County, which the study sought to investigate. Descriptive research design was used in this study, with a sample of 267 MFIs-credit assisted entrepreneurs drawn using stratified and proportional random sampling techniques. A semi-structured questionnaire, observations, mini-case studies and key informant interviews were used to collect data. Data was analyzed using: descriptive statistics; chi-square, correlation and regression analysis. The study found that significant differences exist in entrepreneurs' and MEs' characteristics and these factors too significantly influence credit demand and utilization levels among entrepreneurs. To improve credit demand and utilization levels among entrepreneurs, the study recommends policies that will: promote education to make entrepreneurs less risk averse; encourage entrepreneurs to diversify their sources of income; and aim to improve prices and markets for MEs products and services. Also, both National and County Governments should come up with a raft of entrepreneurs' business training programmes that focus on critical production skills, business operational and financial management, among others.

Keywords: Characteristics, credit demand, entrepreneurs, microenterprises, utilization levels and business, training needs

Determinants of Women's Collective Action in Marketing of Selected Vegetable Value Chains in Buuri-Sub County, Meru County, Kenya

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Collective action through formation of commercial villages is one of the interventions adopted by Meru County government to enable smallholders farmers mitigate the market imperfections and contend with the recent transformations in agri-product markets. Despite this, most of the commercial villages are dysfunctional due to free riding and lack of member commitment regarding participation in the group and its operations. This study therefore, analyzed the determinants of decision to join commercial village, participation and intensity of participation in commercial village activities, in Buuri Sub-County, Meru County. Probit model was applied to analyze the decision to commercial village membership and double hurdle model for participation and intensity of participation in the commercial village activities. The data was collected using a structured questionnaire to interview 138 households who were sampled randomly (110 group members selected proportionately to the group size and 28 nonmembers) from study area. The data was then analyzed through inferential statistics. The probit results indicate that Potatoes, carrots onions and tradition vegetables quantity, gender, farm experience, assets, off-farm income and information access had a positive effect on the probability of joining commercial village. The double hurdle model results revealed that potatoes, carrots onions and tradition vegetables quantity, education level, household size and credit access emerge as key determinants of participation in the commercial village activities. This study recommends inclusivity in decision making in group matters as well as offering incentives such as free inputs and imposing fines to non-compliant members.

Keywords: Determinants, women's collective action, marketing

Social and Cultural Factors Influencing Gender Disparity in Farmers Field Schools Approach among Smallholder Farmers in Kilifi Sub-County, Kilifi County

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The nature and extent of gender inequality and the conditions for farmer empowerment vary across countries, communities and regions. Although the status of women in agriculture has received extensive attention in the literature in recent decades, a research gap persists regarding the state of gender disparity in Farmers Field Schools (FFS) in Kilifi Sub-County. The study of gender disparity in FFS, an experiential learning approach whose outcome is to empower both men and women farmers with agricultural technologies is fundamental. Five FFS comprising of a total of 225 respondents were purposively selected for the study. Structured questionnaire and Focus Group Discussion guide were used to obtain quantitative and qualitative data. Content Analysis was used to analyze data. The results reveal several factors that support or contradict the conventional narratives of gender disparity in group formed to participate in implementation of FFS. In all five FFS, it was noted that although FFS provides a conducive environment for participants' experiential learning on new agricultural technologies, over 90% group members are women. Women are the managers of productive resources such as land and inputs, and custodians of household food stores. The less than 10% men are due to the socio-cultural norms and value that dictate that as household heads, they should engage in income generating activities for immediate monetary household needs. Men find the FFS approach inclined more to farming, an activity considered to be women's primary obligation and engaging in it will compromise their status as household heads. These findings imply that gender disparity observed in FFS approach caused by socio-cultural norms and values hinder farmer empowerment aimed at increasing agricultural production for food security. The development agencies should hold education forums to sensitize the community that achieving food security is a mirage without joint synergies from both women and men.

Keywords: Empowerment, Farmers Field Schools, gender disparity, socio-cultural factors

The Effect of Kenya's Ontological (in) Security in the Context of the Horn of Africa

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In analyzing the evolution of Kenyan foreign policy from the period of 1963 to 2020, I consider the contribution of psychology and sociology into security studies. Comparing different cases such as the 'Shifita wars,' 'Wagalla massacre,' Anti-Terror legislation, International Criminal Court (ICC) cases, 'Operation Linda Nchi' (OLN), and Maritime Boundary Dispute (MBD) including their consequences. Interrogating Kenya's security, I concentrate on the ontological security paradigm, taking into contexts the stability and adaptability of identity components. I conclude that Kenya struggles with her identity internally while internationally, the state's nationalistic identity is almost tangible. The state influence of international actors' impact on the (in) security of Kenya and the region. The paper is guided by the secondary data from the past thinkers on Kenyan foreign policy and primary sources from key informants' interviews and conferences related to the topic. The paper recommends that Kenya's foreign policy behavior should concentrate more on the pan-African philosophy, applying the ubuntu thinking to foster collective identity and avoid sporadic al-Shabaab attacks and Somalia continuous irredentist ideas.

Keywords: Foreign policy, horn of Africa, Kenya, ontological security

Visitor's Perceptions towards the Causes of Seasonality in the Kenyan Tourism Industry: A Case of Nairobi National Park, Kenya

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Seasonality presents a number of issues that require special attention and strategies. In particular, seasonality affects the number of tourists to a region and therefore may threaten the viability of tourism enterprises and regions whether severely or mildly. Seasonality causes the fluctuation in tourists and visitor numbers to a destination. Consequently, some destinations at certain times have more tourists and visitors than they are able to accommodate, while other have few tourists and visitors to the region. Kenyan tourism industry has in recent years suffered low tourist receipts especially at the coast. The main objective is to establish the visitor's perceptions towards the causes of seasonality in the Kenyan tourism industry, specifically, the causes of seasonality at the Nairobi National Park (NNP). The target visitor population at the NNP was 448 visitors for August, 2017, (KWS, 2018). The formula by Miller and Brewer (2003) was used to get the sample size of 205 respondents. Data was collected using questionnaires and interviews, then cleaned, edited and analyzed. Statistical Package for Social Sciences (SPSS) was used to analyse quantitative data, while qualitative data was analysed by use of content analysis. Descriptive analysis test used means, percentages and frequency distributions and charts. Inferential analysis used correlation and regression analysis including ANOVA and X2-square test to establish the level of relationships between the research variables. The findings indicate that the NNP experiences seasonality. Out of 64 respondent's majority strongly agreed both natural and institutional seasonality that weather season both natural and institutionalized seasonality account for 80%; Calendar influence, natural and institutionalized seasonality 51%; Timing decision, natural and institutionalized seasonality 77% finally, Social pressures, natural and institutionally seasonality 50%. All the predictors were statistically significant at $\alpha=0.05$ since p-values are less than 0.05. The study recommends that the government to give incentives to domestic tourists to visit the park regularly, in order to reduce the negativity of institutionalized seasonality. Further studies be done on the strategies to mitigate the causes of seasonality at the NNP.

Keywords: Nairobi National Park, seasonality, tourism, tourists

Community-Policing in Kenya: A strategy for Counter Violent Extremism

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Since the emergence of al-Shabaab in 2006, radicalization has brought anxiety to communities in the Horn of Africa. Focusing on Kenya, the paper examines and evaluates how governments' security tactics have countered violent extremism. With the emphasis that countering violent extremism needs inclusive and strategic policies such as the philosophy of community policing, the paper addresses how community policing in Kenya adopts inclusive policies. It interrogates how government tactical policies contribute to Violent Extremism (VE). The paper links the sporadic al-Shabaab attacks since 2011, the increasing extrajudicial killings, and the community policing tactics. Digging into contextual features of community policing, it interrogates Nyumba Kumi initiative and Community Policing Authority. Information gathered is based on interviews from highly affected communities such as Mount Elgon and Kitale in Tranzoia County, Mombasa, Kwale and Lamu counties, Garissa town, Hagadera, and Ijara in Garissa County, Isiolo County, Hola and Garsen in Tana River County. Government institutions such as Nyumba Kumi office, Local authorities such as Chiefs and Member of County assembly, academic experts, and the Kenya police were cross-examined. The paper also including interviews from Nairobi slum areas affected by extrajudicial killings such as Eastleigh, Mathare, Dandora, and Kayole. Interviews from regions with the best community policing practices such as Muranga and Nyeri Counties and regions with challenges such as Kisumu, Siaya, and Mombasa are beneficial to this paper in explaining and understanding the relationship between the concepts being tested. The paper concludes blending cultural traits, and governance structure into community-policing helps in countering violent extremism. The conclusion and recommendation are arrived at after the triangulation of the interviews with the documents from government and academic writings.

Keywords: Community policing, counter violent extremism, extrajudicial killing, Kenya.

Civil Society and the Struggle to Restrain the Leviathan: The Case of the Law Society of Kenya under Jomo Kenyatta

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The 2010 political revolutions in parts of the Middle East and North Africa also referred to as ‘the Arab Spring’ emerged into contemporary political history as a process in which ordinary citizens through their organised groups exerted decisive influence which brought down powerful governments. Studies on the impact of citizens’ influence on governments have, however, mostly associated it with democratisation, where it is mostly reduced to electioneering processes. Within Kenya, few studies have explored how citizens work to restrain governments from actions that are against public interest. Even fewer studies have ventured into the field of vertical accountability, to examine the interaction between citizens and governments, in which citizens confine government to only lawful actions. Using the Law Society of Kenya (LSK) as a representative of citizens’ organisations, this paper examines how Kenyan citizens endeavoured to restrain the state from excesses during the Jomo Kenyatta era between 1963 and 1978. Using archival data from the Kenya National Archives in Nairobi and secondary data from written accounts on Kenya’s legal, civil society and governance literature as well as the postcolonial governmentalities theoretical framework to explain findings, the paper examines the activities which the LSK deployed to restrain the Jomo Kenyatta state, the state’s reaction to LSK’s efforts to restrain it, and the rule of law regime which evolved out of this interaction. It establishes a complex relationship of accountability between the Jomo Kenyatta state on the one hand, and society and the LSK on the other hand. Under this relationship, the state used different approaches to curb the LSK from restraining it and to maintain its limited accountability to society in general. The paper contributes to Kenya’s rule of law history, particularly by examining the distinct field of vertical accountability.

Key words: *Leviathan, restraint, civil society, vertical accountability, state excesses*

East African Community's Response to Coronavirus: Old Habits Die Hard

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The response to coronavirus not only revealed how EAC partner states place national over regional interest, but also exposed widening cracks within the community. After detection of the virus in the region, individual countries deployed varied approaches against the disease despite indication of joint response from the EAC secretariat. On the outset, the secretariat called for harmonized surveillance and reporting of the pandemic at all border points, distribution of control and prevention materials, and joint training of the EAC mobile laboratory experts. Each country, however, acted unilaterally by imposing restrictions and border checks, concealing of COVID-19 results by some countries, and unharmonised COVID-19 certificates issued at regional border points. The study further argues that, while the absence of regional solidarity might have been motivated by the need to contain the spread of the virus, lack of collective action was greatly influenced by simmering differences among EAC member countries. This is because, before COVID-19 cases, there was tension between Burundi and Rwanda, disagreements between Uganda and Rwanda resulting to the closure of their Gatuma border, Tanzania and Kenya were blocking entry of some goods from Uganda, Rwanda and Tanzania signing bilateral agreements considered to be against the EAC spirit etcetera. As such, the region's responses to the pandemic did not come as a surprise, instead, it laid bare the simmering disagreement within the community. This paper, therefore, uses discourse analysis to explore ways in which COVID-19 revealed cracks in the community reminiscent of the one leading to the collapse of EAC1.

Keywords: EAC I, Covid-19, Cooperation, Collective action, Pandemic

HEALTH, SCIENCE AND TECHNOLOGY



Programme Coordinators: Dr. Alex Mugambi/Prof. Mwangi Ndirangu/Prof. Nancy Mungai	
CONFERENCE DAY TWO WEDNESDAY 25TH NOVEMBER 2020	
AFTERNOON SESSION	
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Rapporteurs: Dr. R. Wambua, Dr. F. Toroitich	
SESSION 4: HEALTH, SCIENCE AND TECHNOLOGY	
13.30pm-14.00pm	Selected videos – Cancer - Egerton Application - Egerton University Anthem
14.00pm-14.15pm	WELCOMING REMARKS: Prof. I. Kibwage, Deputy Vice-Chancellor (Administration, Planning and Development) Egerton University
14.15pm-14.30pm	CHIEF GUEST: Dr. Yeri Kombe, Director General & CEO, Kenya Medical Research Institute
14.30pm-14:50pm	Livestock Zoonoses and One Health Prof. Eric Fevre, Chair of Veterinary Infectious Disease. University of Liverpool/ ILRI Kenya
14.50pm-15:10pm	Determination of Pollutants in Water based on Graphenated Polypyrrole-nanoalloys Nanocomposite Dr. Stephen Mailu, Machakos University
15.10pm-15.30 pm	Cancer Prevention and Control in Kenya Dr. Naftali Busakhala, Moi University School of Medicine
15.30pm-15:50pm	Vaccine Development: Opportunities and challenges Dr. Susan W. Njuki, V.O, Adunga and E. K. Murungi <i>Department of Biochemistry and Molecular Biology</i>
15:50pm-16.15pm	Question and Answer session
16.15pm-16.20pm	Reflections Dr. B. Lishenga, Egerton University/ B. W. Ondimu, Nakuru County
16.20pm-16.30pm	Selected videos/exhibitors

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<p>Microbial Degradation of Polythene using Actinomycetes Isolated from Maize rhizosphere, Forest and Waste Damping Sites within Egerton University, Kenya P. N. Waithaka^{1*}, E. M. Gathuru², B. M. Githaiga², E. Otieno Ochieng² ¹School of Biological Sciences, University of Nairobi, P. O. Box, 30197-00100 Nairobi, Kenya. ²Department of Biological Sciences, Egerton University, P. O. Box, 536 Njoro, Kenya. ³International Livestock Institute, P. O. Box, 30709-00100 Nairobi, Kenya Corresponding Author: waithakanj@gmail.com</p>
<p>Effects of <i>Withania somnifera</i> Root Extracts on Serotonin Secretion in suiz Albino Mice B. M. Githaiga¹, E. Lelmen¹, E. M. Mwangi¹, P. N. Waithaka² ¹Egerton University, Department of Biochemistry and Molecular Biology, P.O. Box, 536 Njoro, Kenya, ²University of Nairobi, School of Biological Sciences, P.O. Box, 30197-00100 Nairobi, Kenya Corresponding Author: waithakanj@gmail.com:</p>
<p>Are Kenyan Fresh Water Lakes Safe? First Evidence of Microplastic Pollution in L. Naivasha F. Migwi, J. Ogunah[*] and J. Kiratu Department of Physical Sciences, University of Embu, P.O Box 6-60100, Embu: +254721750946 Corresponding Author: ogunah.joanne@embuni.ac.ke</p>
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<p>Control of Bacterial Pathogens Isolated from Water using Actinomycetes Extracts at Egerton University, Kenya P. N. Waithaka¹, E. M. Gathuru², B. G. Muriuki², and J. N. Kamunyi² ¹University of Nairobi, School of Biological Sciences, P.O. Box, 30197-00100 Nairobi, Kenya; ²Egerton University, Department of Biological Sciences, P.O. Box, 536 Njoro, Kenya Corresponding Author: waithakanj@gmail.com:</p>
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Persuasive Communication and Adoption of Routine Immunization of Children Aged 0-5 Years in Bomet County

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Children are still Safe from COVID-19 with Schools Reopening: An Immunological Perspective

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SCIENCE AND TECHNOLOGY

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<p>Virulence and Characterization of Potato Bacterial Wilt Isolates (<i>Ralstonia solanacearum</i>) in Rwanda'' M. C. Mutimawurugo^{1,3*}, I. N. Wagara², J. B. Muhinyuza¹, & J. O. Ogweno³ ¹Department of Crop Sciences, College of Agriculture, Animal Sciences and Veterinary Medicine (CAVM), University of Rwanda, P.O. Box 210 Musanze, Rwanda; ²Department of Biological Sciences, Faculty of Science, Egerton University, P.O. Box 536-20115, Egerton, Kenya; ³Department of Crops, Horticulture and Soils, Faculty of Agriculture, Egerton University, P.O. Box 536-20115, Egerton, Kenya. Department of Crop Sciences, College of Agriculture, Animal Sciences and Veterinary Medicine (CAVM), University of Rwanda, P.O. Box 210 Musanze, Rwanda. Corresponding Author: chantalmutima@gmail.com.</p>
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<p>³Department of Dairy and Food Technology, Egerton University. ⁴Department of Animal Science, Egerton University, Kenya Corresponding Author: kairu.peter@gmail.com</p>
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<p>Computational Methods in Drug Discovery: Quantitative Structure-Antitrypanosomal Activity Relationships (QSAR) as a Case Study M. Kimani¹, J. Matasyoh², M. Kaiser^{3,4}, G. Trossini⁵ and T. J. Schmidt⁶ ¹Department of Physical Sciences, University of Embu, Embu, Kenya, ²Department of Chemistry, Egerton University, Njoro, Kenya, ³Swiss Tropical and Public Health Institute (Swiss TPH), Basel, Switzerland, ⁴University of Basel, Basel, Switzerland, ⁵Faculdade de Ciências Farmacêuticas, Universidade de São Paulo, São Paulo, Brazil, ⁶Institute of Pharmaceutical Biology and Phytochemistry, University of Münster, Münster, Germany Correspondence Author: njogu.mark@embuni.ac.ke, Tel, 0728132596</p>

Livestock Zoonoses and One Health

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Livestock-associated zoonoses can influence health directly through human infection, as well as indirectly by mediating livestock production losses that have substantial economic and nutritional impacts on subsistence farmers and their families. Often endemically present, livestock zoonoses occur among populations without a strong political voice. Zoonotic infections of epidemic potential often garner headlines and considerable support for prevention and control. However, it is likely that the health and economic impacts of endemic zoonoses are even greater, especially among subsistence farmers who remain a large demographic group in many low-resource countries worldwide. In such populations, livestock infections may be transmitted to livestock keepers or those who work with livestock, or indeed the broader community, and become major causes of illness and death. In addition they can cause impoverishment either through healthcare costs, or if livestock are sickened or die, family members may suffer through reduced availability of dietary protein and of cash income. One Health approaches - the collaborative effort of multiple disciplines working locally, nationally and globally to attain optimal health for people, animals and the environment - have been promoted as a means to address such health concerns. This talk will explore the neglected problem of zoonoses in rural communities and the central role of One Health approaches to addressing livestock zoonoses.

Determination of Pollutants in Water based on Graphenated Polypyrrole-nanoalloys Nanocomposite

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In Kenya, Cancer is estimated to be the second leading cause of non-communicable diseases related deaths after cardiovascular diseases and accounting for 7% of overall national mortality. Hydrazine has been classified as human carcinogen by the Environmental Protection Agency (EPA). It has been reported that its exposure to humans causes damage to liver, kidney, lungs and respiratory tract system and has long-term effects on the central nervous system. Due to these side-effects, it is highly desirable to fabricate portable, economical, sensitive and rapid methodologies for the determination of hydrazine. This work focuses on the methodologies of harnessing the unique properties of electro-conductive polymers and nanomaterials and their application in sensor technology. A highly sensitive, rapid and simple electrochemical sensor for the detection of hydrazine has been developed using graphenated polypyrrole-Ag-Au nano alloys nano composite. The electrocatalysis of hydrazine on the synthesized nano composite was investigated in aqueous medium using cyclic voltammetry (CV) and square wave voltammetry (SWV). An increased current density, decreased oxidation over potential and low detection limits were observed. The results showed that the synthesized nanocomposite exhibited excellent characteristics for their application in the development of highly sensitive, cheap and easy to use electrochemical sensors for hydrazine detection.

Keywords: Carcinogen, Cyclic voltammetry, Hydrazine, Nanoalloys, Over potential.

Cancer Prevention and Control in Kenya

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Kenya, like most other developing countries, is undergoing an epidemiologic shift of disease patterns characterized by an increasing prevalence of cancer and other non-communicable diseases straining health care resources which were mainly intended for communicable diseases. We describe the development of sustainable cancer prevention and control programs at Moi University and Moi Teaching and Referral Hospital in Western Kenya. The cancer prevention and control program at Moi Teaching and Referral Hospital was started by volunteer nurses and clinicians in 2005 in response to a high prevalence of AIDS-related Kaposi sarcoma. Chemotherapy was donated by a local drug store until 2007 when Eli Lilly pharmaceuticals from Indianapolis in the USA started helping the program through the Academic Model Providing Access to Healthcare (AMPATH). Due to good response rates of patients with AIDS-related Kaposi sarcoma, and lobbying by volunteers, the service became a formal department of Moi Teaching and Referral hospital in 2008. The department has now grown to become the second largest public cancer centre in the country registering about 9000 patient visits per year. In addition, staff have now specialized in various areas such as medical oncology, palliative care, surgical oncology, nursing and gynaecology oncology. The development of a medical oncology program requires a multi-disciplinary team focused on integration within existing programs and expansion of collaborative networks in order to provide the best care to patients.

Keywords: medical oncology, integration, collaboration

Computational Identification of Putative Viral Epitopes for Vaccine Development

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Infectious diseases (IDs) account for 90% of the health problems worldwide, killing about 14 million people annually, 90% of who are from the developing world. Viruses, mostly as zoonoses, account for most of the EIDs and re-EIDs and consequently account for most of the IDs fatalities. Currently, control and management of EIDs and re-EIDs involves vector control, vaccination and chemotherapeutics. These approaches are suboptimal, therefore, improvement of current and/or development of novel control approaches is necessary. One possible solution of huge potential for control of EIDs of viral origin is vaccines. Here, 24 viruses were selected, genome and protein sequences analysed. Using antigen and epitope predicting tools, protein homology modeling and molecular dynamic simulations, 22 potential vaccine candidates were identified. These proteins are found in viruses of international public health importance without licensed vaccines. Epitope prediction, protein structure analyses and MD simulation revealed the identified epitopes as highly immunogenic, highly antigenic, non-allergenic, surface exposed and solvent accessible on the respective proteins and hence most likely accessible to host immune molecules. Additionally, conformational flexibility analyses revealed that the viral proteins are stable to allow epitopes interaction with host immune molecules. Together, these indicate good candidates for further validation and vaccine development. Notably, the *in silico* approach applied is faster and cheaper for potential use in identification of vaccine and diagnostic candidates for viruses.

Key words: Computational tools, emerging infectious diseases, epitopes, re-emerging infectious diseases, vaccine candidates, viruses.

HEALTH AND SANITATION

Calf Health Problems, Causes and Trends in the Semi-Arid Areas of Kenya and Technologies for Mitigation

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The health and management of replacement animals are important components of total dairy herd production systems. The aim of this study was to identify the calf health constraints and possible farm management practices which could be associated with young stock losses in the Sahiwal and Friesian crossbred herds in the semi-arid areas of Kenya. A total of 1742 dairy calves born between January, 2010 and December, 2018 from the Sahiwal and crossbred dairy herd were evaluated. The method of data collection involved regular farms visits, data collection on births, deaths and their causes from health records and post mortem reports. Other data included animal factors (calf sex, breed, and age and birth weight) and environmental factors (year and season of birth and deaths) with their disease causes. All data were analyzed using generalized linear model of statistic. The results showed that the overall mortality rate in live-born calves up to one year of age was 11.62%. Risk factors associated significantly ($P < 0.001$) with mortality rate were calf sex, breed, age, birth weight and season of birth. The overall calf mortality rate was higher for male calves than for female calves ($p < 0.001$). More calves died when young (< 3 months) than old (> 3 months) especially in the wet season. The most common diseases reported at the farm level were digestive tract diseases (27.6%), respiratory tract diseases (16.7%), and premature births (14.1% and malnutrition (11.4%) respectively. Tick-borne and helminthiasis were the least reported disease problems in this herd possibly due to the excellent parasitic disease control program practiced in this farm. Research technologies aimed at reducing mortality rate of Sahiwal and crossbred calves in this herd may include: good calf feeding and housing management, timely disease control and vaccination measures and growing drought resilient crops such as leguminous forages for supplementation during the dry season to minimize malnutrition and retarded growth.

Keywords: Semi-arid areas, calf health problems, technologies for mitigation

Microbial Degradation of Polythene using Actinomycetes Isolated from Maize rhizosphere, Forest and Waste Damping Sites within Egerton University, Kenya

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Polythenes are used in many spheres of human life such as packing of commodities, construction of green houses and ponds among other uses. When not properly disposed, they contaminate our environment since they are not easily biodegraded. In this study, polythene papers were buried around growing maize, in the forest and in waste damping site. Soil samples were separately collected from the three sites, packed in sterilised polythene bags and taken to the laboratory for isolation of actinomycetes. The soils were dried on the bench for one week. Actinomycetes were using starch casein agar. Characterization of the isolates was carried out using cultural, physiological and biochemical means. The polythene were subjected to degradation by the actinomycetes by placing them in conical flasks having starch casein broth followed by incubation in shaking conditions at 30°C for one week. Three groups of potential actinomycetes were isolated from maize soil (EU10, EU15, EU19), forest soil (EU3, EU8, EU13) and damping site soil (EU21, EU25, EU30). The isolated actinomycetes had varying microscopic, physiological and biochemical characteristics. There was no significant difference in polythene sheets degradation between maize, forest and damping site soils ($F=38$, $P<0.05$). However, there was significant difference in the polythene sheets degradation among the actinomycetes ($F=11.49$, $P=0.03$). Actinomycetes from the soils of Egerton University had a great potential of producing metabolites that degraded polythenes. There is need for massive isolation and screening of the actinomycetes for production of metabolites that are capable of degrading polythene.

Keywords: Actinomycetes; degradation; Egerton; Kenya; polythene; rhizosphere.

Effects of *Withania somnifera* Root Extracts on Serotonin Secretion in Suiz Albino Mice

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Pain is a common manifestation of presence of disease or physical injury in humans. High levels of serotonin in the plasma has been associated with pain. This study aimed at determining the effect of *Withania somnifera* root extracts on serotonin levels in Suiz albino mice. *W. somnifera* root samples were collected and ground to small pieces. Ethanol, n-butanol, xylene and methanol were used to extract metabolites from the ground root materials using hot extraction technique. The mice were injected with the extracts separately and serotonin levels determined over a period of 12 h at 2 h intervals. Serotonin concentration was determined using Beer Lamberts method. Light absorbance by the extracts varied significantly (F = 50.2011 P = 1.25x10⁻⁰⁷). The concentrations of serotonin from mice injected with the metabolites from the selected solvents varied significantly (F = 23.3269 P = 0.0000469). In addition, there was no significant difference in light absorbance values obtained by Panadol, methanol and ethanol extracts. (F = 3.7178 P = 0.089). Extracts from *W. somnifera* had the ability to reduce serotonin levels in plasma. Further studies on the mechanisms involved in reducing serotonin levels by *W. somnifera* in blood need to be carried out. There is need for mass production of metabolites from *W. somnifera*.

Keywords: *Withania somnifera*, root extracts, serotonin, Suiz albino mice.

Are Kenyan Fresh Water Lakes Safe? First Evidence of Microplastic Pollution in L. Naivasha

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Microplastics (MPs) are emerging threat contaminants that have been shown to provide toxic pollutants, either from the environment or from their inherent toxic monomers and additives, a pathway into the aquatic food web. In the present study, the occurrence, abundance and composition of microplastic (MP) load in the surface water of Lake Naivasha was determined. Seven sampling locations were selected to ensure maximal coverage of hydrologic and other factors such as anthropogenic pressures that may influence plastic and MP input and distribution in the lake. Surface water physical chemical parameters were measured *in situ* whereas MP samples were collected using plankton net trawls and treated with H₂O₂ to decompose organic matter. The MP particles recovered were classified taking into account their physical and chemical properties which were done via visual observation and attenuated total reflectance - Fourier transform infrared spectroscopy respectively. The average MP concentration range in surface water was 183,333.5±16,666.5 and 633,333.5±66,666.5 particles/km². Fragments, fibers and films were identified and were majorly composed of polypropylene, polyethylene, and polyester. The lakes' dominant abundance of fibrous (81%) and colored (81%) MP is an indication that secondary MPs are the major source of the pollutants in the lake. Moreover, correlational analysis done exhibited a strong positive association between the MP quantities and turbidity, total nitrogen and total phosphorus in the lake. This assessment adds to the growing documentation of MPs presence in freshwater ecosystems, and provides a baseline for future monitoring and assessment in sediment and biota of Lake Naivasha and other Kenyan freshwater systems.

Keywords: Freshwater, Lake Naivasha, Microplastics, Surface-water

Microbial Degradation of Plant Waste Materials using Actinomycetes isolated from Egerton University Soils in Kenya

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Every harvest season, receives a lot of plant waste material that have a negative effect on the environment. The rate at which bacteria and fungi in the environment decompose these wastes is low. This study aimed to isolate actinomycetes from soils obtained from Egerton University and test the actinomycetes for the ability to decompose plant wastes materials. Soil samples were collected from field 7 in Egerton University, Kenya. Actinomycetes were isolated using starch casein agar medium and coded EU followed by a number. Maize stalk and *Grevillea* sp. leaves were collected from field 3 in Egerton University. One hundred grams of the plant materials were mixed with starch casein broth inoculated with the isolated actinomycetes in conical flasks and incubated in an orbital shaker at 28°C for 1 month. The materials were washed using 70% ethanol prior to drying in a hot air oven and weights determined. The isolate EU 10 presented grey aerial mycelia, EU 13 (Green), EU 15 (Grey) and EU 19 (White). The isolates presented varying morphological, physiological and biochemical characteristics. There was no significant difference in plant wastes degradation between isolates EU 10, EU 13, EU 15 and EU 19 ($F=11.49$, $p=0.07$). Actinomycetes from Egerton University had the potential of degrading maize stalk and *Grevillea* sp. leaves. There is need for massive isolation and screening of actinomycetes for production of metabolites that are capable of degrading plant waste materials.

Keywords: Actinomycetes, degradation, isolation, microbes, plant wastes.

Control of Bacterial Pathogens Isolated from Water using Actinomycetes Extracts at Egerton University, Kenya

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Diseases are the worst enemy to man currently. This study was aimed at isolating pathogenic bacteria from water obtained from shallow wells in Dundori Kenya. Also, the study aimed at testing the isolates for sensitivity to antibiotic metabolites previously extracted from Actinomycetes isolates from soils of Egerton University. Water samples were collected from shallow wells randomly selected from Dundori and abbreviated as A, B, C, D, and E. Bacterial pathogens were isolated from the water samples using the membrane filtration technique. The isolates were characterized using biochemical means. Antimicrobial sensitivity testing was carried out using Kirby Bauer disk diffusion method. Data analysis was carried out using the Statistical Package for Social Sciences (SPSS). Comparison of means was carried out using one way ANOVA. Shallow wells B, D and E were highly contaminated with pathogenic bacteria. Biochemical characterization of the isolates indicated that the most common isolates were *Vibrio cholera*, *Klebsiella pneumoniae*, *Proteus sp*, *Escherichia coli*, and *Staphylococcus aureus*. There was no significant difference between the zones of inhibition produced by the antibiotic metabolites ($F=2.149$ $P=1340$) when tested against the test isolates. There were no significant differences between the MICs of the antibiotic metabolites on the bacterial pathogens ($F=2.01$ $P=0.15$). Water from some shallow wells in Dundori is highly contaminated with *Klebsiella pneumoniae*, *Escherichiacoli*, *Proteus sp.*, *Vibrio cholerae* and *Staphylococcus aureus*. The pathogens were effectively be controlled using antibiotics from the Actinomycetes. There is a need to sensitize the residents of the study area on ways of preventing seepage of contaminants into the shallow wells.

Keywords: Bacteria, Egerton, Control, Pathogens, Isolation, Water.

Doctor-Patient Communication and People Living with HIV/AIDS: A Cross-Section Study from Homa Bay County, Kenya

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Introduction: Effective health provider- patient communication, a precursor to building a wholesome, trusting relationship, has been recognized as a vital factor in cultivating suitable self-management practices among patients with chronic infections like HIV/AIDS. However, the level and determinants of doctor patients' communication is not well documented in Homa Bay County and therefore, this study was designed to shade more light into this important field. **Methods:** This was a cross-sectional hospital-based survey conducted among 362 HIV/AIDS patients in Homa Bay County. Data was collected using a self-administered structured questionnaire. Cronbach's alpha and confirmatory factor analysis tests were used to ascertain the reliability and validity of study instruments, while the Chi-square test was used to establish the relationship between demographic factors and doctor patient communication. **Results:** 51% of the respondents were females, with the majority, (30.9%) of respondents being in the aged 45 years and above. Most respondents described health provider-patient communication as effective (mean score 3.60, and SD 1.164. Gender, educational level, marital status, and illness duration were all significantly associated with doctor patient communication in this study at p values less than 0.05. However, majority of the respondents were concerned that the clinical officer/doctor was taking too fast (61.3%), used of medical words that were difficult to understand (62.7% and seldom used pictures or drawings or models to explain issues (70.4%), all of which may reduce the effectiveness of doctor-patient communication. **Conclusion:** This study, therefore, recommends reequipping healthcare providers with effective communication skills, including ability to profile patients with inadequate health literacy who may require special consideration, including taking more time with them and avoiding medical jargon.

Key words: health literacy, doctor-patient communication, HIV/AIDS.

Rationality of Cancer Survivors' Narratives and their Influence on Intention to Screening for Cervical Cancer among Women in Agricultural Sector Kiambu, County Kenya

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There is evidence that use of narrative messages is effective in the context of health. There is however no explanation as to what aspect of narrative leads to high level of persuasion. In this regard, we evaluated the effects of narrative rationality (believability) on uptake of cervical cancer screening among women in agricultural sector Kiambu County, Kenya. A randomized experimental design was used in this study. The messages was presented via a medium of a brief narrative video on cervical cancer and cervical screening. A uniform pretest questionnaire on cervical cancer and cervical cancer screening (T1) was completed by respondents before watching a narrative video. After watching a narrative video on cervical cancer screening participants responded to the post test questionnaire (T2). Data from 378 (100%) respondents for the pretest and 344 (91%) for posttest, was analyzed and included in the study findings for the baseline and posttest respectively. Multiple hierarchical regression analysis was used. Majority of the respondents were aged above 41 years of age at 32%. Majority 249 (65.9%) of the respondents were married. Regarding parity, majority 210 (55%) of the respondents had 1 to 3 children followed by 4 to 5 at 91(24%). After running multiple hierarchical regression analysis, the study found that evaluating the story as rational (or not rational) had influence on the uptake of cervical cancer screening services. The study concluded that while using narrative messages to promote health behavior, use of stories that are credible, consistent, comprehensive and complete may help in increasing adoption of advocated health behavior.

Key words: Narrative communication, cervical cancer, narrative rationality, fidelity

Persuasive Communication and Adoption of Routine Immunization of Children Aged 0-5 Years in Bomet County

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An estimated two to three million annual deaths from Vaccine preventable diseases (VPDs) are preventable through immunization. Currently about 19.5 million infants miss out on routine immunization globally. We carried out a study on the role of caregiver characteristics in persuasive communication on adoption of routine immunization services. Further the moderating role of support systems was evaluated. The study employed a mixed method research design. A sample of 384 caregivers was used. Data was collected using interviewer administered questionnaires and KII. The key informants interviewed were taken with Sub-county medical officer of health, health promotion officer and EPI coordinator. Both descriptive and inferential statistics were applied in the analysis. The study findings were that caregiver characteristics had positive influence on adoption of routine immunization. Additionally, when support systems were added to the variable, the influence became more significant. The study recommended that routine immunization messages be made frequently available, targeted and tailored to the caregivers. Secondly, the community should be involved in advocacy towards adoption of routine immunization, to create ownership and adoption sustainability. Additionally, health workers should be motivated towards good practice in Health worker-client communication specifically, persuasive communication to build trust from the caregivers. The researcher recommends comparative studies should be conducted, comparing the well performing Counties with Bomet County.

Key words: Persuasive communication, immunization, caregiver

Children are still Safe from COVID-19 with Schools Reopening: An Immunological Perspective

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Aim: Countries have eased restrictions and in Kenya children have even been allowed back to school. Several parents still have fears about the health of their children as they go back to school after a long break occasioned by the COVID-19 outbreak. In this review, we aim to provide the immunological basis for our argument and thus opine that it's safe to have the children in school. **Content:** The coronavirus disease 2019 (COVID-19) pandemic caused by SARSCoV-2 has affected many people worldwide, but data on how it affects children are rare. Children have so far accounted for 1%-5% of diagnosed COVID-19 cases. A general pattern reported from multiple countries shows that those children who test positive for COVID-19 experience a mild form of the disease and have a better prognosis than adults. Deaths are extremely rare or low. Diagnostic findings show that compared to adults, elevated inflammatory markers are less common, lymphocytopenia seems rare, and fewer children develop severe pneumonia. COVID-19 is either rare in children or it has not been diagnosed that often because this age group remain asymptomatic. The consequence is that children and younger adults who do not have underlying conditions, such as impaired lung function or immunosuppression, have a much lower risk of severe forms of COVID-19 than other age groups. Children also tend to have many viral infections and it is thus possible that repeated viral exposure supports the immune system when it responds to SARSCoV-2. **Conclusion:** From the above and other immunological findings we show that children in school are safe enough from COVID-19, but those with underlying medical conditions would need close and constant monitoring.

Key words: Covid-19 (coronavirus disease 2019), children, immune system, cytokines, inflammatory markers

SCIENCE AND TECHNOLOGY

PHYSICAL SCIENCES

Optimization in Hilbert Spaces

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Studies on optimization has attracted the attention of many mathematicians and researchers over a long period of time. In this paper, we are concerned with the classical results on optimization of convex functions in infinite-dimensional real Hilbert spaces. The methodology involves the use of Ito's formula and Black-Scholes Model. The results show that a function f has a first order optimality condition. Moreover, if f is differentiable at a point x^* in R^n and if x^* is a local minimum of f , then the delof $f(x^*) = 0$. A simple application involving the Dirichlet problem is also given. In conclusion, with regard to Portfolio Optimization, this study is geared towards applications to particularly stochastic optimization with consideration to: Cox-Ross-Rubinstein model and Hamilton-Jacobi-Bellman Equation.

Keywords: Optimization, Hilbert space, Stochastic analysis, Applications

On Stability of Similarity Orbits

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The notion of stability plays an important role in dynamical systems. It has been extensively studied in various forms. Various properties of stability have been proved under the underlying spaces. However, if we consider similarity orbit to be of power sequence of norm-attainable operators, little has been done to investigate their stability. In this paper, we considered similarity orbit of power sequence of norm-attainable operators and employed the notion of convergence and spectral radius to investigate its stability. The result obtained may be useful in genetics via Markov's chain.

Keywords: Jordan canonical form, similarity orbits, spectral theory, stability

Polymer Solar Cells with Graphene and Germanium Quantum Dots-Based Nanomaterials in the Photoactive Layer

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Bulk heterojunction (BHJ) device structure is one of the most promising approaches towards high efficiency thin film polymer solar cells (TFPSCs). The conjugated polymer, poly-3-hexylthiophene (P3HT), is the commonly used electron donor while the fullerene, (6-6) phenyl-C61-butyric acid methyl ester (PCBM), forms the electron acceptor in the photoactive layer. This study reports the effect of incorporating graphene derivatives *viz* graphene oxide (GO) and novel N-doped graphene-germanium quantum dots nanocomposite (NGr-Ge QDs) in the active layer of P3HT:PCBM based TFPSCs. The inclusion of GO and NGr-Ge QDs in the photoactive layer yields high short-circuit current densities (J_{sc}), which translates to high power conversion efficiencies (PCEs). Also, NGr-Ge QDs in the active layer results in enhanced fill factor (FF). The use of GO in the active layer remarkably improves the optical absorption leading to high charge carriers photogeneration requisite to high J_{sc} . On the other hand, the nanocomposite in the active layer blend serves to ensure effective charge separation and transportation to the respective electrodes. Consequently, an improvement of up to 120 and 183% in the PCE is achieved by inclusion of GO and NGr-Ge QDs in the active layer of TFPSCs, respectively.

Keywords: Active layer, bulk heterojunction, graphene oxide, N-doped graphene-germanium quantum dots nanocomposite

Removal of Fluoride Ions in Stored Drinking Water by Triethylamine Chemically Modified Polyethylene Containers

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This paper reports the removal of fluoride ions in stored drinking water by a container made from chemically modified polyethylene material. To anchor triethylamine within the structure of the polyethylene material and improve its value, the polyethylene was first heated to melting. To the molten material, hot vegetable oil was added slowly with continuous heating followed by a strongly basic hydrogen peroxide solution then activated with triethylamine to produce a water insoluble material. The resulting synthesized products were characterized using FTIR and ¹³C NMR after each step. The triethylamine activated epoxy material was molded into a one liter container which was cured for three hours in an electric oven at 150° C to form a hard mechanically strong container. It was then used for water storage and removal of dissolved fluoride ions. Its ability to remove fluoride ions was based on complexation reaction between the fluoride ions- quaternary ammonium compounds. A 40% removal efficiency was achieved from a solution containing 12.5 mg l⁻¹ of fluoride ions in less than 7 days of storage at the physiological pH of water. The existence of sulphate and nitrate ions had no observed significant effect on the fluoride removal process. This study revealed that the container has a potential application for the remediation of fluoride laden waters in the rural areas during the water storage process to make it safe for domestic consumption.

Keywords: Fluoride, polyethylene, remediation, regenerate, Quaternary ammonium compounds.

Microwave Synthesis of Carboxymethyl Cellulose (CMC) from Rice Husk

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Carboxymethyl cellulose is an important non-toxic cellulose derivative which plays vital roles in paper coating, pharmaceuticals, food, detergents, and others. Research work involving the extraction of cellulose from agricultural biomass and its modification cellulose using a microwave has been reported, but not much work has been done on the rice husk, thus helping in managing associated waste. In this study, cellulose extracted from rice husks was used as the raw material for the synthesis of food-grade carboxymethyl cellulose (CMC). In the process of the synthesis of carboxymethyl cellulose from rice husk, cellulose was carried out by alkalization, an etherification process, using sodium hydroxide (NaOH) and monochloroacetic acid (MCA). Characterizations of CMC products was carried out by Fourier Transform Infrared (FTIR) spectroscopy and Xray Diffraction (XRD). The reaction conditions optimized include power (microwave), sodium hydroxide concentration, amount of monochloroacetic acid and reaction time. The degree of substitution (DS) was determined using a potentiometric titration method and the maximum DS of 0.79 was obtained when 30% NaOH was used.

Keywords: Carboxymethyl cellulose, cellulose, Degree of substitution (DS), microwave

Chemical Composition of *Azadirachta indica* A. Juss and *Ricinus communis* Linn. Seed Oils Growing in Marigat, Baringo County, Kenya

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A laboratory study was conducted to determine chemical composition of *Azadirachta indica* and *Ricinus communis* seed oils grown in Marigat, Baringo County, Kenya. Seed oils of *A. indica* and *R. communis* were extracted from mature dried seeds by cold pressing and boiling respectively and chemical compositions were determined using Gas Chromatography (GC)-Mass Spectrometry (MS). The constituents of both seed oils were dominated by saturated and unsaturated fatty acids, cyclic esters and methyl esters. The predominant constituents of *R. communis* were (Z)-6-Octadecenoic acid (37.33%), Ricinoleic acid (30.22%) and 13-Hexyloxacyclotridec-10-en-2-one (26.67%) while those of *A. indica* were 2-hexyl-1-decanol (30.97%), Octadecanoic acid (29.69%) and Oxalic acid, 6-ethyloct-3-yl ethyl ester (15.55%). Oils contained Hexadecanoic acid and Octadecanoic acid which are known to play vital role in manufacture of products such as candles, soaps, lotions, perfumes and cosmetic products. Octadecenoic acid is important in human health and diseases and Ricinoleic acid in production of alkyd resins for surface coating and biofuel. From the results, the seed oils of *A. indica* and *R. communis* have chemical constituents with potential applications in agricultural, industrial, cosmetics and pharmaceutical sectors.

Keywords: *Azadirachta indica*, *Ricinus communis*, seed oil, GC-MS, chemical constituents

Virulence and Characterization of Potato Bacterial Wilt Isolates (*Ralstonia solanacearum*) in Rwanda

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Bacterial wilt caused by *Ralstonia solanacearum* is one of the two major potato diseases in Rwanda. An *in vitro* study was conducted to identify and differentiate the pathogen isolated from three potato cultivars highly susceptible to *R. solanacearum* in Rwanda namely Kinigi, Kirundo and Gikungu. This was performed by streaming of vascular flow assessment as well as cultural and morphological tests on triphenyl tetrazolium chloride (TTC) and casamino peptone glucose (CPG) agar as well as biochemical tests through Gram staining and biovar test. In addition, an *in vivo* trial was also carried through to evaluate the incidence and severity of those target isolates on potatoes. All isolates showed typical morphological traits of virulent *R. solanacearum* on CPG and TTC media. The test isolates were all Gram-negative bacteria. Biovar test confirmed that all the isolates belonged to race 1 biovar 3 of *R. solanacearum*. Moreover, the highest disease severity (DS=100%) and disease incidence (DI=100%) were recorded in Gikungu isolate followed by Kinigi (DS=97.33% and DI=98.25) and Kirundo (DS=94.67% and DI=92.61%). From the findings of this first study it is concluded that the pathogens isolated from Kinigi, Kirundo and Gikungu were typical *R. solanacearum* belonging to race 1 biovar 3 and were all pathogenic to potato plants. Gikungu and Kinigi isolates were highly virulent and caused severe wilting and frequent incidences than Kirundo isolate. Race 1 of *R. solanacearum* affects a wide range of plant species in the Solanaceae family. Therefore, Gikungu or Kinigi isolates belonging to this race can be used for further studies in plant protection in management of the disease.

Keywords: Bacterial isolates, Pathogenicity test, Potato, *Ralstonia solanacearum*, Rwanda.

Grasshoppers and Locusts Species Diversity and Distribution in Nakuru County, Kenya

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Grasshoppers play strategic roles in the ecosystems of recycling of plant nutrients and acting a first order consumers along the trophic food webs. Therefore, their distribution and diversity within an ecosystem signify richness and evenness. Despite their usefulness, very little is known about the diversity, the relative abundance as well as the distribution of *Caeliferans* in Africa and more so, Kenya. This study was undertaken to understand the species diversity, distribution and abundance of grasshoppers and locusts in the ecological zones of Nakuru County, Kenya. Nakuru County was selected based on having different ecological zones (Forest, grassland and semi-arid for zone I, II and III, respectively) and major economic activity which is agriculture that encompasses both crops and livestock farming. Specimens were captured using a sweep net or by hands and then transferred to a 500 ml Kilner jar, containing a cotton wool soaked with 6.9% diethyl ether concentration for killing. Shannon-Wiener index was used as a measure of species diversity while Simpsons' index was for species dominance. A total of 456 individuals (Order *Orthoptera*; sub-order *Caelifera*) belonging to 2 families and 18 species were recorded during the study period. *Acrididae* family had six sub-families including *Cyrtacanthacridinae*, *Oedipodinae*, *Gomphocerinae*, *Eyprepocnemidinae*, *Acridinae* and *Catantopinae* while *Pyrgomorphidae* had one sub family, *Pyrgomorphinae*. *Aiolopusthalassinus* species was the most abundant and found in the three ecological zones while *Ornithacrispictula*, *Gastrimagusverticalis* and *Heteropternis coulonia* were the least abundant. Shannon-Wiener diversity index (H') was recorded at 2.38 overall and 2.45, 1.37 and 1.3 for zone ii, zone iii and zone iv respectively. Simpsons' abundance index was 0.095, 0.313 and 0.125 for zone ii, zone iii and zone iv respectively. Diversity was found to be significantly different among the three ecological zones at $t=0.04$ while abundance was not significantly different at $t=0.08$. Difference in grasshopper diversity between ecological zones was greatly influenced by the difference in range of vegetation available. Therefore, ecological zones affect species abundance and diversity and their conservation is threatened, thus forestry to improve biodiversity conservation should be encouraged.

Keywords: Abundance, Caelifera, diversity, ecological zones, Nakuru County, orthoptera

Molecular Characterization of Four Antibiotic Producing Actinomycetes Isolated from Menengai Crater

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Multi-drug resistant pathogens are a leading cause of human morbidity and mortality all over the world. This study aimed at isolating actinomycetes from the soils of Menengai crater and characterizing selected actinomycetes using classical and molecular techniques. Actinomycetes were isolated using starch casein (SC), Luria Bertani (M1) and starch nitrate (SN) agar media. The screening for antibiotic activity was carried out via primary screening using perpendicular method and secondary screening using agar plug technique against selected bacterial and fungal pathogens. The best actinomycetes based on size of inhibition and broad spectrum of activity coded PAN 25, PAN 41, PAN 75 and PAN 110 were selected for further bioassay. The selected actinomycetes were characterized using molecular technique that involved extraction of 16S rRNA gene, PCR and phylogenetic studies. Data was analyzed using Statistical Package of Social Sciences (SPSS) software. There was a significant difference in the number of actinomycetes isolated using the three types of media ($F=3.315$ $P=0.04218$). There was no significant difference in the zones of inhibition between the isolates PAN 25, PAN 41, PAN 75 and PAN 110 ($F=0.8928$ $P=0.5431$). Molecular characterization revealed that isolate PAN 25 had 99% similarity with *Streptomyces variabilis*, isolate PAN 41 (*S. indiaensis*), isolate PAN 75 (*S. luteogriseus* strain ZG728) and isolate PAN 110 (*S. acrimycini* strain K30). Menengai crater had actinomycetes that inhibited growth of the selected actinomycetes. There is need of isolating actinomycetes from other unique regions. Large scale production of antibiotics from the selected actinomycetes need also to be carried out.

Keywords: Actinomycetes, antibiotics, characterization, Menengai, molecular, sensitivity.

Assessment of the effectiveness of SSR markers in the selection of interspecific hybrids of tea

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This study was conducted to assess the effectiveness of simple sequence repeat (SSR) markers in separating interspecific hybrids of tea (*Camellia sinensis*). A total of 20 SSR primers (5 EST-SSR and 15 microsatellite markers) were screened against three genotypes, i.e., 570/2, 688/1, and 83/1 from 2005, 2007, and 1999 trials, respectively. Genomic DNA was isolated using the CTAB method and amplified using specific PCR conditions for SSR primers. Subsequently, amplicons were separated on 2.0% agarose gel. The polymorphism information content (PIC) of 10 primers was ≥ 0.5 with a mean of 0.60. A total of 52 alleles (1-9 alleles per locus) were detected. Based on PIC (≥ 0.5) and the number of polymorphic bands (≥ 2), a set of eight primer-pairs (TM 134, TM 179, TM 51, TM 58, A37, A 47, Camsin M3, Camsin M5, and Camjap A2) were determined as ideal for genetic diversity studies in interspecific tea hybrids. These markers can be utilized for unambiguous detection and marker-assisted selection of tea hybrids to exploit their full potential.

Keywords: Interspecific hybrids, microsatellite marker, simple sequence repeat markers, polymorphic, *Camellia sinensis*

Changes in Carbohydrates Associated with Senescence of Cut Gladiolus Spikes as Affected by Pulsing and Wet Cold Storage Durations

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Several biochemical and metabolic changes are associated with the senescence of cut gladioli particularly carbohydrates. This study aimed to determine the effects of pulsing and wet cold storage on the starch and sugar biomarkers in cut *Gladiolus grandiflorus* L. cv. Fado vase quality. Pulsing treatments of 600-ppm 8-hydroxyquinoline sulphate plus 5 % sucrose solution versus distilled water were administered prior to wet cold storage durations of 0 – 5 days on the cut *Gladiolus* cv. Fado, grown from the corms in the open field at the Horticulture Research and Teaching Field, in the Department of Horticulture, Egerton University, Kenya, during two successive seasons. Analysis of total soluble starch and sugars was done. A two by six factorial experiment embedded in a completely randomized design with four replicates was adopted. Proc GLM in two way Anova was adopted; the means were separated using Tukey's test at 5 % level of significance. There was significant difference ($P = < 0.0001$) in total soluble sugars (TSS) and Total starch of *Gladiolus* spikes pulsed with 600 ppm 8 – HQS + 5 % sucrose as compared with the control during the third day in the vase life of the cut flowers. Prolonged vase life of cut gladioli spikes was associated with decrease in total soluble sugars and increase in total starch as influenced by pulsing and wet storage duration up to 4 days.

Key words: pulsing; storage: *Gladiolus*, quality, Fado

The Effect of Climate Parameters on the Performance of Chókwè Irrigation Scheme, Mozambique

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Chókwè Irrigation Scheme (CIS) is the biggest of its kind in Mozambique, supporting the practice of irrigated agriculture in region and contributing to food security and economic growth. The scheme faces seasonality in water flow-flux resulting from the climate variable effects. Sediment particles has accumulated over decades in the canals causing serious problem in the scheme. The lack of knowledge on the climate variables influence is the utmost limit in the site. To address these concerns, this study investigated the effect of climate variables on the performance of the scheme. Climate and hydrology data of the region were obtained from the National Meteorology Institute (INAM), Water Administration for South region (ARA-SUL) and Chókwè Hydraulic, Public Enterprises (HICEP). The effect of climate variables on the performance of CIS was found to be significant for precipitation and air temperature, which plays significant role on the water flow made available in the scheme. A need for a reference evapotranspiration model adjusted to local characteristics was found critical and therefore, a model proposed. The most relevant meteorological variable in estimating ETo for Chókwè region, was found to be the Global Solar Radiation ($r=95\%$; $r^2=90\%$). Estimation of the ETo by the Methods Based on Solar Radiation resulted on the Hargreaves method being the best fitting ($r^2=94\%$; $r=97\%$), and Benevides and Lopez ($r^2=76\%$; $r=87\%$) methods proved to be better and reliable, for Methods Based on Air Temperature. These findings can play role in water flow-flux and sedimentation management and prediction.

Keywords: Climate variables, water flow-flux, sedimentation, precipitation, air temperature.

Co-digesting Pretreated Chicken - Goat and Untreated Cow Manure on Biogas Production in Fixed Dome Laboratory Digester

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Generation of biogas can greatly be influenced by feed stock pretreatment. The effect of hydro, mechanical and thermal pretreatment of chicken and goat manure on biogas production was done using a 0.15m³ laboratory scale batch digester. The feed stocks were subjected to 6, 12 and 18 hours of soaking, 2 mm, 3 mm and 4 mm of mechanical mincing, and 60°C, 80°C and 100°C of heating. Pretreated feed stocks were co-digested with untreated cow manure from an extensive dairy rearing system. Experiments were done at 8 % substrate total solids and a constant temperature of 35°C. Averagely, mechanical pretreatment resulted in the highest increase in mean biogas production rate with 11.11%, over the co-digestion control (0.54 m³/m³d), followed by thermal and hydro by 5.56% and 1.85%. Maximal increase in production for each pretreatment was at 6 hour soaking time (9.30%), 3 mm effective feed stock particle sizes (18.52%) and 80°C of heating (14.81%). Co-digestion increased mean biogas production rate over mono-digestion by 68.97% (chicken), 81.84% (goat) and 8.8% (cow manure). Superior outer cell wall and cover disruption of feed stocks for easy hydrolysis advantaged mechanical pretreatment.

Keywords: Pretreatment, Chicken-goat-cow manure, Biogas production, Fixed dome, Laboratory digester

Computational Methods in Drug Discovery: Quantitative Structure-Antitrypanosomal Activity Relationships (QSAR) as a Case Study

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Human African trypanosomiasis is a fatal vector-borne parasitic neglected tropical disease affecting millions of people in poorly developed regions of sub-Saharan Africa. It is caused by two subspecies of protozoan parasites: *Trypanosoma brucei rhodesiense* (*Tbr*) and *T. b. gambiense*. There are few available chemotherapeutic options for this infection which are aggravated by high toxicity, high cost, difficulty in administration and unavailability to resource deprived rural communities. In the past few decades, computational methods in drug discovery have improved tremendously. These methods are broadly classified as either structure-based or ligand-based methods. Structure-based methods include ligand docking, pharmacophore, and ligand design methods. In these approaches the target and ligand structure information are needed. On the other hand, only the ligand information is needed in ligand-based methods for predicting activity depending on a molecules' similarity/dissimilarity to previously known active ligands. In this presentation only the ligand-based approach will be explained. Three methods employed in quantitative structure-activity relationship (QSAR) study on the antitrypanosomal activity of sesquiterpene lactones towards *Tbr* will be discussed. These QSAR approaches include: (1) "Classical" descriptor-based QSAR using a genetic algorithm to select the most relevant variables, (2) indicator variables deduced from pharmacophore features obtained from a 3D alignment of the most active molecules and (3) hologram QSAR (HQSAR) based on molecular fingerprints of fragments extracted from the 2D molecular structure.

Key words: QSAR, sesquiterpene lactones, trypanosomiasis

HISTORY, LITERATURE AND CULTURE



Programme Coordinators: Dr. Alex Mugambi/Prof. Mwangi Ndirangu/Prof. Nancy Mungai	
CONFERENCE DAY THREE THURSDAY 26TH NOVEMBER 2020	
MORNING SESSION	
October/November, 2020	E-REGISTRATION: Zoom Link
Session Chair: Dr. Dishon Kweya , Chairman, Department of Languages, Literature and Linguistics Rapporteurs: Dr. J. Thuo, Dr. H. Murenga	
SESSION 5: HISTORY, LITERATURE AND CULTURE	
09.30am-10.00am	Selected videos –Egerton Application - Egerton University Anthem
10.00am-10.15am	WELCOMING REMARKS: Prof. Alex Kahi , Deputy Vice-Chancellor (Academic Affairs) Egerton University
10.15am-10.30am	CHIEF GUEST: Hon. Florence Kajuju , Chair, Commission for Administrative Justice
10.30am-10:50am	Unmasking the Complementarity of History, Literature and Culture in Lives of Citizens: New Dynamics and Imperatives of Interdisciplinarity Prof. Maurice N. Amutabi , Vice-Chancellor, Lukenya University.
10.50 am-11.10am	We are Agents, Not Passive Victims: The Role of Muslim Feminist Scholars in Peace building and Security in Northern Nigeria 1980-2018 Dr. M. Tukur , Umaru - Musa Yar'adua University, Nigeria
11.10 am-11.30am	Exercise of Innocuous Power by Female Characters in Selected African Prose Fiction Works J. N. Murage, A. M. Rutere and N. K. Gor , Laikipia University
11.30am-11:50am	Protocol and Order During the Late President Moi's Mourning Period: Understanding the speech Act Theory Prof. C. W. Kitetu , Egerton University
11:50am-12.15pm	Question and Answer session
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<p>We are Agents, Not Passive Victims: The Role of Muslim Feminist Scholars in Peace building and Security in Northern Nigeria 1980-2018 M. Tukur¹ and P. Khanakwa² ¹<i>Department of History and Security Studies</i> <i>Umaru Musa Yar'adua University, Katsina Nigeria, PhD Fellow, Gerda-Henkel Stiftung, Makerere University Kampala.</i> ²<i>Department of History, Archaeology and Heritage Studies</i> <i>Makerere University, Kampala Uganda</i> Corresponding Author: <i>saltuk.mt@gmail.com; mubarak.tukur@umyu.edu.ng</i></p>
<p>A Decline in Observing Taboos: A Recipe for Environmental Degradation E. A. Essel <i>National University of Public Service, Hungary:</i> Corresponding Author: <i>abeabi@yahoo.com; emmanuel.abeku.essel@hallg.uni-nke.hu</i></p>
<p>Peacebuilding and Security in Northern Nigeria; A Study of Muslim Women Scholars, 1978-2018 M. Tukur <i>Department of History and Security Studies, Umaru Musa Yar'adua University Nigeria</i> <i>Makerere University, Uganda.</i> Corresponding Author: <i>saltuk.mt@gmail.com/ mubarak.tukur@umyu.edu.ng</i></p>
<p>Nadharia ya Metausasa [Metamordenism] katika Fasihi: Mfano katika Kitabu cha Shujaaz M. C. Kiarie na A. Taib <i>Idara ya Lugha, Isimuna Fasihi Chuo Kikuu cha Egerton.</i> Corresponding Author: <i>kiariec90@yahoo.com</i></p>
<p>The Proliferation of Covid-19 English Neologisms on Digital Media in Kenya A. Manyasi^{1*} and J. Khaemba² <i>Egerton University Box 436 Egerton, Kenya</i> <i>Tel: +2547222636853, + 254722265757; jkhaemba76@gmail.com</i> *Corresponding Author: <i>anne.manyasi@gmail.com</i></p>

Unmasking the Complementarity of History, Literature and Culture in Lives of Citizens: New Dynamics and Imperatives of Interdisciplinarity

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Space, agency and voice are important in history and literature and provide some of the best representations of culture. In this article, I seek to demonstrate that History and Literature have been bedfellows as disciplines and often complement each other in representation of facts and fiction. They are often used as ardent vehicles and vessels of presenting and preserving culture. The works of Chinua Achebe have been used to teach the history of the Igbo people of Nigeria. The world has gained a lot of knowledge about the history of the Kikuyu and Mau Mau from reading novels of Ngugi wa Thiong'o. Many scholars have admitted that they learned a lot about mining in South Africa through the rendering of the fiction of Peter Abrahams in his book *Mine Boy*. Scholars such as Homi Bhabha and Ngugi wa Thiong'o have used historical narratives to augment their literary works while others such as Ifi Amadiume and Colin Bundy have used creative works to reenact historical scenes from the past, thereby affirming the complementarity of the two disciplines. The postmodern and post-colonial presentation provides a lot of possibilities and prisms of reenacting many scenes and scenarios which this paper will be dealing with. The notion of silences and the need of vocalization of voices using feminist, gender and other dimensions is important and to understand marginalization and silencing in order to seek liberation and mainstreaming. How do these new approaches transform how we look at space, agency and voice? What are some of the tensions that we encounter in these revisionist projects? In what ways do we need to deconstruct domination narratives and insert our stories in order to change the meta-narrative? These are some of the questions that this paper will address.

We are Agents, Not Passive Victims: The Role of Muslim Feminist Scholars in Peace building and Security in Northern Nigeria 1980-2018

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For more than three decades, studies on patriarchal domination of women have quelled the oppressive masculinity. There is a shift of prototype, where some Muslim women scholars of Islam in Northern Nigeria are now changing the narratives of confinement to public discourse of their feminine roles in peace building and security. Some of these Muslim women combine both Islamic and western (formal) education in their peace building and security activities. The surge in Islamic knowledge production, has led to many of them to assume the position of intellectual Islamic scholars with religious authority, and leadership in Northern Nigeria. They use their intellectual and scholarly knowledge in building bridges of peace and security in a context characterized by Boko haram insurgency, banditry and abductions, and matrimonial conflicts among couples. This paper explores the feminine roles and contributions of Muslim women scholars of Islam in peace building and security through their religious roles and leadership. This paper uses gender and development framework to show that Muslim women have developed a network of change in the patriarchal popularization and dominance in Northern Nigeria. The paper found out that Muslim women scholars in northern Nigeria have attempted to demystify the assertion of Islamic patriarchal dominance through scholarly analysis and intellectual discourse of Islamic knowledge production.

Keywords: Islamic Feminism, matrimonial conflict, Muslim women, peace building, religious organization, religious leadership

Exercise of Innocuous Power by Female Characters in Selected African Prose Fiction Works

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This study establishes how female characters in Nawaal El Saadawi's *God Dies by the Nile* (2007), Mariama Ba's *Scarlet Song* (1986), Assia Djebar's *Fantasia: An Algerian Cavalcade* (1993) and Bake Robert Tumuhaise's *Tears of my Mother* (2013) use non-aggressive types of power to negotiate relevance. The study is justified by the fact that African theorists on feminism have increasingly been replacing belligerent ideas found in first and second wave of Western feminism with accommodative versions of African feminisms. As a result, it is necessary to read these texts with a view of finding out how female characters acquire and exercise power without resorting to militancy. Motherism, a coinage of Catherine Acholonu, is one such variant of African feminism that forms the theoretical framework of the study. The study locates the acquiescent subalternity associated with female characters within the authors' intention of demonstrating that African feminism is not equivalent to a battle of the sexes but is instead a way of creating complementarity between male and female characters. This is an interpretivist study on textuality whose conclusion is that the form of power exercised by female characters is non-confrontational but nevertheless effective in the creation of a complementary interaction between male and female characters.

Keywords: Gender, Legitimation, motherism, panopticism, STIWANISM

Protocol and Order during the Late President Moi's Mourning Period: Understanding the Speech Act Theory

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This paper is a reflection on both the language and acts of protocol as witnessed during the days of moaning and funeral service of the late retired second President of the Republic of Kenya, Daniel Toroitich Arap Moi, between the fourth and the twelfth of February 2020. Using the Speech Act theory as expounded by John Austin 1962, John Searl 1963, Levinson 1973 and Ethnography of Communication by Dell Hymes, this paper will discuss the key themes, terms, acts and procedures during this period of moaning. Interviews with some military officers will be used to shed light on the meanings of acts and procedures which include; the flags traditions, the military marches, and the use of guns by the army, which was in charge of much of the ceremonies and activities that took place during the time of moaning. The paper argues that while Chomsky gives scientific explanations for understanding human language and also argues for objectivity in linguistic studies, yet his theory fails to explain the intricacies of language and meanings that accrue in various human experiences and activities in social life. On the other hand, the speech Act theory and Ethnography of communication as analytical tools show how the language and protocol in the military has the effect of reaffirming and consolidating existing social structures, and that this language has both practical and ritual functions.

Key words: Chomskian linguistics, Speech Acts, Ethnography, Communication, Military, funeral

DOWRY: A Possible Impediment to Happy Marriage

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Payment of Dowry as a condition for legitimization of marriage is a common practice in many societies and is central to the ways in which the institution of marriage is understood and inserted in diverse African traditions. In most African societies, it is taken for granted that the groom has a responsibility to pay, usually livestock, to the bridal family in return for her hand in marriage. However, issues arise concerning the social construction of dowry payment and the implications for the woman whose worth is quantified in terms of livestock, on the one hand, and marriage as a social institution that inherently entails and predetermines power relations in partnership. This paper casts attention to the implications of dowry as legitimisation of marriage and the dynamics of the relations between the wife and husband/in-laws in a context where her worth is quantified and monetized. Using interviews with prospective and actual couples, this paper examines the meanings that those involved discern from this institution with specific reference to the African milieu, its current status and its relevance in contemporary society. This paper concludes that the contemporary socio-political consciousness demands a radical revision of the understanding and practice of marriage to demonstrate awareness of the shifting consciousness that interrogates the traditional concept of power relations that legitimizes dowry payment.

Keywords: Dowry, marriage, society, tradition.

We are Agents, Not Passive Victims: The Role of Muslim Feminist Scholars in Peace building and Security in Northern Nigeria 1980-2018

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For more than three decades, studies on patriarchal domination of women have quelled the oppressive masculinity. There is a shift of prototype, where some Muslim women scholars of Islam in Northern Nigeria are now changing the narratives of confinement to public discourse of their feminine roles in peace building and security. Some of these Muslim women combine both Islamic and western (formal) education in their peace building and security activities. The surge in Islamic knowledge production, has led to many of them to assume the position of intellectual Islamic scholars with religious authority, and leadership in Northern Nigeria. They use their intellectual and scholarly knowledge in building bridges of peace and security in a context characterized by Boko haram insurgency, banditry and abductions, and matrimonial conflicts among couples. This paper explores the feminine roles and contributions of Muslim women scholars of Islam in peace building and security through their religious roles and leadership. This paper uses gender and development framework to show that Muslim women have developed a network of change in the patriarchal popularization and dominance in Northern Nigeria. The paper found out that Muslim women scholars in northern Nigeria have attempted to demystify the assertion of Islamic patriarchal dominance through scholarly analysis and intellectual discourse of Islamic knowledge production.

Keywords: Islamic Feminism, matrimonial conflict, Muslim women, peace building, religious organization, religious leadership

A Decline in Observing Taboos: A Recipe for Environmental Degradation

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In Ghana, the role of taboo in solving contemporary environmental issues is an ongoing debate with some people taking the conservationist stance while others reckon that traditional beliefs and practices play a significant and positive role in ensuring that the environment is in good shape for future generations. In the Cape Coast Metropolis, taboos are part of the daily activities of its indigenes. Among the Cape Coast people environmental taboos play a pivotal moral role toward the ontological wellbeing of both the individual person and the environment at large. The impact of taboos, however, appears to have lessened in comparison with traditional societies due to factors such as western scientism and modernity - western hegemonic tendencies that have demonized African traditional and cultural values and promoted the idea that they are diabolic, savage and regressive. The objective of this study was to find out how the decline in observing taboos amongst the people of Cape Coast is affecting the environment. The research was conducted using mixed methods, which allowed for a mixture of quantitative and qualitative approaches. The targeted population were people of Cape Coast in Ghana some selected Non-Governmental Organisations. The study revealed that the people still hold on to their traditions and culture and would not do anything which will have dire consequences on their lives should they break any taboos including those that pertains relationship with environment. In view if this there is the need for the local government laws to have a fusion of both traditional and cultural laws as part of efforts to preserve the environment.

Keywords: Environmental degradation, impact, taboos, tradition

Peacebuilding and Security in Northern Nigeria; A Study of Muslim Women Scholars, 1978-2018

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Northern Nigeria has a long history of been the center of Islamic revivalism since the establishment of the Sokoto Caliphate (1804-1808). The misconception and deception of some of the Muslim religious organizations in the name of Islam have today became a theater of religious conservatism. This was followed by misinterpretation, misconception and misleading of the general populace through a tactical deception by some misguided religious elements. It is important to note that, Muslim women in Northern Nigeria are significant in any discourse in Africa. This research will explore the hidden role, contribution, and activities of peacebuilding and security in the conflict Northern Nigeria society by Muslim women scholars of Islam. They cut across different Islamic sect and ideology. They greatly impacted and dedicated their lives in building peace across the volatile conflict zones in Northern Nigeria through religious means. They succeeded in peace settlement of hundreds of thousands of matrimonial disputes. They engaged in changing the lives of thousands of women internally displaced persons (IDPs) since the emergence of conflict and violent religious extremism in Northern Nigeria since in the 1970s. an ethnographical use of Qualitative historical methodology will be adopted to unravel and examine how these women aided in establishing a solid peacebuilding and security in Northern Nigeria in DE radicalization of violent religious extremist ideologist, insurgency and counter-insurgency of using women as suicide bombers, women fighters in banditry and kidnappings, matrimonial peacebuilding through their scholarship, and knowledge production.

Keyword: Banditry and kidnapping, matrimonial conflict, peacebuilding and security, violent extremism

Nadharia ya Metausasa [Metamordenism] katika Fasihi: Mfano katika Kitabu cha Shujaaz

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Fasihi imepitia mabadiliko kadha katika makuzi yake. Kuanzia fasihi simulizi [hadithi, semi, maigizo, ushairi simulizi, mazungumzo nangomezi], ikaja fasihi andishi [riwaya, tamthilia, hadithi fupi na ushairi andishi] na kasha fasihi ya watoto na vijana inayohusisha michoro. Kufikia sasa fasihi ipo katika filamu na video. Mabadiliko haya bila shaka yanaandamana na mabadiliko ya namna jamii inavyoendelea kubadilika kijamii, kiuchumi, kiteknolojia na mifumo mingine yajamii. Nadharia za uhakiki wa fasihi nazo zimeasisiwa kukidhi mahitaji haya ya ukuaji haya ya fasihi. Kuna zile nadharia asilia [urasimi, umuundo], nadharia nyambuaji [urasimimpya, umuundoleo] na nadharia changamano [uhalisia, ujamaa]. Nadharia hizi zinatumiwa na zinakidhikika mili fuutunzi na uhakiki wa kazi za fasihi simulizi na fasihi andishi. Nadharia kama vile ya Usasa [*Modernism*] baada yake kumetokea nadharia ya Usasa leo [*Postmodernism*]. Kisha baada ya Usasa leo kuna Metausasa [*Metamodernism*]. Lengo la utafiti huu ni kuonyesha namna nadharia yametau sasa inavyojidhihirisha katika kazi yafasihi. Ilikufanikisha haya tutahakiki namna mihimili yake inavyojitokeza katika kitabu cha katuni cha Shujaaz kama fasihi ya kimetausasa. Utafiti huu utafafanua yaliyomo kitabuni hiki kwa kuongozwa na nadharia hii na maelezo na mifano kutolea kitabuni kwa njia ya maelezo. Matokeo yakiwa ni kudhihirisha namna fasihi za kimetau sasa vilivyo kwa kutumia Shujaaz kama mfano.

Keywords:

The Proliferation of Covid-19 English Neologisms on Digital Media in Kenya

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The current global pandemic has not only changed the lives of people globally but also caused language change. Seemingly, there is a parallel language contagion to the pandemic given that some dictionaries have already made unscheduled updates in response to coronavirus-related vocabulary. Since previous research has reported pandemics and epidemics to have given rise to certain neologisms, the study aimed at exploring neologisms related to COVID-19 using data from digital platforms in Kenya. It focused on identification of neologisms and their meaning, word-formation processes as well as the word classes of neologisms related to the pandemic. It is a qualitative study that uses observation and field notes. The study is informed by Pavol Štekauer's (1996, 1998, 2001b) theory of onomasiology which states that name giving is governed by the needs of language users and any act of naming an object is based on its reflection and processing in human consciousness. Data from the study was coded then presented using tables and discussions. The study provides a synchronic account of COVID-19 neologisms and is useful to linguists and scholars of language change. The findings reveal that the contagion has seen an emergence of new English words, phrases, acronyms and abbreviations in day to day language, with a majority springing from previous pandemics. The new words are chiefly nouns and adjectives and are of medical background. This paper, therefore, argues that there are multiple neologisms that are currently in use as a result of the coronavirus pandemic or 'the new normal.'

Key Words: neologism, coronavirus, COVID-19, contagion, language change

EDUCATION AND CHANGE



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14.00pm-14.15pm	WELCOMING REMARKS: Prof. F. Keraro E-Campus Coordinator, Egerton University
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14.30pm-14:50pm	The Role of Infrastructure in the Provision of Higher Education for Sustainable Development in Kenya. Dr. D. K Mutunga, Daystar University
14.50pm-15:10pm	Access and Provision of Quality Technical and Vocational Education for Sustainable Industrial Development in Kenya. Dr. J. O. Gogo, Maseno University
15.10pm-15.30 pm	Teacher Professional Codes of Ethics of New Zealand and Kenya: A Document Analysis Dr. Truphena Oduol, Pan African Christian University, Kenya
15.30pm-15:50pm	Place-Based STEM Education for the Agricultural Workforce Prof. J. Mukuni and Prof. G. Glasson, Virginia Tech School of Education
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16.15pm-16.20pm	Reflections - Dr. J. Ngeno/Dr. Paul Maithya, Maasai Mara University
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<p>Effect of Overcrowded Classrooms on Student Behaviour in Schools in Kenya <i>P. A. Onyango, University of Nairobi, 0721324101</i> Corresponding Author: <i>pamsao@gmail.com</i></p>
<p>Evaluation of Women Participation in Leadership Positions in Kenya since 2010: A Case of the Abagusii Community Kisii and Nyamira Counties, Kenya <i>C. Nyamwange</i> <i>Kisii University</i> Corresponding Author: <i>nyamwangebona@gmail.com</i></p>
<p>The Influence of Language as Medium of Teaching -learning on Learners' Academic Achievement: A case of Nile Basin Primary School (NBPS) in Goma Town, Democratic Republic of Congo <i>A. H. Mvukiyeh</i> <i>ISP Kinyatsi-Nyamitaba, DRC, University of Eastern Africa, Baraton</i> Corresponding Author: <i>athanasehabimana2014@gmail.com</i></p>
<p>Education Production Function: Does Health Matters? <i>B. Muktar</i> <i>Department of Economics, Faculty of Management and Social Sciences, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria</i> Corresponding Author: <i>muktarbala@yahoo.co.uk</i></p>
<p>Effect of Stress Management Techniques across Gender on Task Performance among Secondary School Student Leaders in Kisumu County, Kenya <i>P. A. Mudis</i> <i>Department of Educational Psychology, Kisii University, Kenya</i> Corresponding Author: <i>pamelamudis@gmail.com</i></p>
<p>The Intrigues in Education Financing and its Effect on the Provision of Quality Education in Kenya <i>J. O. Gogo</i> <i>Maseno University</i> Corresponding Author: <i>jotieno2009@gmail.com</i></p>
<p>Effects of Free Day Secondary Education Policy on Academic Performance of Rural Public Day Secondary Schools in Kilifi County, Kenya ¹<i>J. Olang'o; ¹J. Malechwani* and ¹S. Murage</i> ¹<i>Pwani University; School of Education P. O Box 195-80108, Kilifi-Kenya</i> *Correspondent Author: <i>j.muthiani@pu.ac.ke</i></p>
<p>Microfinance Credit-Assisted Microenterprises: Entrepreneurs' and Businesses' Characteristics and their Implication on the Development Needs of the Microenterprise-Sector in Kakamega County, Kenya <i>Obulinji, H.W.</i> <i>Department of Geography, Egerton University. P.O. Box 536- 20115 Egerton, Kenya</i> Corresponding Author: <i>humphreysobulinji2015@gmail.com</i></p>

The Role of Infrastructure in the Provision of Higher Education for Sustainable Development in Kenya

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A country cannot attain sustainable development without considerable investment in human capital. This makes education an important factor in development because it enhances people's understanding of themselves and their world. It does so by providing the knowledge, skills and attitudes essential for the promotion of entrepreneurial and technological advances which in turn raise people's economic and social progress. To achieve this, a country needs to provide quality higher education to its citizenry, and quality learning presupposes the presence of qualified human resources and good infrastructure in these institutions of higher learning. Recent years in Kenya have seen a lot of focus on access, but while ensuring that all those who qualify for higher education transit to the various institutions of higher learning, the efforts to develop the infrastructural capacity of these institutions has not matched the growth in student numbers. It is an accepted fact that quality learning does not only depend on relevant curriculum content, but is very much influenced by the learning experience created by the physical environment and especially the adequacy of: lecture halls, laboratories, libraries, accommodation facilities, assessment instruments and instructional aids. This paper examines the influence of infrastructural capacity in the provision of quality higher education as a strategic tool for sustainable development. The study is guided by the theory of Infrastructure-led Development which proposes that long-run development should be based on public infrastructure as the engine for growth and sustainable development. The paper will mainly explore relevant literature from different resources and use the findings to draw conclusions and formulate recommendations to address the infrastructural challenges in Higher Education in Kenya.

Keywords: Higher education, sustainable development, infrastructure, human capital

Access and Provision of Quality Technical and Vocational Education for Sustainable Industrial Development in Kenya

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Technical and vocational education plays a critical role in the acquisition of practical knowledge and skills that are vital to industrial development worldwide. Kenya aspires to achieve Vision 2030 by intensifying application of science, technology and innovation in its education system for global competitiveness. To achieve this, Kenya was expected to raise the quality and relevance of education and increase transition rates to technical institutions and universities from 3% to 8% by 2012 with an emphasis on science and technology. However, various challenges such as low enrolments in science and technology departments in technical institutions and universities have slowed down the pace at which this could be achieved. Enrolment in technical institutions is skewed towards academic programmes rather than practical oriented courses. This has denied Kenya the middle level workforce that is important for a growing economy. Secondly, performance in science and technical courses is equally wanting due to rising student/teacher ratio and technical institution being turned into universities or university campuses. This paper, therefore, discusses access and provision of quality technical and vocational education for human resource development and provision of infrastructure, teaching/learning materials and equipment in schools, colleges and universities.

Keywords: Access, industrial development, innovation, technical education, quality of education, vocational education

Teacher Professional Codes of Ethics of New Zealand and Kenya: A Document Analysis

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The upsurge of ethical malpractice in schools has renewed interest in the ethical dimension of education. Professional ethics codes have become crucial elements for regulating the conduct of teachers globally. The value and prevalence of these frameworks vary across professions and contexts especially in developed and developing countries. This study examined how professional codes of ethics for teachers in New Zealand and Kenya shape the ethical conduct and responsibilities of teachers across the two contexts. The objectives of the study were to examine (a) what the purpose the codes serve (b) the ethical values, principles and standards engrained within each to better understand the perspectives that inform their development and commitment to ethical conduct. A qualitative design was used, and written codes of ethics for each country, relevant documents and the tacit knowledge of researcher were the primary sources of data. The data were downloaded from the relevant online websites of the two countries and relevant literature sources derived from credible data bases and subjected to content analysis. The findings demonstrate the varied approaches available for managing teachers ethical conduct through codes of ethics thus, the Teacher's Council, New Zealand relies on an aspiration code of ethics while the Teachers service, Kenya's a regulatory or compliance-based code. The results suggest that when codes of ethics are constructed with the teacher's purpose in mind, they are likely to inform their commitment to ethical practice. While contributing to theory and policy, these findings should stimulate further dialogue that can enhance the constructive development of relevant ethical frameworks for managing teacher ethical conduct in schools in Kenya.

Place-Based STEM Education for the Agricultural Workforce

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The importance of place-based science, technology, engineering, and mathematics (STEM) education cannot be over-emphasized, particularly in developing economies. It takes a strong presence of a knowledgeable and highly skilled workforce talented in STEM fields to drive the economy towards prosperity through economic growth and poverty alleviation, and it takes place-based STEM education to develop the agricultural-STEM workforce that the East African agribusinesses for sustainable development. This abstract has proposed the adoption of place-based STEM education, with due emphases on the notion of place and the signature pedagogy for STEM education. It is hoped that implementation of the proposal will facilitate the production of shakers and movers needed in East Africa's agricultural workforce to drive the economy towards prosperity through economic growth, poverty alleviation, and sustainable development in the agricultural sectors of the East African region.

Keywords:

Poverty Eradication Interventions in Kenya: A Mirage or an Achievable Dream?

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The government of Kenya has since independence made great strides to eradicate poverty through its fight against disease, poverty and ignorance. Different development plans, sessional papers and high level forums have spelt out different strategies to address poverty, but they have not been translated into implementable effective policies and approaches that can overcome poverty situations in the country. Government and non-government agencies have mobilized and used huge amounts of resources in various development projects but the level of poverty has continued to rise to a level where currently 45% of the population live below the poverty line. This happens as the world struggles to achieve sustainable development goal No. 1, eradication of poverty. Poor economic performance has led to increase in poverty as most Kenyans lack food, access to decent housing and clean and safe drinking water among other services. Government subsidy on the cost of education has not saved the situation either because schools charge illegal and or unaffordable levies that cause children to drop out of school. Government's intervention to improve the agriculture sector by providing subsidized farm inputs has not yielded significant results because of different challenges. Efforts by most development agencies have not transformed the lives of Kenyans as they have at best been counterproductive and a frustration. The purpose of this paper is to explore some of the efforts the government has made to reduce poverty and the socio-economic and environmental factors that frustrate these efforts and make suggestions as to how this stalemate can be addressed. The study will achieve this by reviewing existing literature on poverty and environmental degradation and based on the findings draw conclusions and make recommendations on effective and best practices for achieving sustainable development.

Keywords: Environmental sustainability, poverty, poverty eradication, sustainable development

Effect of Overcrowded Classrooms on Student Behaviour in Schools in Kenya

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Kenya has made remarkable improvement in the quest for universal primary education as a way of achieving international target for realizing Education for All (EFA) which has resulted in the increase in student enrolment. However, one of the most common concerns of schools is overcrowding. Several facilities have been overstretched in the primary schools and secondary schools. Primary schools in Bondo Sub county struggle to realize the ambitious rate of transition expected by the Ministry of Education with overstretched facilities. Numerous studies have been undertaken with the aim of establishing the effect of overcrowding on academic achievement. However, not much investigation has been done about the effect of overcrowded classrooms on student behavior. The aim of the current study therefore is to investigate the effect of overcrowded classrooms on student behavior in primary schools in Bondo Sub county of Kenya. Five primary schools will be purposively sampled for the study. Qualitative data and quantitative data will be collected from head teachers, deputy head teachers, heads of guidance and counseling and pupils from 5 primary schools. Quantitative data will be analyzed using descriptive statistics and correlational analysis while qualitative data will be analyzed using thematic framework. In conclusion, the findings of the study may be useful in the formulation of relevant policies for addressing overcrowding in primary schools and managing student behavior in schools.

Keywords: Behavior, classrooms, effect, management, overcrowding

Evaluation of Women Participation in Leadership Positions in Kenya since 2010: A Case of the Abagusii Community Kisii and Nyamira Counties, Kenya

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Locally and globally, women's leadership and political participation are restricted. Women are underrepresented as voters, as well as in leading positions, whether in elective offices or in the civil service, in the private sector or even in academia. This article seeks to assess strides women have made in leadership since the promulgation of the constitution of 2010: A case of the Abagusii people of Kisii and Nyamira counties, Kenya. The study adopted descriptive survey research designs, which supports the use of questionnaire and interview schedules to elicit information from a sample population of 120 participants. Respondents were selected randomly and some purposively from the 16 sub counties of Kisii and Nyamira counties. Data collection was done by the use of questionnaires and interviews. Results were presented using frequency tables, charts and narrations. From the findings of the study, it is concluded that women are still marginally under-represented in leadership in the community far from the third gender rule as is in the constitution of Kenya. And cultural factors are blamed to be the strongest hindrance. The findings of this study are significant as they will assist the community and relevant government departments in developing appropriate strategies, strengthen existing policies and regulations so that more women take part in leadership positions in Kisii and Nyamira Counties.

Keywords: Appointment, constitution, culture, election, equality, leadership, women

The Influence of Language as Medium of Teaching -learning on Learners' Academic Achievement: A case of Nile Basin Primary School (NBPS) in Goma Town, Democratic Republic of Congo

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The paper investigated the influence of languages (national and official) on learner's academic achievement as recommended by the new framework law of education n° 14/004 of 11thFebruary,2014.A population of 187 learners from six forms of Nile Basin Primary School (NBPS), were involved in the study, where a test in language subjects (French and Kiswahili), both respectively official and national medium of instruction at primary level in Eastern Democratic Republic of Congo, was administered and the result recorded. Using a Statistical Package of Social Scientists (SPSS), the regression analysis was applied to find out the relationships between the languages results test and the student's summative results of the first term 2018-2019, collected through the review of school result document records.The findings are as follows: correlations coefficients, Form1 (.795), Form2 (.737), Form3 (.860), Form4 (.745) form5 (.774) and Form6 (.869). It was concluded that the mastery of the language of instruction influences positively the learner's academic achievement. Teachers and school administrators are advised to put a great emphasis on language, as a medium of instruction.

Keywords: Framework law, medium of instruction, school result

Effect of Stress Management Techniques across Gender on Task Performance among Secondary School Student Leaders in Kisumu County, Kenya

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The focus of this study was on stress management techniques and their effect on task performance among secondary school student leaders in Kisumu County, Kenya. Despite the key role that stress management techniques play in dealing with the inevitable effect of stress through problem solving, emotional support and denial there has been a burden among male and female student leaders, triggered by task performance. Specifically, this study sought to assess the effect of stress management techniques across gender on task performance among secondary school student leaders. The study was guided by Cognitive Appraisal theory. To realize this objective, Correlation research design was used. The target population was male and female student leaders in secondary schools in Kisumu County. Stratified random sampling technique was used to select 1275 student leaders, 53 deputy head teachers and 53 head teachers. Data was generated through questionnaires. Reliability of the instruments was tested using Cronbach alpha and it gave an overall internal consistency of 0.7, hence reliable. Analysis of data was done using t-test and regression. The findings of the study show that female student leaders are more effective in task performance than their male counterparts. Secondly, the results indicate that gender has a moderating effect on task performance among student leaders. The study recommends appropriate and timely intervention in choice of stress management techniques for male and female student leaders.

Keywords: Gender, stress management techniques, student leaders, task performance

Effects of Free Day Secondary Education Policy on Academic Performance of Rural Public Day Secondary Schools in Kilifi County, Kenya

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The purpose of the study was to investigate the influence of Free Day Secondary Education (FDSE) policy on academic Performance of Rural Public Day Secondary Schools (RPDSS) in Kilifi County, Kenya. The study adopted descriptive survey research design and a sample of 375 subjects was considered sufficient. Structured questionnaires and interview schedules were used to collect data from principals, teachers, and education director. Data on performance and enrolment were collected through document analysis. Reliability of the instruments was ascertained through test and retest method that yielded a correlation coefficient of 0.83 an indication of reliable instruments. The study found out that there was a decrease in school means score between 2003-2007 and 2013-2017. There was a strong positive correlation ($r = 0.93$) between enrollment and poor performance. Further, learning resource and students finance were inadequate. The study recommends a reduction in class size, timely disbursement and increased student's capitation.

Key words: Educational policies; enrolment; school resources; school performance

Microfinance Credit-Assisted Microenterprises: Entrepreneurs' and Businesses' Characteristics and their Implication on the Development Needs of the Microenterprise-Sector in Kakamega County, Kenya

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The microenterprise (ME) sector is key in Kenya's development process. In Kakamega County, the sector continues to register remarkable growth than agriculture and wage-employment sectors, employing 30% of the labour force and contributing significantly to households' incomes and livelihoods. The sector is characterized by variations in entrepreneurs' and MEs characteristics, making any stakeholders' intervention strategies in its development difficult without appropriate data. It is however, not clear to what extent entrepreneurs' and MEs characteristics vary among businesses in Kakamega County, which the study sought to investigate. Descriptive research design was used in this study, with a sample of 267 MFIs-credit assisted entrepreneurs drawn using stratified and proportional random sampling techniques. A semi-structured questionnaire, observations and key informant interviews were used to collect pertinent data. Data was analyzed using: descriptive and inferential statistics, as well as, correlation analysis. The study established that significant differences exist in entrepreneurs' and MEs' characteristics. To improve the sector, the study recommends policies that will: promote education and training of entrepreneurs; encourage entrepreneurs to diversify their businesses/products and income sources in increasing their incomes; and need to provide credit and improve prices and markets for MEs products and services. Also, both National and County Governments should come up with a raft of entrepreneurs' business training programmes that focus more on critical production skills, business operational and financial management, among others.

Keywords: Microenterprises, Entrepreneurs, Characteristics, Credit demand and Utilization Levels and business Training Needs

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