

NAPA CONFERENCE 2018

FIRST BIENNIAL CONFERENCE

Oklahoma City, Oklahoma, USA

MAY 26-27, 2018

CONFERENCE PROCEEDINGS



Global Food Security Through Agricultural Transformation

Edited by:

Prem B. Bhandari | Ramjee Ghimire | Suman Rimal Gautam |
Margaret Holler Stephens | Lila B. Karki



**ASSOCIATION OF NEPALESE AGRICULTURAL
PROFESSIONALS OF AMERICA**

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Message From The Proceeding Publication Committee

This **Proceedings** publication contains abstracts that were accepted for oral and poster presentations at the First NAPA Biennial Conference. Ninety-three abstracts were received by the Scientific Subcommittee before the deadline. The submissions were from ten countries: USA, Nepal, Canada, Australia, Benin, Ethiopia, China, Vietnam, Tanzania, and Nigeria. The abstracts cover a wide range of disciplines in agricultural and allied sciences: agronomy, animal science, horticulture, social sciences, economics, Geographic Information System (GIS) and remote sensing, agro-forestry and more.

Broadly, the abstracts are divided into three sections: i) Oral, ii) Poster, and iii) Special Session presentations. Within each section, the abstracts are presented in ascending order of the first name of the first author for convenience to the readers. We have done our best to minimize the errors and omissions in this manuscript. We would greatly appreciate readers' feedback on any errors observed, and suggestions for future publications. We are confident that the NAPA Executive Committee and its Subcommittees will welcome and give due consideration to those suggestions in the upcoming publications.

The publication of these **Proceedings** would not have been possible without the support of numerous friends and colleagues during the process of communicating with the authors and co-authors, and with various committees and members, compiling, revising and editing the submissions. We would, first of all, like to thank Dr. Lila Bahadur Karki, NAPA President and Chair, Conference Organizing Committee, for providing us this opportunity, and for his constant encouragement and support during the entire process. Second, Dr. Krishna P. Paudel, Chair, Scientific Subcommittee, and his committee members deserve special appreciation for making the abstracts available on time. Third, colleagues from other various Subcommittees were extremely supportive during the entire process of preparation of the proceedings. We highly acknowledge and thank all for providing their valuable support. Last, but not the least, we owe the authors a big hand for scientific contributions. Your timely submission of scholarly work has been very inspiring to come thus far. We look forward to meeting and interacting with you all at the conference, and to discuss how together we move forward to make NAPA best serve our members and society at large as per her mission and vision.

**Prem B. Bhandari | Ramjee Ghimire | Suman Rimal Gautam |
Margaret Holler Stephens | Lila B. Karki**

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Conference Theme: **Global Food Security Through Agricultural Transformation**

Food security is a global problem. In 2012, one in eight people in the world lived in extreme poverty, resulting in 11% of the world population being undernourished. A vast majority of this population lives in rural areas with subsistence agriculture and allied activities as the main source of livelihood. Agricultural transformation is a key to reducing hunger worldwide. The **NAPA Conference 2018** focuses on securing food, feed, fuel, and fiber (F4) for the ever increasing population through advanced agricultural innovations, best management practices, and environmentally friendly sustainable agricultural production systems with equitable distribution in a world of widening inequalities, increased climate variability, dynamic land-use, and volatile agricultural markets.

Keynote Speaker

Dr. Jean L. Steiner

Jean L. Steiner is the Director of the USDA Agricultural Research Service's Grazinglands Research Laboratory in El Reno, Oklahoma where she leads and conducts research on watersheds, climate, and sustainable forage-grazing systems. She obtained her B.A. from Cornell College, Mt. Vernon, Iowa and M.S. and PhD degrees in Agronomy from Kansas State University, Manhattan, Kansas. She has been employed by the Agricultural Research Service since 1983, first in the Texas Panhandle, focusing on water conservation, crop residue management, and energy balance research in dryland agricultural systems and then leading research in the Georgia Piedmont region focused on sustainability of agriculture at farm and watershed scales. She has been with the Grazinglands Research Laboratory in Oklahoma since 2001. Dr. Steiner is the Co-Director of the Grazing CAP project entitled Resilience and Vulnerability of Beef Cattle Production in the Southern Great Plains under Changing Climate, Land Use and Markets. Dr. Steiner has served on the Board of Directors and as President of the Soil and Water Conservation Society and was the 2015 President of the American Society of Agronomy.



Message from the President and Conference Committee Chair



Greetings all,

On behalf of the Executive Committee (EC), the Conference Organizing Committee (COC) along with the Local Management Committee (LMC) and Subcommittees (Scientific, Proceedings Publication, Student Essay Writing Contest, Agri-poem, Essay Judging, Fund Raising, Panel Discussion, Logistics Management, Sports and Culture, Round Table), I would like to welcome all the participants to the historic first NAPA Biennial Conference in beautiful Oklahoma City, Oklahoma, USA. We are overwhelmed by the amazing number of submissions (96) for oral and poster presentations, 17 essays for the students' writing contest and the many agri-poems that have been received. Moreover, this conference has brought together over 210 scientific scholars to this platform as authors and co-authors. These scholars are directly working and/or collaborating in ten countries around the globe and are representing 71 institutions. The progress thus far has energized us to accelerate our efforts in making this conference a great leap forward in fulfilling NAPA's mission and vision. I am thrilled to welcome and witness the invaluable scientific contributions that encompass the conference theme **'Global Food Security through Agricultural Transformation.'**

This very first Biennial Scientific Conference is uniquely structured to include intensive technical sessions, students' competitive oral and poster presentations, a students' essay writing contest, an agri-poem contest, opening plenary session, and panel discussions to mention a few. In addition, the COC has also injected fun-filled events (golf and volleyball sports, wellness walk & run, cultural night, and door prizes) to meaningfully engage our varied group of participants. It is our boundless pleasure to have set competitive oral and poster presentations to encourage young professionals, an open competitive agri-poem for interested poets, writers, and a students' essay contest to recognize and promote their talents through cash prizes, plaques and appreciation letters. Additionally, the COC, with the financial contribution of some generous donors, has thoughtfully planned to invite all presenting scholars from Asia, Africa, and Australia to the conference by providing a token of travel grants.

I salute all those hardworking individuals for their unwavering commitment in this enduring journey of NAPA from day one to this stage. These accomplishments were possible in this short time within the tenure of this first EC just because of your strong support and commitment. Last, but not the least, I highly appreciate the relentless hard work tendered by the Proceedings Publication Committee Chair Dr. Prem B. Bhandari and his team members to bring the **'Conference Proceedings'** to you on time. Again, on behalf of the EC and COC, I wish all of you an exciting conference, a comfortable stay and safe travels back to your destinations, and look forward to meeting all of you in the near future.

Together, we can make a difference.

Lila B. Karki, PhD

Achievements (2016-2018): An Overview

On January 6, 2016, NAPA was officially registered in Louisiana, USA. The first elected Executive Committee (EC) began to lead NAPA after it was officially installed at the Dallas General Meeting on May 27, 2016. Within its two years, NAPA has made significant progress through the collective efforts of our dedicated members and volunteers. We proudly summarize the achievements as below.

Organizational Development

- Organized the first annual general meeting (AGM) in Dallas, Texas on May 27, 2016.
- IRS Granted [501 (c) 3] federal income tax exemption status and Public Charity Status 170(b) (1) (A) (vi).
- Formed 11 committees as below to support NAPA's goals and objectives:
 - Advisory Council
 - Agri-Connection
 - Talk Session /Web Conferencing
 - Book
 - Research/Policy Brief
 - Global Journal of Agriculture and Allied Sciences (GJAAS)
 - Membership Drive
 - Student Co-ordination
 - Scholarships Management
 - IT Support
 - Working Paper Series
- Membership increased by 154 (a total of 242 members as of March 2018).
- Membership expanded to 39 states in the US.
- Global membership expanded to Australia, Canada, Mexico, and Nepal.
- Collaboration with several institutions/organizations initiated.
- Working network established in Australia, Canada, Japan, Nepal and Thailand.
- Nepalese women professionals in agriculture database initiated.

Scientific Contributions

- Scheduled first biennial scientific conference in Oklahoma City, USA (May 26-27, 2018).
- Book publication in progress ***“Food Sustainability, Food Sufficiency, Food Safety and Healthy Food in Nepal: Principles and Practices of Food Security”***.
- Journal publication in progress: ***Global Journal of Agricultural and Allied Sciences (GJAAS)***.

- Published seven issues of **Agri-Connection** (an online quarterly newsletter).
- Published two issues of **Research/Policy Brief** “online”

Capacity Building Initiatives

- Distance learning initiated (two remote schools: in Salyan and Okhaldhunga, Nepal).
- Countless hours invested by committee members in organizational meetings (inclusive of 10 Subcommittees, 1 Advisory Council, Conference Organizing Committees and Subcommittees and Executive Committee).
- Over 2,200 Facebook followers (professionals, agri-business entrepreneurs, agri students, “producers”.
- Established NAPA scholarships for academic excellence (\$2510 as of March 2018) for needy students undergoing agricultural schools and colleges in Nepal.
- Initiated and established endowment funds (\$800 as of March 2018).

Intellectual Discourse

- Organized 11 Talk Sessions/Web Conferencing and delivered several presentations about NAPA’s role, programs and strategy around the globe.
- A large number of audiences benefitted through live Zoom conferencing, tele-conferencing and Facebook live streaming.

Charitable Initiatives

- A financial support of \$4,428 provided for flood relief in 2016.
- Provided \$1,260 as financial support for a fatal car/vehicular accident in 2016.

Information Dissemination

- Established and maintained an informative website (~19,100 visits in two years) with options for online membership and donation payment.
- Shared research grant, higher studies opportunities, and employment advertisements to members and beyond.
- Agri-Connection (an online quarterly newsletter).
- Research and Policy Brief.
- Talk Sessions (Virtual Seminars).

Financial Transactions

As of March 2018:

- Total financial transactions over \$22,243.
- Current balance ~\$13,645.
- Collected and pledged endowment funds \$800.
- Collected scholarships for academic excellence \$2,510.
- Oklahoma Conference funds \$4,931.

Conference Events

Pre-Conference Activities

Friday, May 25, 2018

- Wellness Sports Events (Golf and Volleyball)
- Conference Organizing Committee Meeting
- Pre-conference Tour: USDA-Agricultural Research Service Grazinglands Research Laboratory, El Reno
- Open Forum:
- Local Management Committee Meeting
- Pre-Conference Reception Dinner and Socialization

Conference Activities

Saturday, May 26, 2018

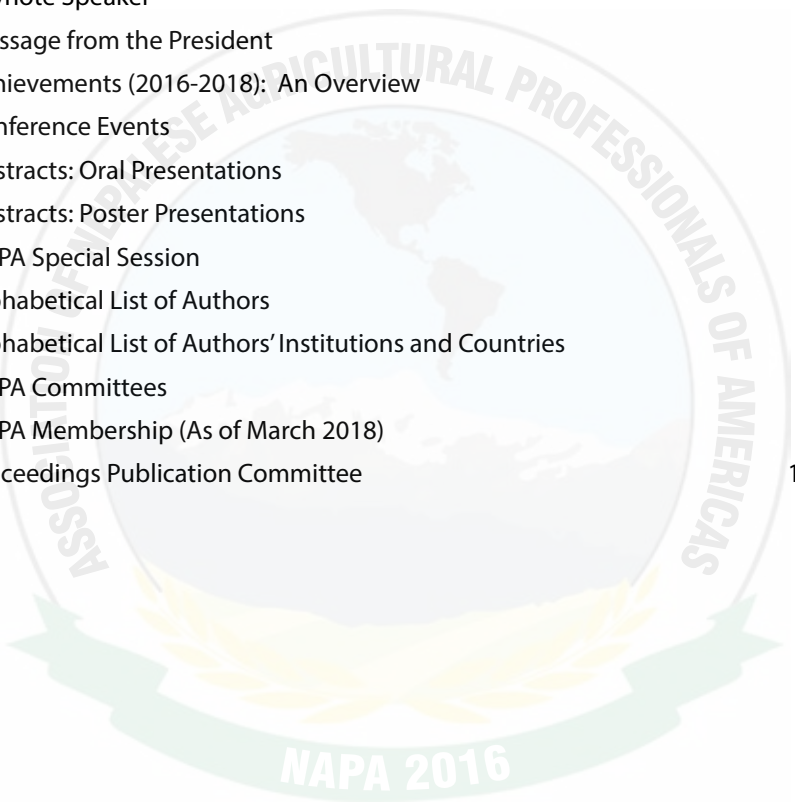
- Inaugural Session, Welcome and Keynote Address (Plenary Session)
- Concurrent Sessions
- Students' Competitive Poster Session
- Students' Writing Contest Awards Luncheon
- Open Agri-poem Contest
- Welcome Reception
- Honoring Outstanding NAPA Members' Awards Dinner

Sunday, May 27, 2018

- Wellness Walk and Run
- Concurrent Sessions
- Students' Competitive Oral Session
- Best Students' Poster and Agri-poem Awards Luncheon
- Special NAPA Session
- Joint Members Round Table
- Youth Session
- Annual General Meeting
- Student Session Volunteers Recognition/Appreciation
- Best Students' Oral Presentation Awards, and Farewell Dinner Door Prizes
- Induction of New Executive Committee (2nd)
- Cultural Night

TABLE OF CONTENTS

Sections	Page
Message From The Proceeding Publication Committee	ii
Conference Theme	iv
Keynote Speaker	iv
Message from the President	v
Achievements (2016-2018): An Overview	vi
Conference Events	viii
Abstracts: Oral Presentations	1
Abstracts: Poster Presentations	63
NAPA Special Session	85
Alphabetical List of Authors	88
Alphabetical List of Authors' Institutions and Countries	92
NAPA Committees	95
NAPA Membership (As of March 2018)	99
Proceedings Publication Committee	104



“

Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.

”

-Margaret Mead

Abstracts: Oral Presentations¹

Technical Efficiency of Organic versus Conventional Cotton Farming Systems in Northern Eastern Benin

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Due to negative effects of conventional farming on health and environment, some Non-Governmental Organizations (NGOs) have promoted organic farming in Benin. Previous studies on organic farming focus mostly on the potential determinants of adoption decision and economic profitability. Resource use efficiencies in organic versus conventional farming have not yet been addressed in current organic cotton literature. This study intends to fill this gap by analyzing the technical efficiency of organic versus conventional cotton farming systems in Benin. The study has been conducted in the districts of Ouassa-Pehunco and Kandi in Northern Eastern Benin. A total of 150 cotton farmers with 86 organic farmers and 64 conventional farmers have been selected from a random sampling. Analysis using a parametric approach based on Cobb Douglas stochastic production frontier showed that the farmers' average technical efficiency is estimated at 0.68 with a minimum score of 0.19 and a maximum of 0.9250. Effects of inefficiency exist in both production systems, and 65% and 87% of these inefficiencies are due to some factors specific to conventional and organic farmers respectively. Overall, conventional cotton farmers are more efficient in allocating productive resources than organic farmers. Farmers in Pehunco District are less efficient than farmers in Kandi District. When looking for factors of inefficiencies, the number of visits of the extension agent and experience in farming are important drivers. Policy makers and agricultural development agencies should focus on these determinants in targeting farmers with the goal of increasing their level of production efficiency.

Keywords: conventional farming, North-Benin, organic farming, technical efficiency

¹Abstracts are arranged in ascending order of the first name of the first author.

The Impact of Infrastructure and Development in Food Security and Nutrition in Rural Nepal: A Case Study in Kalika Municipality in Chitwan, Nepal

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In Nepal, transportation infrastructure is essential to increasing the situation of food security. Stable road networks would help promote farmers' abilities to purchase inputs and produce, and sell surplus production. Improved access to resources like education and enterprises would lead to better livelihoods. Development and women's empowerment in agricultural households is also positively related to productivity of smallholder farmers. This study qualitatively examines the impact of "Building Community Enterprises of Smallholders in Bangladesh and Nepal" (BCES), as well as villagers' experiences in the past 15-20 years of infrastructure development, agricultural production, market access, general livelihoods, and the status of women in rural households. Beneficiaries of the BCES project were selected for discussions during field visits in July 2017. A semi-structured questionnaire served as a guide for these interactions and for historical recollection of respondents' experiences about farming in the region and changes in food security and livelihoods in recent years. Three group discussions and two individual interviews were completed. The farmers' consensus was that in the past 20 years, road access to the villages has increased incomes and food security, but farmers still rely on intermediaries to transport their surplus to market, limiting their income potential. Farmers gained greater advantage in the marketplace, and compensation for the lack of transport facilities, after the construction of collection centers and irrigation infrastructure and the development of community enterprises through the BCES project. Women also have a significant role in making household and farm decisions. Road infrastructure is essential but not sufficient for increasing agricultural productivity and proper access to markets. Community enterprises and collection centers help provide farmers greater access to inputs and technical resources and increase the value of agricultural surpluses. Empowering women will ensure that investments in agricultural development translate to improved nutrition.

Keywords: agricultural productivity, community enterprises, food security, market access

Land Cover Change Assessment of Five Major Watersheds in Central Kentucky

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Kentucky, a major agriculture state, had rapid population growth of 17.74% from 1990 to 2010. Five major watersheds of Central Kentucky (viz. Pond Creek, Bear grass, North Elkhorn, South Elkhorn, and Hickman Creek) were selected for land cover change assessment. The United States Geological Survey classified standard 30-m resolution National Land Cover Data (NLCD) from 1992 and 2011, and hydrological units for watershed boundaries were analyzed to determine the percentage change in the land cover classes for each watershed. The developed area was significantly increased with the maximum percent increase in Bear grass watershed (16.44%) and the minimum in North Elkhorn (12.21%). However, forest and cultivated areas were significantly decreased in all watersheds; the maximum percent decrease for forest was 9.9% in Pond Creek and cultivated area was 11.38% in Hickman. We can conclude that urbanization is increasing rapidly, resulting in loss of forest and cultivated land. The rapid increase in urbanization with its increase in population will increase vulnerability of forest and agriculture areas. This study suggests that further research should include impacts of these land cover changes on water quality, urban land management, and ultimately on quality of life.

Keywords: forest, Kentucky, land cover changes, urbanization

Assessment of Land Cover, LST, and NDVI Change in Lexington, Fayette County, Kentucky

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Increase in population over time impacts Land Use and Land Cover (LULC). Urbanization can help induce the development of the area into a heat island: an urban area that is slightly warmer than surrounding areas. This study focuses on examining the changes in LULC of Fayette County along with changes in Land Surface Temperature (LST) from 2000 to 2017, and compares it with the LST of Lexington and areas surrounding it. Landsat image, obtained from Earth Explore, was classified for 2000 and 2017 to evaluate the changes in LULC. The Moderate Resolution Imaging Spectroradiometer (MODIS) LST, an 8-day product, and Normalized Difference Vegetation Index (NDVI) were obtained for the month of June for both years. The changes in NDVI and LST were compared with the changes in LULC of Fayette County for that period of time. The results show that there is significant change in NDVI with an increase in developed areas. Additionally, there was greater increase in LST in developed areas in comparison to other land cover classes. The increase in temperature and change in NDVI suggest considering land use planning for urban and surrounding areas.

Keywords: land cover, land use, MODIS, NDVI

Energy–Environment–Economy Assessment on Production of Major Crops in Lowland Tropical Region of Nepal

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Increased use of energy in crop production systems is closely related to its economic outputs, environmental impacts and sustainability issues. This study investigates the efficiency of energy consumption, CO₂e (carbon dioxide equivalent) emissions and return-cost ratios of different cereals, legumes and vegetable production systems in Nepal. Primary data were collected from 238 selected farms by using a structured questionnaire in stratified random sampling method. Data envelopment analysis (DEA) was used to estimate the energy saving potential of these farms. The maximum energy consumption was in vegetables (12.37 GJ ha⁻¹) then cereals (10.60 GJ ha⁻¹), followed by legumes (3.80 GJ ha⁻¹) production systems. Rice provided the highest energy output (68.99 GJ ha⁻¹) among the crops. The majority of farms under each crop were technically energy inefficient, indicating a considerable potential of energy inputs saving (18 to 35%) without compromising the economic yield of respective crop production systems. The CO₂e release was more from garlic cultivation (2,997.13 kg CO₂e ha⁻¹). The estimated CO₂e emissions from rice, wheat, maize, lentil, mung bean and onion crops were 60, 28, 63, 5, 3 and 86% of that of garlic crop, respectively. The return-cost ratios were found to be between 1.21 to 1.96 in cereals, 1.83 to 2.61 in legumes, 2.96 to 3.52 in vegetable production systems. There is a considerable potential of improving input use efficiency and economic output. An adaptation of improved crop production technologies and input mix could help in reduction of inputs use and environmental impacts without conceding the economic returns.

Keywords: energy input-output, greenhouse gas emissions, return-cost ratio, technical efficiency

Determinants of Pesticide Application in Nepalese Vegetable Farming: An Empirical Analysis using Multivariate Probit Model

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Pesticides are a boon to farmers as they help fight against diseases and pests; at the same time, pesticide residues can have negative impact to human health. Identification and determination of factors affecting the application of pesticides are essential. The objective of the study is to identify and evaluate determinants of pesticides application in Nepali vegetable farms. A household survey of 300 households was carried out, and an empirical analysis was done using multivariate probit model using Stata 13. Powder and liquid forms of pesticides used in summer and winter season vegetable farming were the outcome variables. Socio-economic, demographic, farm-level and perception data were the explanatory variables. The results show that vegetable growers are highly likely to use the pesticides. The results of correlation coefficients show that the powder form of pesticides in winter vegetables and summer vegetables, the powder and liquid form of pesticides in the summer vegetables, the liquid form of pesticides in the winter and the summer vegetables are highly inter-related and positively associated. Age and gender of head of household, household size, access to the weather information and the application of chemical fertilizers were found to be the influencing factors for pesticide use. Seasonal disintegration of vegetable farming provides the deeper understanding of dynamics of pesticides uses and is further enriched by disintegrating forms of pesticide. The result supports establishing the relationship between the climate change and diseases-pests and suggests the promotion of technological advancement in vegetable farming. Finally, the outcome variables can be promoted or discouraged simultaneously, which is an advantage to the government.

Keywords: determinant, multivariate probit model, Nepal, pesticides, vegetables

Employment, Occupations and Social Exclusion in Nepal

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Nepalese society is highly stratified in terms of caste/ethnicity and gender. Exclusion based on caste/ethnicity and gender has been an important focus of academia and in the policy arena; however, very few studies examined the differentials in occupation and employment in terms of these stratifying measures. This paper examines the socio-cultural disparity in employment and occupations of Nepalese youths. We attempt to empirically answer the questions: Do caste/ethnicity and gender influence the employment status of Nepali youths, net of other factors? Do caste/ethnicity and gender influence occupation of these youths, net of other factors? We use the nationally representative Nepal Labor Force Survey data collected in 2008 (most recent). We use the descriptive statistics and multivariate analysis. Depending upon the measurement of our outcome measures, we use both binary and multinomial logistic regression to examine the associations between caste/ethnicity and employment and occupation adjusting for a set of controls such as wealth (land holding), age, education, training and rural/urban location of individuals. We used the social exclusion framework to examine the associations. Results from binary and multinomial logistic regression suggest that: Dalits are likely to be employed in informal type of self-employment sector more as compared to other caste/ethnicities. On the other hand, Brahmin/Chhetri youths predominate in agriculture and professional businesses; Newar youths are occupied in professional positions, crafts and trades, whereas Dalits and disadvantaged Janajatis predominate in elementary positions. By gender, women are most likely to be engaged in agriculture and least likely to get employed in professional positions compared to their male counterparts. These results provide important insights on the significance of socio-cultural exclusion within employment and occupation, suggesting that there is still a long way to go in creating an environment for a meritocratic society in Nepal.

Keywords: caste, gender, employment, exclusion, occupation

Normalized Difference Vegetation Index a Guidance for Grain Yield Prediction and Decision Support Tool for In-Season Nitrogen Management in Maize

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Precision agriculture technologies have developed optical sensors that can determine a plant's normalized difference vegetation index (NDVI), which is closely related to plant growth performance. Limited studies were carried out for estimating grain yield potential and in-season N management of maize in Nepal. To evaluate the relationship among in-season NDVI readings, grain yield and N levels were applied. An experiment was conducted at farm land of Regional Agricultural Research Station, Parwanipur during the winter season of 2013. The field experiment was laid out in randomized complete block design (RCBD). Eight different levels of N (0, 30, 60, 90, 120, 150, 180 and 210 kg N ha⁻¹) were applied for hybrid maize RML-32 X RML-17 and replicated thrice. Periodic NDVI was measured at 15-day interval from 65 days after sowing to 95 DAS by using a Green seeker hand-held crop sensor. The results showed that periodic NDVI measurements taken at a range of growing degree days (GDD) was critical for predicting grain yield potential. Poor exponential relationship existed between NDVI measured before 316 GDD (65 DAS) and grain yield. At the 478 GDD (80 DAS), a strong relationship ($R^2 = 0.70$) was observed between NDVI and grain yield. Later sensor measurements after 677 GDD (95 DAS) failed to distinguish variation in NDVI and poorly related to grain yield. N level had significant influence on NDVI reading, measured grain yield, dry matter production, periodic plant growth, and response index (RI) and grain N content. NDVI reading measured at 478 GDD (80 DAS) was found highly correlated with plant height, dry matter yield, stover yield. Results showed that yield potential in maize could be accurately predicted in season with NDVI measured. Measuring NDVI reading by growing degree days (GDD) allows a practical window of opportunity for side dressing N applications.

Keywords: crop sensor, dry matter, GDD, NDVI, response index

Predictive Mapping of Stand Characteristics Using Non-parametric Approach

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Estimates of forest attributes such as number of trees, biomass, volume and basal area per acre have become increasingly important for large scale forest management planning. For example, a predictive mapping of spatial distribution of woody biomass is prerequisite for planning a continuous supply of feedstock for biofuel production or extent of trees per acre loss from fire and/or damage from insects and diseases are important for the strategic forest management. Traditional field based timber cruising and forest inventory are costly and time consuming; therefore, we explored an opportunity to utilize remote sensing data for mapping forest attributes both temporal and spatial scales that are relevant for large scale forest management planning. We hypothesized that variables derived from remote sensing data could be important predictors while estimating stand level attributes from pixel to landscape level. Landsat 5 TM satellite imagery and their derivatives, national land cover dataset, and digital elevation model were paired with Forest Inventory and Analysis (FIA) data from 2007 to 2011. We evaluated the use of non-parametric approach – random forests to build predictive model for aboveground total biomass and trees per acre (TPA) for five USGS zones – 46, 47, 48, 53 and 57 that cover the entire state of Tennessee, USA. The models explained over 39% of variability with Root Mean Square Error (RMSE) of 18 tons per acre for biomass and over 47% of variability with RMSE of less than 92 trees per acre for TPA estimates across the entire state of Tennessee. Among many other variables canopy cover was the most important predictor variable for both aboveground biomass and TPA prediction. Map modeling approach was used in R statistical computing environment to generate a continuous gridded biomass and TPA raster maps for the state of Tennessee. Such maps are useful to access resource availability at user specified locations and proximities.

Keywords: biomass, predictive mapping, random forests, stand characteristics, trees per acre

Impact of Land Use Change on Flow in the Khokana Outlet of the Bagmati River, Kathmandu, Nepal

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The land use change is a key factor for altering hydrological response. The objective of this research is to estimate the impact of land use changes on Bagmati River discharge and sediment yield at Khokana gauging station of Kathmandu valley outlet. This study analyzes the impact of land use changes from the year 2000 to 2010 using a semi-distributed hydrological, Soil Water Assessment Tool (SWAT) model. LOADEST model is used to simulate limited available sediment data. Sensitivity analysis is performed using ParaSole (Parameter Solution) method within SWAT Calibration and Uncertainty Procedure (SWAT-CUP) which shows linear parameter for calculating the maximum amount of sediment that can be re-entrained during channel sediment routing is a most sensitive parameter that affects the hydrological response of the watershed. 1995 to 2002 years monthly time step discharge and sediment data are used for calibration and remaining 2003 to 2010 years, monthly time step data are used for validation. Four statistical parameters such as Coefficient of Determination (R^2), Nash- Sutcliffe Efficiency (NSE), RMSE-observations standard deviation ratio (RSR), and Percentage Bias (PBIAS) are estimated in order to evaluate the model performance. The results show a very good agreement between monthly time step measured and simulated discharge data as indicated by $R^2 = 0.87$, $NSE = 0.80$, $RSR = 0.45$, and $PBIAS = 0.16$. The model shows nearly the same performance also with sediment data. The land use change data shows about a 6% increase in built-up area from the year 2000 to 2010 whereas remaining areas such as forest, shrub, grass, agriculture, open field, and rivers/lakes are decreased. The surface runoff contribution to stream flow, and sediment yields are increased by 18% and 54% respectively. On the contrary, lateral flow contribution to stream flow and groundwater contribution to stream flow are decreased by 6% and 5% respectively.

Keywords: Bagmati Watershed, GIS, Khokana, land use change, SWAT

The Urban Heat Island in Kathmandu, Nepal: Evaluating the Spatial Distribution of Changes in Normalized Difference Vegetation Index and Land Surface Temperatures 2000-2016

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The term “urban heat island” (UHI) describes the increased surface and atmospheric temperatures in an urban core relative to surrounding non-urbanized areas. Although the phenomenon has been studied to a great extent throughout the world, it is less understood for Kathmandu, Nepal. This study uses the Moderate Resolution Imaging Spectro-radiometer (MODIS) 8-day product (MOD11A2) to evaluate land surface temperatures (LSTs), the MODIS-derived Normalized Difference Vegetation Index (NDVI) product (MOD13Q1) to quantify land surface characteristics, and the MODIS annual land cover classification product (MCD12Q1) to identify major land cover classes. We evaluated the spatial correlation between significant changes in LSTs and NDVI from 2000 to 2016 during the month of May. Overall, urban LSTs were consistently greater than non-urban LSTs; however, the rate of increase in temperature was higher outside the urban area. Furthermore, significant changes in NDVI values over time were more widespread and not spatially coincident with the significant changes in LST values. These results provide insight into systematic planning of open and green areas, and construction of new infrastructure in peripheral areas, as well as highlight the challenges in applying traditional UHI methods to rapidly developing urban areas in Kathmandu, Nepal.

Keywords: Kathmandu, LST, MODIS, NDVI, Nepal, UHI

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Grain Yield, Phenology and Accumulated Heat Units of Drought Tolerant Rice Cultivars under Different Crop Management Practices in Central Terai of Nepal

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Increase in temperature due to climate change has resulted in an increase in evidences of drought stress in crop production, including for rice. Proper selection of resource conservation technologies and drought tolerant cultivars are being potential strategies determining the productivity of rice in drought-prone areas. The growth and development of a crop is passed by several phenological stages, and each stage has its own significant physiological importance. Further, heat unit systems are new tools in assessing the crop performances under climate-changed conditions. This study was planned, executed and accomplished for assessing grain yield, phenology and accumulated heat units of various drought tolerant rice cultivars grown under different crop management practices. A field experiment was accomplished in the central Terai of Nepal during the rainy season of 2014. The experiment was carried out in strip plot design with three replications consisting of four drought tolerant rice cultivars (Sukkhadhan-3, Sukkhadhan-4, Sukkhadhan-5 and Hardinath-2) and three crop management practices (System of Rice Intensification-SRI, Integrated Crop Management-ICM and Puddled transplanted-Conventional). The analyzed data revealed that SRI produced significantly higher grain yield (5.28 t/ha) than conventional management practice (4.49 t/ha), whereas cultivars had no influence on grain yield. Among management practices and cultivars, SRI and Hardinath-2 were the earliest to reach panicle initiation, heading and physiological maturity and also required the minimum growing degree days (GDD) to reach each phenological stage. The heat use efficiency (HUE) was significantly higher in SRI practice than other management practices, suggesting to us that it was more heat tolerant than other management practices. The cultivars had no influence on HUE. Thus, SRI could be adopted as an adaptation approach for early maturing, and obtaining higher and stable grain yield under climate-changed conditions in central Terai and similar agro-climatic regions of Nepal.

Keywords: drought tolerant, growing degree days, heat use efficiency, integrated crop management, system of rice intensification

Maoist Female Ex-combatant in Commercial Agriculture in Nepal

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During the Maoist insurrection (Feb 1996 to Nov 2006), women participated in politics as well as in fighting force. Twenty percent of the total fighting force was females. Ending all forms of discriminations against women was one of the strongest motivations to participate. However, this hope was largely shattered after the signing of the Comprehensive Peace Agreement on 21 Nov 2006. A total of Maoist combatants sent for verification was 32,250 and that verified by United Nations Mission in Nepal (UNMIN) was 19,602. Of the total, 3,846 (19.6%) were females. A total of 2,791 males and 1,217 females were disqualified combatants. Similarly, among the minors (below age of 18 on 25 May 2006) (2,973), 986 (33.1%) were female whereas among the late recruits (1,035), 231 (22.31%) were female. Out of the total combatants present during the categorization for integration, volunteer retirement and rehabilitation (17,052), 3,558 (20.87%) were female. Among those absent during verification (2,550), 282 were female. Among those opting for volunteer retirement (15,624), 3,454 (22.11%) were female, and out of the total opting to integrate in the Nepal Army (1,422), only 104 (7.31%) were female. Large number of females opted for voluntary retirement. Hence, the objective of this study was to assess the state of arts of voluntarily retired women. The qualitative methods used in the study were observations, focus group discussions, in-depth interviews, key informant interviews and transact visits at the sites of female ex-combatants working places. We found that a large majority of female ex-combatants were not only frustrated but also struggling for their better livelihood and well-being. Among various options, a large majority of them opted for commercial agriculture as their livelihood strategy. They were engaged in vegetable production and poultry farming. These women were facing numerous problems related to their business as well as to psychological and emotional stresses.

Keywords: emotion, ex-combatants, female, insecurity, insurgency, Maoist

Bioprocessing of Low-value Biological Resources for Higher-value Biochemicals

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Bioprocessing is utilizing natural (biological) resources via complete living cells or their components (e.g., bacteria, enzymes, chloroplasts) to obtain desired products. Low-value biological resources, for example, cassava processing waste, potato peels, sugarcane molasses, cheese whey etc. could be converted into desired products (e.g., biochemicals, biomaterials) via tools like fermentation for growths of beneficial microbes. Vitamins, amino and fatty acids, nutraceuticals, and drug molecules have been produced via fermentation. This study provides an overview of bioprocessing for higher-value biochemicals, and compares production and functionality of two biosurfactants on treated fibrous feedstock. Our Lab has collaborated with a company and other researchers at Iowa State University in producing and evaluating two biomolecules (surfactin and fatty-acyl glutamate) on low-value coproducts as an energy source for microorganisms. Soy hulls, switchgrass, DDGS, and cane bagasse were pretreated with enzymes (cellulase, pectinase, xylanase) to produce simple sugars and grow the bacteria *Bacillus subtilis* at both 50-mL and 5-L scales. Yields of biosurfactants on various feedstock and their surface properties were compared. Feedstock hydrolysates were very comparable to glucose control in supporting the microbial growths and producing titers of biosurfactants in the range of 300 mg to 3 g/L. Comparative cost-benefit analysis of surfactin production on switchgrass sugars for projected 250-L fermentation suggested an estimated biosurfactant cost of \$6.63/kg. This value, while encouraging, may not be competitive. Solid-state fermentation that requires minimal treatment is proposed to bring down the price range to 2-3 \$/kg. The biochemicals produced demonstrated emulsion-stabilizing effect with model emulsion produced and antimicrobial effects against two foodborne pathogens: *E. coli*, and *L. monocytogenes*. Better yielding varieties of bacteria need to be used for biosurfactant production. Emulsion and antimicrobial characteristics demonstrated biochemicals' potential use to achieve dispersion, emulsion, and food-safety functions in food and non-food applications.

Keywords: bioprocessing, biosurfactants, fermentation, value-addition

Sustainable Nature Farming Practices in Nepal: An Experience Sharing

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In general, sustainable nature farming can be defined as permanent agriculture, which means achieving sustainable agriculture and animal husbandry through protecting or improving the natural environment, and permanent-culture, which means preserving, supporting and working with the local culture and environment. Sustainable agriculture, which is based on the ethics of caring for the land, the people and the future, is very beneficial in helping us to understand and create an integration of harmony between people and nature. In Nepal, we are looking at “Sustainable Integrated Forest and Farming System (SIFFS)” as one of the promising approaches of natural farming system to the changing environment and climate change impact which is becoming an emerging critical issue to be dealt with by linking it with food security and sustainable livelihoods of rural communities of Nepal. The main objective of this paper is to review the sustainable nature farming practices in Nepal and share with the conference participants’ challenges and opportunities of sustainable food production linking with the sustainable and ecosystem based livelihoods development in Nepal. This paper will be based on the review of available literature, research documents and some relevant case studies in Nepal. This paper will also explore sustainable natural farming practices in rural communities of Nepal and how these practices are creating opportunities for sustainable livelihoods of Nepal. This paper will create “increased and strengthened knowledge and practice” of sustainable natural farming practices of Nepal which will be shared with the conference participants around the world, creating a learning forum and network for resilient agriculture, food security and livelihood development.

Keywords: food security, integrated forest and farming, nature farming, permanent resilient agriculture, sustainable livelihoods

Traditional Mountain Crops for Household Food Security and Conservation of Agrobiodiversity in Nepal Himalayas

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Traditional underutilized crops (barley, buckwheat, beans, millets and amaranths) in the Himalayas of Nepal have played an important role in household food security and livelihood needs of small farmers for generation. However, presently the information is scant about production of traditional crops, their role in mountain food security, management of diversity and factors driving their production, availability and consumption. This study was undertaken to analyze household specific factors influencing cultivation, consumption and maintenance of cultivar diversity for households' food security in the mountains of Nepal. The study used sample surveys of 328 farm households from four representative high altitude locations (1500-3000 msl) of Humla, Jumla, Lamjung and Dolakha districts. The survey was carried out in 2014-2015 using a household questionnaire to elicit and assess household socioeconomic, farm agroecological, institutional and market features, which was supplemented with participatory rural appraisals, field monitoring visits and local stakeholder consultation. The availability of the average food sufficiency period from their own production was less than 4 months in Humla and Jumla and 5-6 months in Lamjung and Dolakha. Tobit, Probit and Poisson regression models were used to assess factors driving households' decisions to allocate areas for production, consume traditional crops and maintain cultivar diversity, respectively. Factors influencing traditional crop production, cultivar diversity, consumption and households' food security of these crops were related with farmers' age, farm size, agroecology, women members in the households, and market distance. Household food sufficiency level is very low in the mountains, particularly in the Karnali region (Jumla and Humla) but farmers maintain a high diversity of traditional crops. A positive relationship is found between productions and household self-consumption of the crops. Farmers' age, agroecology, farm size, market access and gender are important for ensuring household food security and conservation of traditional crop biodiversity.

Keywords: consumption, cultivar diversity, food security, production, underutilized crops

Pesticide Use and Its Residue Status in Food Crops in Nepal: A Review

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Insubstantial options for chemical pest management compelled farmers to use synthetic pesticides against crop insect pests. Pesticide exposure and its repercussion in public health and environment are now detectable. Understanding of prevailing pesticides uses and their state regulation status is the major objective of the study. Secondary data were assembled and analyzed using the Excel. Chemical pest management commenced from using Paris green, gamaxone, nicotine sulphate and chlorinated hydrocarbons in the 1950s to 117 chemically defined pesticides including bio-pesticides and bio-rational compounds of 2,186 formulations from 1960s to 2018; this progression has made obvious changes in the pest management scenario in country. Around 352 MT of active ingredients (a.i.) of pesticides are in use in agriculture. Per hectare pesticide consumption in Nepal is 396.0 g (a.i.) while in the commercial vegetable sector its consumption is as high as 1,600 g a.i. per ha. Pesticide residues in fresh vegetables are problems, particularly in the Kathmandu valley where the highest level of pesticide contamination in root vegetables (11.9%) followed by leaf vegetables (10.9%) is found. Hazardous pesticides, namely aldrin, BHC, chlordane, DDT, dieldrin, endosulphan, endrin, heptachlor, lindane, methyl parathion, mirex, monocrotophos, organo mercurial fungicides, phorate, phosphamidon and toxafen, in the course of regulation, are banned for marketing in the country. There is an option dearth, but farmers' reliability only in chemical applications in pest management in crop fields has resulted in repercussions of a vicious circle of compelled higher dose pesticide applications in crops. The obvious result is scores of multitudes of pesticides crowded in the market in the country.

Keywords: public-health, pesticide-consumption, pesticide-market, residue

Husbands' Migration: Increased Burden on or More Autonomy for Wives Left Behind?

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World population is more mobile today than at any point in human history. It has important social and economic consequences for both sending and receiving populations. Using recently collected data from Nepal, we examine the impact of husband out-migration on the left-behind wife's work burden and autonomy. We empirically investigate an important but less studied question - whether a husband's out-migration increases the burden on and/or autonomy to the left-behind wife? We argue that husband's out-migration influences his wife in two important ways. First, the loss of household labor due to the husband's out-migration is likely to increase the burden on the wife - as measured in the number of activities performed on a daily basis and participation in farming. On the other hand, the absence of the husband, supposedly the household head, will likely provide more social space and increase autonomy - as measured in participation in economic activities and media use. Additionally, the effect of loss of household labor will likely be compensated by remittance the wife received, thus offsetting her burden. Results of our multi-level multivariate analysis suggest that the number of months of a husband being away from home during the last year significantly increases the number of daily activities performed by the left-behind wife. Likewise, a husband's away from home also increases the odds of participation in farming. As we hypothesized, these effects are dependent on whether or not the husband sends remittance back to his wife. Similar to the number of daily activities and participation in farming, a husband's out-migration also increases the odds of participation in economic activities and social media use. In a society like Nepal where women have little or no participation in economic activities and media use, women's engagement in economic activities and social media use signifies higher autonomy and empowerment. These results provide important feedback to scholars and policy makers from migrant-sending settings.

Keywords: autonomy, burden, husband, out-migration, wife

Gender Roles and Women's Enterprise Promotion Needs in Nepal

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A baseline survey was conducted in two distinct geographic regions of Nepal, mid-hills (two sites) and inner Terai (five sites), across five districts, to investigate the pattern of gender roles prevailing in rural settings and to identify the need of enterprise promotion to rural women. A purposive sampling was used to determine the sample respondents. Accordingly, 175 respondents, representing 25 from each survey site, were chosen based on the criteria set forth. The findings revealed that a higher degree of women's autonomy was found in the mid-hills, particularly in food and cash crop growing areas along with the overall household-related decisions, compared with the Terai. Likewise, women's autonomy in decisions related to input purchasing was higher in the mid-hills, but women's autonomy in crops to grow and livestock production was found higher in the Terai. In terms of ownership and financial capacity of women, joint ownership was more common in the Terai whereas both sole and joint ownership existed in the mid-hills. The decision-making approach of women, particularly to purchase assets, was also higher (77%) in the mid-hills compared to that in the Terai (19%). Terai women were willing and confident in purchasing assets and also transferring their owned assets, but women in the mid-hills were reluctant to do so. Women at both geographical regions were able to participate in household decisions, but the mid-hill women had more freedom in loan management from women's saving group funds and from relatives. Terai women showed significantly greater entrepreneurship in livestock and dairy enterprises followed by agriculture and food processing business, whereas mid-hills women preferred livestock, dairy and village cottage businesses as priority areas of their enterprise. The findings of this study revealed that mid-hills and Terai women are different in terms of capacity in decision-making related to household chores and entrepreneurship, and thus these two groups should be dealt with independently while formulating specific project planning and development efforts.

Keywords: household decisions, livelihood, policy issues, women's autonomy

Adoption of Large Cardamom-based Agro-forestry System in Taplejung District of Nepal: Trends and Determinants

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Agroforestry is a traditional production system in the hills and mountains of Nepal. This system is believed to be ecologically sustainable, socially acceptable and economically viable. This paper has used agricultural census data of 2011/12 aiming to identify the determinants of the adoption of the cardamom-based agroforestry system in the Taplejung district of Nepal. A Tobit model has been used given the censored population. About one-third of the agricultural holdings reported the cultivation of large cardamom. On an average per annum increase in cardamom planted areas was 3.2% between 1997/98 to 2013/14. The average planted area per household was 0.18 hectare. The cultivated land per household was about one hectare and around 70% of the total land was under the upland category. The results showed that the age and education of the household head, male-headed households, the proportion of the area under upland, total number of livestock, and months of self-sufficiency from their own production were significant variables determining the adoption of this type of agroforestry system. In order to further increase the area under this system, there is a need to raise awareness and organize various capacity-enhancing activities for the households. In addition, the households should be supported by government and non-government agencies in both production as well as post-harvest related aspects. The constraints on adoption by female-headed households should be identified, and focused activities should be implemented for increasing the level of adoption.

Keywords: agroforestry, cash crop, household income, large cardamom, upland

Biological Soil Management: A Basis for Sustainable Agriculture in Nepal

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Soil analyses indicate that soils of Nepal have very low levels of organic matter, nitrogen, phosphorous and potash, indicating a low level of inherent fertility. The dynamic geomorphology of the Nepalese landscape plays a significant role in the inherent fertility and the productivity of the land. Loss of nutrient rich topsoil through erosion caused by high intensity monsoon rainfall, steep slopes, and the fragile nature of bedrock resulting in high erodibility of soils has been an ongoing process in the Siwaliks, hills and the mountains of Nepal. It is well recognized that the forest with good floor surface cover and the lands with good grass cover generate a low level of run-off in comparison to extremely bare land. The problem of soil degradation critically undermines the sustainable productivity of Nepalese agriculture. The combined impacts of number of factors such as soil erosion, deterioration of soil structures, loss of nutrients or the nutrient holding capacity, build-up of salts or toxic elements, and acidification are leading to the diminution or the destruction of productive capacity of agricultural land of Nepal. Biological factors influence soil nutrients, soil chemical and physical properties, and that the management of the soil biological processes can lead to the pathways to restore soil fertility and sustain crop productivity. Soil microbial ecosystems play an essential role in maintaining productive capacity of the soils. The maintenance of soil fertility and productivity is a complex biological process encompassing the dynamic equilibrium between soil microbial ecosystems and the organic matter present in the soil. Organic carbon is the basic substrate for the functioning of the microbial ecosystem. It is not an overstatement to state that Nepal's top research priority is the biological management of the soils. The important point in sustainable agriculture is not to achieve the maximum yield but to achieve the long-term stabilization and the development of self-sufficient, diversified and economically viable agroecosystems. Agricultural research must be directed towards designing sustainable agricultural production systems in the hills, valleys and the mountains of Nepal given its fragile geomorphology.

Keywords: Microbial ecosystem, soil degradation, biological processes, sustainable agroecosystems, ecosystem health, biological diversity

Conflict Management and Community Development Initiatives in Buffer Zone of Chitwan National Park, Nepal

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The people-centered approach for biodiversity conservation has shifted a wildlife-centered approach with the passage of a conservation amendment in Nepal. This study assesses the natural resource-based conflict management and community development initiatives of the government programs supported by the United Nations Development Program. A pre-tested, semi-structured questionnaire was deployed to collect primary data from 90 households chosen using a stratified random sampling technique. The sample size of 90 people is comprised of 45 from Close to Park and 45 from Far from Park areas of 8 Village Development Committees in the Chitwan district, Nepal. Similarly, 15 park staff members including both security and administration were selected and interviewed. It was found that the major causes of environmental conflict in both locations were insufficient thatching materials and firewood collection time banning animal grazing; inadequate compensation to the community for human, domestic animals and crop damage due to wildlife entrance; the unhelpful behavior of park administration; and monsoon flooding. On the other hand, the trend of utilization and collection of natural resources in both locations did not vary significantly where the dependency was found meaningful. Modern energy technologies for cooking were commonly used by elite groups, but occupational and aboriginal ethnic groups were still heavily dependent on firewood from the national park and publicly owned forests. The study showed that livestock farming was an important earning source where stall-feeding was commonly started in park vicinity areas. This study suggests two policy recommendations: first, an alternative source for local people's energy demand should be prioritized in buffer zone policy to minimize park-people conflicts; and second, access to forest resources should be attenuated with the provision of microenterprises using off-forest resources.

Keywords: buffer zone, collective action, participatory conflict management, natural resource

Did the Environmental Protection Index Policy Implementation Reduce Air/Water Pollution in Chinese Cities: An Assessment using a Synthetic Control Method

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Environmental pollution is becoming a critical issue for the Chinese government. During the last ten years, the Chinese government has promulgated various environmental laws and regulations, but the effect of environmental governance needs to be evaluated. Notable is that China had put the environmental protection index into three local governments' (Zhejiang, Sichuan and Inner Mongolia) performance appraisal for the first time in 2005. That is, the promotion of local officials is directly linked to the environmental governance effect of the region. This paper analyzes the impact of the environmental policy index by using the synthetic control method. It assesses whether the incentive provided to local officials improves air and water qualities in the policy implemented regions. In this study, we collected the data from 271 Chinese cities from 2000 to 2011, and chose Chengdu and Hangzhou as the research object. The results showed that these two cities significantly reduce air pollution and water pollution since the implementation of incentive policies. However, through further research we found that Chengdu pollution emissions reduction mainly comes from the technical innovation. After the policy implementation, it significantly reduces pollution emissions per unit of output, but in Hangzhou we did not find any significant results. Therefore, it is prudent to conclude that local governments should be constrained and motivated to promote environmental governance.

Keywords: policy, pollution, synthetic control method

RNAi-Mediated Knockdown of Inhibin α Subunit on Granulosa cell Led Oocyte Development in Transgenic Mouse Model

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Inhibin α (INH α) Subunit gene plays a vital role in folliculogenesis, cell differentiation and oocyte development in mammals. However, the specific action of RNAi-INH α in folliculogenesis, oocyte development and other ovarian function remain largely unclear. To define its roles in mammalian reproduction, transgenic mice of RNAi-INH α that knock down the INH α expression by shRNAi were used. The action mechanism of RNAi INH α on Granulosa cells (GCs) apoptosis, GCs cell cycle regulation, hormonal control; puberty and super ovulation were investigated by using transgenic mice model. RNAi-INH α transgenic female mice were sub-fertile and correlated with the number of oocytes ovulated after puberty with cellular and molecular alterations. The results showed that at 3 weeks, transgenic mice produced the increased number of oocytes as compared to control mice. In contrast, oocyte numbers were significantly reduced ($p < 0.05$) in 6 and 9 weeks of age even with the PMSG and hHCG administration in transgenic mice. Serum INH α level was significantly decreased in both 3 and 6 weeks whereas, FSH was significantly up regulated in 3 weeks but not in 6 weeks. Furthermore, suppression of INH α expression significantly promoted apoptosis by up-regulating Caspase-3, Bcl-2, INH β B and GDF 9 and down regulating Kitl and TGF β RIII genes both at transcriptional and translational levels. Moreover, it also dramatically reduced the progression of G1 phase of cell cycle and declined the number of cells in S phase as determined by flow Cytometer. Knockdown of INH α by using RNAi-transgenic technology leads to disruption of normal ovarian regulatory mechanism in mammals. These results indicate that INH α subunit is an important regulator of GCs apoptosis, cell cycle progression, oocyte development and other reproductive events in mammals.

Keywords: apoptosis, granulosa cells, INH α , in-vivo study, RNA interference

Determinants of Consumers' Preferences for Rice in Kilimanjaro Region, Tanzania

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Rice is the second most important food and commercial crop in Tanzania after maize; it is among the major sources of employment, income and food security for the farming households. Despite that individual consumer preferences are subjective and dynamic. The main objective of this study was to examine factors that influence consumer preferences for rice in the Kilimanjaro region, Tanzania. Data for the study were collected using a questionnaire, through face-to-face interviews on a randomly selected sample of 230 consumers with analysis through descriptive and logistic regression. The results indicated that locally produced rice was highly preferred by 81% compared to 19% for imported rice. The results showed that women were 54.3% of the study participants and men constituted 45.7%. As to the consumption frequency of rice, approximately 10.9% consume rice once per week; 33.5% consume rice twice per week; 33.9% consume rice thrice per week, 13.0% consume rice four times per week and about 9% consume rice more than five times per week. Both intrinsic and extrinsic features of rice such as aroma, taste, cleanness, and percentage of broken rice, price, origin and swelling capacity had a statistically significant relationship to inform consumer preferences and buying decisions. Socio-economic factors of price, income, frequency of consumption, and household size were significant variables to influence consumption and expenditure for rice. Understanding consumer preference for rice is very important in meeting consumer expectations and building a vital health of the economy-local, national, and international. More efforts are still needed to improve the quality and production of rice in order to meet the increasing demand for rice.

Keywords: consumer preference, consumption, local and imported rice, quality characteristic of rice

Neoliberal Globalization, Migration, and Food Security: The Case of Nepal

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Trade liberalization has been one of the main tenets of neoliberal global economic order since the 1980s. One of the tools used to liberalize agriculture in the 1980s was “food security,” which was supposed to be best achieved through trade rather than self-sufficiency. The main goal of the paper is to critique the notion of food security through trade as promoted by international organizations and present food sufficiency as a measure to ensure “right to food” to everyone as per the 1948 United Nations Declaration of Human Rights. Based on grounded theory, the paper uses primary and secondary data from existing literature, among others. The paper is organized into five sections. The first section introduces the topic and defines food security and introduces how various international organizations are addressing the issue. The second section highlights the global context to changes in food governance, production, distribution, and consumption during the neoliberal era. This section also critically investigates the changing institutions of food provision—from NGOs to the World Trade Organization in the realm of governance and from small producers to transnational corporations in the realm of food provision. The third section explores the food security policies in the case of Nepal during pre-liberalization and liberalization periods. The fourth section delves into the implication of migration and remittance flows to food security and sufficiency in the case of Nepal. Also explored in this section is the food sovereignty issue as the agrarian workforce moves away from the agricultural sector to work in perceived higher return non-skill sector in overseas or nearby cities. The fifth section concludes the paper by offering policy recommendations to ensure food security and sufficiency in Nepal.

Keywords: food security, food sovereignty, international organizations, liberalization, remittance flows

Opportunities and Issues for Commercial Scale of Organic Waste Recycling through Vermicomposting in Nepal

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Horticulture industries produce large quantities of organic wastes globally. These wastes are generated in farms, and significant amounts transported to the markets and consumers as part of fresh or processed food. Management of organic wastes is costly, and it also generates significant environmental problems when disposed of inappropriately. Recycling of organic wastes to organic fertilizer can potentially add value to the wastes, and therefore, generate market demand for otherwise currently wasted resources. We quantify their volumes at the national scale and present the current state of technologies for recycling. We also examine the quality of organic fertilizers developed from these wastes, and finally the effect of fertilizer products developed from these wastes upon the soil application as fertilizer to a number of horticultural crops. Fruits and vegetable wastes were recycled for organic fertilizer through the biological process of vermi-composting, and tested for options for household and semi-commercial scale of processing. However, large-scale commercial operations will be required for recycling of the large quantity of organic waste prevalent in the country. The challenges for commercial scale operation of waste recycling will need to take into account the issues of cost associated with bulk handling for wastes collection from scattered sources, sorting of wastes from the mixture, moisture control and drying for the processing. Furthermore, issues related to pathogen contamination in waste-borne compost and option for deactivation, choice of processing operations, and removal of potential heavy metals load need to be critically evaluated. Industrial processing of organic waste also provides opportunities for balancing nutrients composition, formulation of different products, packaging, and control release of nutrients and during mineralization. Fertilizer from waste can be a win-win; however, a coordinated approach needs to be placed between waste generators, handlers, processors, and users of waste-borne fertilizer for sustainable recycling of waste for the horticulture industry in Nepal.

Keywords: earthworm, organic fertilizer, organic waste, vermi-compost, waste recycling

Impact of Climate Change on Agriculture and Food Security in Nepal

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Climate change in Nepal affects agricultural production, food security, employment and livelihoods. This research reviews literature and Nepal's government records on agricultural development, and utilizes Nepal Living Standards Survey 2010/2011 (NLSS-III) data. It integrates the NLSS data with the dietary guidelines of the US Government to convert grain consumption into calories (energy generation) needed for sedentary, moderately active and active male and female population of various ages under six different scenarios of food consumption. Agriculture remains the main source of livelihood for Nepal's 27.5 million people. It contributes 32.72% of the Gross Domestic Product (GDP), over 40% of the value-added products, employs about two-thirds of the total labor force, and serves as a fundamental factor towards achieving food security, poverty reduction, and economic transformation. At the same time, the agriculture sector has also been the most vulnerable sector due to market shocks and climate change. Nepal's agricultural production increased with the advent of high yielding varieties (HYV) of wheat and rice. Increase in food production not only led to an increase in food production on irrigable lands, and made Nepal independent in food requirements, but also led Nepal to become a rice exporter to Bangladesh and India. However, this situation did not last long. Changing climate and a major exodus of working age people for remittances from the late 1990s have challenged Nepal's food security conditions. Despite such challenges, there is a lack of hydro-meteorological data covering diverse terrains of Nepal. With the current trend in climate change, Nepal's rice yield is predicted to decline by 4.2%. Literature on agriculture agrees that temperature is increasing at higher elevations at a more rapid rate than the world's average. This rise in temperature will have cumulative effects on glaciology, hydrology, and agricultural economies. An in-depth analysis is needed for this assessment.

Keywords: agriculture, climate change, food security, Nepal, remittance

Co-regulation of the Glycine max Soluble N-ethylmaleimide-sensitive Fusion Protein Attachment Protein Receptor (SNARE)-Containing Regulon Occurs during Defense to a Root Pathogen

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Heterodera glycines also known as Soybean Cyst Nematode is a major pathogen of soybean (*Glycine max*) that causes nearly a billion-dollar loss in the U.S. annually. Various strategies such as plant breeding, crop rotation, biocontrol, nematicides are in practice to control this pathogen. But the success is at a minimum. Therefore, focusing on mechanism of resistance at the cellular level could provide species specific control through genetic resistance. Closer study of the infected cells in resistant variety *G. max* [Peking/PI548402] and the susceptible variety *G. max* [Williams 82(PI518671)] through laser microdissection has revealed various unique genes that present in *G. max* [Peking/PI548402]. Transcripts mapping of the major resistance locus, *rhg1* led to the identification of alpha soluble N-ethylmaleimide sensitive fusion protein (alpha-SNAP) being present within the locus. Overexpression of these genes in susceptible cultivar *G. max* [Williams 82(PI518671)] resulted in resistance by inducing incompatible reaction, and RNA interference of these genes in resistant genotypes resulted susceptible reaction by inducing compatible reaction. In this approach, we have overexpressed the components of the Soluble N-ethylmaleimide-sensitive fusion (NSF) Attachment Protein (SNAP) Receptor (SNARE) complex that helps in docking of the vesicles to the membrane and subsequent release of the vesicular contents to the apoplast. The core components of this study are syntaxin 121 (SYP121), Synaptosomal-associated protein 25 (SNAP-25), Synaptotagmin (SYT), Synaptobrevin (SYB), Secretion 1/ mammalian uncoordinated-18 (Munc18/[SEC1]), and N-ethylmaleimide-sensitive fusion protein (NSF). Syntaxin 121, *Glycine max* homolog of *Saccharomyces cerevisiae* Suppressor of *sec1* (SSO1) identified *genetically in Arabidopsis thaliana* as PENETRATION1 (PEN1), function in resistance to H glycines. Co-expression of SYP121 with SNARE homologs results in elevated transcripts in infected cells inducing resistance. Thus, studying the actual cellular mechanism of resistance and implicating host resistance against this devastating pathogen can help minimize yield loss, thereby saving billions of dollars in loss worldwide.

Keywords: membrane fusion, overexpression, RNAi, SNARE, vesicle transport

Determinants of Water Resource Adaptation to Farming Practices in the Koshi River Basin of Nepal: A Logistic Regression Analysis

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Climate change is impacting the Nepalese farming system significantly. Smallholders have been experiencing pressure in managing water resources in their farming practices. A survey of 450 smallholders in three ecological regions of the Koshi river basin—Mountain, Hill and the Terai regions examines how the farmers have been facing climate change impact on their agricultural water resource management. Incidence of both drought and flooding are increasing in Nepal. A majority of the respondents reported increasing temperatures, more intense precipitation, and greater frequency of flooding than in the past. About two-thirds of small creeks and springs have disappeared and others will soon disappear if current trends continue. The survey indicates that only 46.01% of total water demand in the study area is fulfilled at present. Respondents in the Mountain, Hill and Terai regions are willing to pay 78.24%, 62.24% and 76.33% more than the baseline price for water. All respondents in the Mountain region, 72% in Hill region and 85% in the Terai region prefer collective water management. Logistic regression analysis shows that farm income, market access, access to extension services, desire to emigrate, and distance from the market are statistically significant predictors of adaptive behavior in the river basin regions. In conclusion, if the water supply was expanded and/or adaptation strategies were implemented, the Koshi river basin alone could add as much as a 10% increment in livestock (herd size), increased farm outputs of about 11,700 metric tons (mt) of cereal crops (rice, maize, wheat, and barley), and 20,000 mt of vegetables, worth about NRs. 20-25 millions in the local economy.

Keywords: adaptation, extension service, logit model, Koshi River, water resource

Multidimensional Poverty Measurement of Farmers in Chitwan, Nepal

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Solving the poverty problem across Nepal has particular importance for the country's political stability, ethnic unity, social well-being, and ecological security. This paper measures the multidimensional poverty situation of farmers in Chitwan, Nepal by using the Alkire-Foster method. We use four dimensions (health, education, food security, living standard) and several indicators to calculate multidimensional poverty indices using six different weights. We use randomly stratified interview data collected in 2013 in nine VDC from 395 farming households. The results show that 1) in the single dimension poverty, the indicators average time adult family members received formal education, home toilet type, and labor ability show a higher incidence of poverty, 2) in the multidimensional poverty, the three dimensional poverty incidence rates of farmers reach high, 3) the prevalence of poverty and the Multidimensional Poverty Index decrease with the increase of poverty dimension, but the average poverty gap shows an upward trend with the increase of poverty dimension, and 4) the dimension decomposition results show that the contribution rate of average time adult family members received formal education, home toilet type, labor ability, household fuel supply, and per capita housing area to the Multidimensional Poverty Index is large, while the contribution rate of household electricity supply and number of consumer durables is small. Calculated poverty index should help to identify essential variables to focus on to overcome poverty in Chitwan specifically and in Nepal generally.

Keywords: Alkire-Foster method, Chitwan, multidimensional poverty

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Variability, Heritability, Correlation and Path Coefficient Studies for Yield and Yield Related Traits in Rice (*Oryza sativa* L.) at Rupandehi, Nepal

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A study at IAAS, Paklihawa Campus agronomy farm was conducted to estimate genetic variability, correlation and path coefficient analysis of yield and yield-attributing traits in twenty-three genotypes of rice during summer, 2015 in Randomized Completely Block Design. The variations of yield and yield-attributing traits were determined by using descriptive statistics, genetic parameters, correlation and path coefficient analysis. The study revealed the variation in quantitative traits of genotypes. High genotypic coefficient of variation (GCV) was observed for fertile grain per panicle, flag leaf length and number of tillers per plant, and low for days of harvesting, panicle length and plant height. In all cases, the phenotypic variances were higher than genotypic variances. The high heritability was observed for the days of harvesting and the days of anthesis, and high genetic advance was observed for the fertile grain per panicle, plant height and flag leaf lengths indicating that these traits were additive in gene action and would be effective for selection for the genetic improvements. The grain yield had significant correlation with fertile grain per panicle and panicle length. Path coefficient analysis revealed maximum positive direct contribution towards yield by test weight and fertile grain per panicle, so, these traits (test weight and fertile grain per panicle) can be considered for improving yield in rice breeding programs.

Keywords: correlation, fertile grain, path coefficient, rice

Construction of High Density Linkage Map in Tetraploid Alfalfa Using GBS

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Alfalfa (*Medicago sativa* L.) is a cool-season, C^3 , perennial, allogamous and autotetraploid ($2n=4x=32$) legume. It has a genome size of approximately one Gb. In this study, we aim to construct high-density alfalfa linkage maps for genomes of a dormant alfalfa cultivar, 3010, as maternal parent and a non-dormant cultivar, CW1010, as paternal parent of a pseudo test cross F1 population. 184 F1 hybrids were developed by control pollination. The hybrids along with the two parents, and standard checks were planted using RCBD design with three replications at two locations. Phenotypic data for fall dormancy (FD) and low-temperature (LT) tolerance were collected in order to observe the population segregation pattern and for mapping quantitative traits loci (QTL). A Genotyping-by-sequencing (GBS) library was constructed using a single digestion of DNA by ApeKI enzyme followed by annealing of adapters and amplification. Two 96-multiplexed GBS libraries were sent to the Georgia Genomics Facility for sequencing on Illumina NextSeq PE75 High Output Flow Cell platform. We received 2 Billion (B) raw reads from sequencing, out of which 1B paired reads were usable. The sequenced data were processed using the Tassel Uneak pipeline using the R1 reads of the pair-end data. The loci that were present in at least 80% of the total population were considered for the genotyping. Only the single dose markers were used for constructing genetic maps. Of the total single dose markers, 1377 SNPs of CW1010 and 1837 of 3010 parents were mapped into 32 linkage groups of respective parents. The average density of markers in both parental maps was 1.5 cM/marker. The markers were subsequently used for QTL mapping for fall dormancy and winter hardiness in the population. We observed several QTLs.

Keywords: alfalfa, genotyping-by-sequencing, linkage map, quantitative trait loci

Exploring the Relationship between Financial Behaviors and Willingness to Strengthen Financial Capabilities of College Students

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Financial literacy is becoming increasingly important to collegiate youths as they are taking greater financial responsibilities and striving for financial independence more than ever before. African American (AA) students are the least financially literate among students of all ethnic groups and have lower financial literacy scores than their white peers. The objective of this study was to identify ways to strengthen students' abilities to make better financial decisions. A structured survey was introduced to 69 college students (78% female and 22% male). A vector of demographic, financial behavior, and social learning opportunity variables was analyzed using SPSS. Descriptive Statistics, Chi-Square Test and Binary Logistic Regression (BLR) were carried out. Results revealed that 85% of the total students were AA, of which 17% were first generation college students. The composition of the participating students was senior (41%), freshman (29%), and junior (17%) and graduate (13%). Forty-five percent of respondents paid late fees plus high annual percentage rates (>20%) because they never paid the entire monthly credit card bill on time. Similarly, 49% of respondents bought things for pleasure rather than meeting needs. Their financial situation was the major worry for 39% of the respondents. The Pearson Chi-Square Test results were found positively significant while analyzing the relationship between willingness to learn financial education and social learning opportunities; influence of financial educator/coach; and influence of peers ($p < 0.05$). Among the variables included in the model, the BLR results indicated that financial record-keeping behavior, influence of a financial educator, sophomore year in college, influence of peer group, influence of siblings, and buying insurance were found positively significant ($p < 0.05$) to the response variable 'willingness to participate in financial literacy'. Thus, implementing a personal finance education program through cooperative extension could help bridge the knowledge gap and strengthen the financial capabilities of students.

Keywords: extension, financial education, social learning opportunities, spending behavior

Transitioning to Adulthood in Chitwan, Nepal: School, Work, and Family in an Era of Rapidly Expanding Opportunity

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We investigate the transition to adulthood in Chitwan, Nepal, during a period of rapidly expanding opportunity. Chitwan is a particularly compelling case study because school and work opportunities for young adults have rapidly expanded locally, nationally, and globally since the late 1990s. We use data from the Nepal Ethnosurvey of Family, Migration, and Development, conducted in 2012-2013 in eastern Chitwan, to describe the structure of opportunity for young adults to pursue higher education and/or to pursue labor market opportunities. Second, we explore factors that influence young Chitwanese adults' school, work, and family decisions. We focus on the decision to migrate (to other regions or abroad) in pursuit of school and work opportunity as opposed to pursuing similar opportunities within the region. Third, we explore how young Chitwanese adults' migration decisions influence family formation and parenthood. All our analyses consider gender differences. We conclude with a broader discussion of implications of our findings. Our paper should contribute to discussions of the broader longer-term implications of broad-based migration for work and school on life-course trajectories of individuals and household structures in sending regions.

Keywords: education, employment, labor migration, marriage, parenthood, transition to adulthood

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Left Behind and Doing Fine with Hajur Buba and Hajur Aama: Multigenerational Families, Migration, and Children's Schooling in Chitwan, Nepal

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We argue that family economy perspectives on educational choices for children should take a multigenerational perspective. We further suggest that multigenerational perspectives are particularly relevant in the context of labor migration and rapid economic and educational change, such as has been the context of Chitwan, Nepal, over the past 50 years. We assert the importance of multigenerational family economy not only because many migrant labor fathers leave their children to live with their grandparents (and mothers), but also because many children whose fathers did not migrate lived with their parents in the household of their grandparents. At the same time, there were also many examples of more nuclear, single-generation households in the survey region. Although these families probably had strong social and emotional ties to grandparents and other family members, the fact that school age children were not co-residing with their grandparents seemed, to us, to be potentially relevant for their educational outcomes because of the many positive financial and nonfinancial benefits of co-residence. Our findings suggest that the primary benefit of grandparent co-residence is to counter the negative impact of siblings. Family studies have long shown that siblings exert a negative effect on educational outcomes in the single-generation, nuclear family context, and our findings for children who did not co-reside with their grandparents support these previous findings, as they have reduced odds of private school enrollment or high school investment. For multigenerational households, however, our findings challenge previous findings of negative sibling effects. For general living with grandparents, each additional sibling actually increased their odds of private school enrollment and high school investment. Just as the literature on sibling effects has explored variations in sibling density, configuration, sex composition, and spacing, we encourage future research exploring sibling effects in multigenerational households. Importantly, in the multigenerational contexts, one's school age sibling may include cousins in addition to brothers and sisters and, therefore, grandparents' influence may extend beyond the nuclear family in multiple ways.

Keywords: education, left behind, remittance

Integrated Management of *Lygus* Bugs in Texas High Plains Cotton

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The western tarnished plant bug, *Lygus hesperus*, is the primary *Lygus* species inhabiting cotton and several other crop hosts in the Texas High Plains. In Texas High Plains, cotton *Lygus* bugs are generally more pestiferous in the boll development stage than in the early squaring stage, with significant potential to cause lint yield loss in upland cotton. A comprehensive survey study characterized the host-plant sequence of *Lygus* movement from non-cotton habitats to cotton. Individually caged cotton plants exposed to five levels of *Lygus* (0, 1, 2, 4, and 6 adults per plant) for one week at three boll development stages (early, mid-, and late season) quantified the *Lygus* damage potential and established the management thresholds. Until cotton begins flowering, *Lygus* preferred to stay in various roadside weed hosts, including mustard, alfalfa, thistle, sunflower, pigweed, and others. As roadside weeds senesced and cotton began flowering, cotton vulnerability to *Lygus* infestations increased. *Lygus* injury to maturing bolls is generally the highest during mid-season (4-5 weeks into flowering). The early season *Lygus* injury at low level caused significantly lower lint loss compared to that during mid-season, whereas late season "fruit thinning" caused full/overcompensation in lint yield. Based on this study, *Lygus* management options for Texas cotton after flowering are recommended as follows: monitoring of cotton crop and adjacent habitats for *Lygus* abundance and movement behavior and avoidance of insecticide treatment for *Lygus* in cotton prior to 200 HU from first flower, 2-4 *Lygus* per 6 row-ft for mid-season cotton, and 4-6 *Lygus* per 6 row-ft for late season cotton. In the Texas Plains, *Lygus* can be managed using comprehensive ecologically-based Integrated Pest Management (IPM) practices, with a focus on non-cotton habitat management. The ecological approach integrates the *Lygus* host utilization behavior and sink-source relationships of non-cotton host habitats influencing *Lygus* movement into cotton and action thresholds and insecticide chemistries.

Keywords: cotton, ecological pest management, economic threshold, plant bugs

Overview of the Suggestion for the Establishment of the Grazing Reserve Bill and the Farmer–Herdsmen Rifts in Nigeria

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The rate of killings done by cattle herdsmen in the North, East, and South of Nigeria is a serious problem in which many farmers, populace, and individuals were affected and the death of few innocent Nigeria citizens occurred. It reduces the farm yields and productivity and affects the security of the land. The issues have to do with the rate in which the herdsmen move their cattle about in search of greener vegetation for their cattle. A lot of discussions were focused whether to establish a grazing reserve for them in order to resolve all this menace and formulate a guiding policy in a context where unfriendly policies and laws have frequently undermined the pastoralist livelihood. This paper used evidence-based pictures taken from the field survey of the affected communities and write-up in some daily newspapers of 2015 and 2016. Also, the various oral interviews, discussion that was documented with some of the agricultural stakeholders proves that some of the various laws governing the establishment of grazing reserves in Nigeria started in 1965, later in 1978, the land acts, which were extended to cover it. In 1988, the Nigeria national policy also earmarked 10% of the total national territory for grazing areas, and about 9.8 million hectares of land were earmarked in 1988 for grazing reserves. The figure was later increased to 20 million hectares. This paper supported the establishment of the grazing reserve; the state and federal government need to pass the bill, establish cattle routes, which have been damaged by agronomy, ecology and encroachment, and the various policies of the past administration have given more attention to other agricultural sectors and the livestock was neglected. There is an urgent need to work out a policy.

Keywords: bill, cattle herdsmen, clashes, farmers, grazing, Nigeria, reserve

Paradigm Shift in Nepalese Agriculture: The Prime Minister Agriculture Modernization Project

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The Ministry of Agricultural, Land Management and Cooperatives implemented a ten-year long-term project '*Prime Minister Agriculture Modernization Project*' in 2016, with a goal of modernizing the agriculture sector as an assistant project to '*Agriculture Development Strategy*', the agricultural development policy adopted by the Government of Nepal. It has a clear roadmap of increasing production and productivity of the agriculture sector. Major activities include the utilization of modern technology with agricultural inputs, mechanization in production systems, improved infrastructures for processing of agricultural products, and marketing. The project envisions at transforming current agriculture into modern agro-industry-based, commercial, sustainable, and self-reliant sector through integration of value chain elements. The objectives include establishing specialized areas of major agricultural production, enhancing competitiveness of exportable agriculture commodities through value addition, developing agriculture to a respectful and profitable business that creates ample employment opportunities, and ensuring effective service delivery through functional coordination among key stakeholders. The project strategies include scientific use of land, adoption of modern agricultural technologies, agricultural mechanization, and infrastructure development for processing and marketing of agricultural commodities, improved coordination among agriculture research, extension and teaching, adoption of output-based incentive systems, quality control and food safety, and a climate change resilient agriculture system. The program components under the project are pocket, block, zone and super-zone for particular commodity value chains based on area coverage. Initially, the project launched its activities covering the entire nation with 2,100 pockets, 150 blocks, 30 zones and 7 super-zones. By the end of the project period, it is expected to reach 10,000 pockets, 1,500 blocks, 300 zones and 21 super-zones, which in turn contribute to reaching self-sufficiency in vegetables and fisheries within 2 years, major cereals within 3 years, and major fruits within 7 years of implementation.

Keywords: agriculture modernization, agricultural sustainability, self-sufficiency

Nepal's Rural Hill Agriculture at Crossroads: A Reflection of a Farming-Descendent-turned-professional

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The rural hill agriculture in Nepal has been undergoing changes in resource use patterns while remaining technologically static. Changes in resource use patterns are mainly driven by the out-migration of youths in quest of economic opportunities. The rural hill agriculture was sustained over generations as a locally closed, diverse and subsistence-oriented production system with a low level of market integration. It involved tight recycling of nutrients on-farm with import of additional nutrients from rangelands as fodder and bedding materials for livestock. Agriculture was a livelihood and way of life for rural people, while being the backbone of the national economy. Depending on the size and quality of land ownership, farm families had varying level of the reliance on off-farm income. Institutional supports were sparse and scanty. Agricultural extension emphasized awareness building and transfer of knowledge and technology to the farmers for the modernization of agriculture. The promoted inputs included chemical fertilizers, pesticides and crop cultivars developed in high-input, intensive management systems. Improved crop management such as row-planting and fertilizer banding was emphasized, without parallel efforts in designing and/or introducing appropriate machinery or equipment. However, introduction of early-maturing crop cultivars facilitated multiple cropping, especially in the irrigated and bonded terraces. Use of cash-intensive inputs mismatched with the subsistence-oriented, labor-intensive farming. The nature of agriculture lagged far behind the livelihood aspirations of the rural youths. Consequently, a growing out-fluxes of youths for foreign employment is posing a challenge to continue the labor-intensive system in a sustainable way. A paradigm shift in technology transfer from top-down, external input-based recommendations to participatory learning and action, tailored to local resource bases has shown some promise in improving agriculture in recent years. This presentation will discuss the issues facing Nepal hill agriculture and prospects for improvement.

Keywords: agriculture, diversity, intensification, sustainability, system

Variability in Carbon Dioxide Fluxes among Six Winter Wheat Paddocks Managed under Different Tillage and Grazing Practices

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Carbon dioxide (CO₂) fluxes from six winter wheat (*Triticum aestivum* L.) paddocks (grain only, graze-grain, and graze-out) managed under conventional till (CT) and no-till (NT) systems were synthesized for the 2016-2017 growing season to compare the magnitudes and seasonal dynamics of CO₂ fluxes and to investigate among-site variability of CO₂ fluxes. Large variations in CO₂ fluxes were observed among paddocks. Maximum daily (7-day averages) net ecosystem CO₂ exchange (NEE) ranged from -3.39 to -8.68 g C m⁻², gross primary production (GPP) ranged from 7.33 to 16.92 g C m⁻², and ecosystem respiration (ER) ranged from 5.85 to 9.98 g C m⁻². Seasonal sums of NEE ranged from -137 to -542 g C m⁻². Optimum photosynthetic photon flux density (PPFD), air temperature (T_a), and vapor pressure deficit (VPD) for NEE were approximately 1700 μmol m⁻² s⁻¹, 22 °C, and 1.25 kPa, respectively. Across-site analysis showed the percent of canopy cover (%) was strongly correlated with NEE (R² = 0.76) and ecosystem light use efficiency (ELUE, R² = 0.76). Integration of photosynthetically active radiation (PAR) with leaf area index (LAI) and integration of T_a with dry biomass weight (DW) explained 81% and 74% of variations in GPP and ER, respectively. Remotely-sensed enhanced vegetation index (EVI) explained 66% and normalized difference vegetation index (NDVI) explained 69% of the variations in NEE. Integration of PAR with NDVI or EVI explained ~80% of variations in GPP, while NDVI × T_a explained 58% of variations in ER. Results illustrated that differences in wheat canopies related to paddock management, as indicated by differences in DW, LAI, Canopy percentage, NDVI, and EVI, must be accounted for in explaining among-site variability of CO₂ fluxes. Long-term measurements from our clustered and paired EC towers will provide insights into the effects of tillage and different grazing practices on CO₂ dynamics in winter wheat.

Keywords: ecosystem light use efficiency, eddy covariance, net ecosystem CO₂ exchange, no-till, spatial variability

Transcriptome and Metabolome of the Extremophyte, *Schrenkiella parvula* Reveal Unique Adaptations to Survive High K⁺ in its Native Soils

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Schrenkiella parvula, a close relative of *Arabidopsis thaliana* and Brassica crop species, grows in the shores of Lake Tuz, Turkey. *S. parvula* can complete its life cycle in the presence of multi-ion salt concentrations lethal to *A. thaliana* and most plants. The genome of *S. parvula* compared to that of *A. thaliana* reveals multiple signatures of copy number variation and structural differences that suggest unique regulatory cascades in responding to salt stress. The objective of this study was to investigate how the genomic blueprint for high K⁺ tolerance is manifested in stress-adapted *S. parvula* compared to the stress-sensitive *A. thaliana*. Next generation sequencing of transcriptome of root and shoot samples for high potassium at four different time points was performed and analyzed computationally. We obtained the ionome and the metabolome for each transcriptome sample to facilitate inferences linking genomic structural changes, its response via the transcriptome, to a molecular phenotype measured using the metabolome. In response to high K⁺, both the primary and lateral root architecture changes significantly compared to control conditions, and the phenotypic change in *A. thaliana* is more pronounced than the effect observed for *S. parvula*. Key differently regulated pathways between the two species include photosynthesis, stress responses coordinated by ABA, response to H₂O₂, cellular response to phenylpropanoid biosynthetic process, plasma membrane repair and water transport, autophagy, and mannitol biosynthesis. Overall, this study sheds a light on the stress adapted lifestyle of the *S. parvula* using a systems biology approach.

Keywords: extremophyte, ionomics, metabolomics, next generation sequencing, *Schrenkiella parvula*

Community Context, Migration and Women's Participation in Agriculture

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Using recently collected data from Nepal, we examine the relationship between lost household labor (male migrants) and household transfers (remittances) on women's participation in farming. We empirically investigated two questions: Do (a) labor out-migration from the household and (b) household transfers – the receipt of remittances from migrants influence women's participation in farming? We hypothesize that migration influences women participation in two opposite ways: (i) outmigration of household farm labor will likely increase participation of left behind women in farming; (ii) the remittances from migrants will loosen cash constraints, allowing hiring of farm laborers resulting in either off-setting of labor loss or an actual decrease in women's participation in farming. Using the multilevel multivariate logistic regression, our results show that: (a) outmigration of males increased the odds of women's participation in farming, whereas (b) outmigration of females decreased the odds of left-behind women's participation in farming. Remittances however did not have a significant effect on women's participation in farming. These results perhaps provide signals on 'feminization of agriculture' due to male outmigration in Nepal.

Keywords: farming, migration, participation, remittances, women

Relevance of the Land Grant University Model for Inclusive Agrarian Transformation in Nepal

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In the context of the newly introduced federalization in a long stagnant agrarian economy – characterized by persistent inequality, structural poverty, and stunted economic growth – this paper explores the relevance of the Land Grant University (LGU) model for overall inclusive agrarian transformation in Nepal. Based on a comparative analysis of US-based land grant institutions, and Historically Black Colleges and University (HBCU) missions and contributions in the agrarian landscape of Nepal, this work presents a comparative analysis of Nepal's agrarian transformation through a consideration of land grant institutions. In particular, this paper foregrounds an analysis of their mission and cooperative extension, relevance of HBCUs and their new life to promotion of racial justice and diversity for African-American farmers and minorities, analysis of Nepal's inclusive constitutional provisions and relevant policies, and structural features of Nepal's stagnant economy. Pioneered by US President Abraham Lincoln via the Morrill Act of 1862 and its second amendment in 1890, new provincial state assemblies should take initiative to develop state universities for inclusive transformation using an emancipatory development model. The University should therefore have primary accountability to defined territories and communities beyond the academic excellence; building a strong university-community relationship and providing rationale and plans for productive use of available natural and human resources in an agrarian landscape. Through inclusive constitutional provisions, agrarian transformation, and pro-poor agrarian reform, resource governance should be based on sound regional planning, commitment to social diversity, and inclusion for Nepal's future education and transformation.

Keywords: inclusive agrarian transformation, Land Grant University, social diversity, State University

Climate Variability and Productivity of Grassland under Different Management Systems

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Climate variability and management practices in isolation or in combination influence the properties of ecosystems and the flows of energy and materials through them, resulting in changes in productivity. We examined the impacts of climate variability on 17 years of productivity under two grassland management systems (native pasture and managed pasture). Satellite-based Vegetation Photosynthesis Model (VPM) was used to simulate the gross primary productivity (GPP) to assess the productivity of grassland from 2000 to 2016. Nine site years of data from three eddy covariance (EC) sites were used to validate the GPP simulated from the model. The GPP simulated from the model and the GPP from EC measurements showed a good agreement with overall correlation coefficient (r^2) of about 0.87 and slope of about 0.88. With precipitation varying across years from 474-1359 mm, this variation caused GPP to vary by 132.6 and 130 g C m⁻² among years in native and managed pasture, respectively. The productivity of both pastures responded to the drought and pluvial events. The drought events of the year 2006 and 2011 decreased the productivity. The pluvial years (2007 and 2013) had larger than average productivity at both management systems. The managed pasture showed greater sensitivity (-32% and -45%) to drought compared to the sensitivity of native pasture to drought (-26% and -36%) in 2006 and 2011, respectively. However, there was not any significant difference in the productivity between the native and managed pasture during the pluvial years. If these results are consistent across ecosystems, we will have to account not only for climate variability, but also the management activities for the predictions of ecosystem responses to changing climate.

Keywords: drought, eddy covariance, gross primary productivity, Vegetation Photosynthesis Model

Integrated Animal and Crop Production Systems and Food Production in Nepal

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The proposed study aims to evaluate the impact of integrating crop production with livestock enterprise on farm productivity using nationally representative household survey data from Nepal. The preliminary analysis shows that both the number of cattle owned as well as the proportion of income generated from the livestock enterprises has a significantly positive impact on crop yield. However, the relationship is non-linear, implying that crop yield rises initially as the size of the livestock enterprise increases, but eventually, it starts to exert a negative impact on crop production as its size increases.

Keywords: animal husbandry, farm productivity, mixed farming, subsistence farming

Evaluation of Fungicides and Native Biocontrol Agents for Black Scurf Disease Management in Potatoes at Western Terai of Nepal

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Black scurf (BS) caused by *Rhizoctonia solani* is an important soil and seed (tuber) borne disease in potatoes in Nepal, causing up to 60% economic losses due to reduced marketability of the tuber. Experiments were conducted to develop ecofriendly and sustainable BS management practice for western Terai of Nepal in 2015. Antagonistic fungus *Trichoderma* were isolated from several ecological domains of Nepal and four best inhibitors to *R. solani* in confrontation test in potato dextrose agar plates were selected for field experiment. Field experiment was conducted at farmer's field having previous BS history at Mainapokhar, Bardiya. Experiment was conducted in randomized complete block design with 3 replications of 8 treatments -- boric acid, two fungicides: kick (captan 70% + hexaconazole 5% WP) and bavistin (carbendazim 50% WP), four *Trichoderma* isolates: T-6 (Salyan), T-21 (Chitwan), T-28 (Khajura) and T-26 (Khumaltar) and untreated. Potato tubers cultivar cardinal were treated with either 3% boric acid, or 2% fungicides solutions or *Trichoderma* spore suspensions (~106 spores ml⁻¹ of water) for 10 minutes before planting. BS severity, incidence, total tuber number and yield were significantly affected by treatments. Significantly, the lowest BS index (5.67) and BS incidence (19.66%) were recorded in boric acid treated plots. Significant reduction in BS severity ($p < 0.001$) was also recorded in fungicides and *Trichoderma* treated plots compared to untreated. Potato tuber yield was recorded significantly highest in bavistin treated plot (17.5 mt ha⁻¹) which was at par with *Trichoderma* T-6 (16.93 mt ha⁻¹) and kick (16.93 mt ha⁻¹) and lowest was in boric acid (11.72 mt ha⁻¹). *Trichoderma* treatment leads to reduced BS and increased tuber number and yield. Boric acid might not be economically viable due to lower yield even when most effective for BS reduction. Fungicides have several environmental hazards, and *Trichoderma* would be the best alternative for BS management in Nepal.

Keywords: biocontrol, black scurf, sustainability, *Trichoderma*

Effect of Organic and Mineral Fertilizers on Growth and Productivity of Sweet Pepper (*Capsicum annum* L.)

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Continuous use of chemical fertilizers leads to a decline in soil productivity. In Nepal, growers face an increased economic burden as a result of the boom in prices of imported fertilizers. Alternatively, organic manures such as vermi-compost (VC), chicken manure (CM) and farmyard manure (FYM) can be locally produced—and are benign to soil and consumers' health. Sweet pepper (*Capsicum annum*) is a highly nutrient responsive crop. Suitable rate of organic manures is essential to recommend for profitable and sustainable production. Experiments were conducted to evaluate the effect of recommended mineral fertilizers (150:75:50 Kg NPK ha⁻¹), three organic manures (VC, FYM and CM) and their three different combinations (½ urea + ½ VC, ½ urea + ½ FYM and ½ urea + ½ CM) in growth and yield of sweet pepper cv. "California wonder" in 2015 and 2016 at western Terai of Nepal. Experiments were conducted in randomized completed block design with three replications of seven treatments at the Regional Agricultural Research Station, Khajura, Nepal. The results showed the significant effects of mineral fertilizers, VC and ½ urea + ½ VC on plant height, spreading and branching. Similarly, fruit quality parameters such as fruit weight (116.93, 122.00 gm), fruit girth (7.11, 7.69 cm), fruit length (6.60, 7.08 cm), vitamin C (330 mg/100 g edible portion) content were recorded significantly highest in vermi-compost applied treatment. The number of fruit and yield was recorded the highest in mineral fertilizers (26.59, 18.14 mt ha⁻¹) which was at par with vermi-compost (23.89, 18.47 mt ha⁻¹) and ½ urea + ½ vermi-compost (26.11, 20.77 mt ha⁻¹). Thus, two years' consistent results indicate the possibility of replacing expensive mineral fertilizers by locally available vermi-compost, without reducing the yield in sweet pepper farming. These results could be extended to farmers' fields through outreach research programs for sustainable sweet pepper production in this region.

Keywords: organic farming, quality, sustainability, vermi-compost

Connectivity Initiatives – Agricultural Potentialities and Prospects of Economic Development in Nepal

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Economic growth and poverty alleviation have been intertwining challenges in the developing countries like Nepal, where these have been the priority policy agendas for several decades. This study explores and analyzes the potential impacts of connectivity initiatives like cross-border connectivity, Belt and Road Initiative (BRI), and regional and sub-regional connectivity on agriculture-based economic development in Nepal. The study uses secondary data sources, literature review, discussions with concerned stakeholders, and bilateral and multilateral interactions. One of the major reasons for the stagnated economic growth in the country is trade deficit (export import ratio estimated to be 1:13.5 in 2016), where the trend of this ratio has been rapidly growing annually. Nepal mainly exports agricultural raw products, and imports high value processed products (agricultural and non-agriculture) that have led to high trade deficit. Nepal has made many bilateral and multilateral treaties, commitments, and signed memorandums of understanding (MOU) with different countries and institutions including BRI, that possibly brought the countries into global connectivity, economic integration, and that led to country-specific economic boosts up. Recently, the issue has been raised on how the country could harvest benefit from these initiatives, and how agriculture could contribute in gaining economic advantage. This study suggests enhancing the competitive value chain of some major agricultural commodities in the Mid-hill road corridor, and strengthening export promotion in Nepal.

Keywords: agriculture trade, BRI, connectivity, economic development

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Socio-economic Assessment on Maize Production and Adoption of Improved Varieties in Dang District of Nepal

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Research was conducted from February to May 2017 for socioeconomic assessment of maize production and adoption of improved maize varieties in the Dang district of Nepal. Pre-tested interview schedule, Focal Group Discussion (FGD) and Key Informant Survey (KIS) were used to collect the primary information from the respondents, while secondary information was collected by reviewing different relevant publications. Altogether, 100 samples were taken by simple random sampling from different maize-growing clusters in proportionate of their sampling frame for the purpose of the study. Descriptive statistics, unpaired t-test, probit regression model and indexing were used for data analysis using statistical tools- SPSS, STATA and MS-Excel. Probit econometric model revealed that ethnicity (at 1% level), gender (at 5% level), area under improved maize (at 1% level), seed source dummy (at 1% level) and number of visits by farmers to agrovet (at 5% level) significantly determined the adoption of improved maize varieties. In addition, unpaired t-test revealed that the productivity of improved maize varieties was significantly higher (at 5% level of significance) than local; also, the multinational companies' hybrids showed significantly higher productivity (at 1% level) when compared to improved varieties. Furthermore, indexing identified lack of availability of quality seeds and fertilizers ($I= 0.86$) as the major problem, followed by lack of advanced technology and training ($I= 0.74$), when questioned about the problems associated with the maize production. The area coverage and adoption of improved maize could be increased, if the government gives an aggressive subsidy for improved seeds and dealership to registered agroverts for selling the subsidy seeds of improved varieties. Moreover, government organizations working in agricultural extension and research must focus on the adoption of improved maize varieties among farmers, substituting the local and developing the high-yielding hybrid varieties in Nepal to increase the maize productivity.

Keywords: adoption, maize productivity, probit regression, socio-economic assessment

Correlation between Ownership Size and Landscape Diversity in Whitley County, Kentucky

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In Whitley County population increased by 0.47% from 2010 to 2016. The increase in population has led to land fragmentation in the form of ownership size that affects landscape diversity to a greater extent. The objective of this study is to distribute land cover (agriculture, forest and pasture) in each parcel category to understand and explore possible changes in landscape diversity. Different land imagery services, NLCD data for land cover and parcel data were used to analyze 1078 parcels based on their size, structure, land patches, and the extent of land cover use. Preliminary results show that small to large land parcels have been mostly developed for forest management, diversified wildlife and their habitat area. Similarly, in terms of area coverage, proportion of land, land patches; the forest has been significantly developed in all parcel sizes. Pasture development is satisfactory from small to large sized parcels. There is no cultivated area for small and some medium sized land parcels, which denotes that the area has been depending for food products. The agriculture is less mechanized in large sized parcels with low crop coverage and agricultural operations. Since, ownership size has greater impacts in any landscape.

Keywords: land cover, landscape, NLCD, ownership size, parcels

Diurnal Behavior of Kiko Wethers in the Southern-Pine Silvopastures Planted with Warm-Season Forages

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Goats are popular among limited-resource small-holders in the southeastern United States. They are common livestock species integrated within silvopasture systems. Previous study of goats grazing in southern-pine silvopastures showed significant debarking of pine during the cool-season grazing period. However, goats' diurnal behavior in southern-pine silvopasture during the warm-season grazing period has not been previously reported. The objective of the study was to determine the diurnal behavior and distribution pattern of Kiko wethers in southern-pine silvopastures planted with warm-season forages. The study was carried out in Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, Alabama consisting of three (0.4-ha each) silvopasture plots with longleaf (*Pinus palustris* Mill.) and loblolly (*Pinus taeda* L.) pines at a tree density of 402 trees ha⁻¹ (loblolly: longleaf ratio-1.27). Plots were divided into three zones, and three different warm-season forages were planted in each zone within each plot. Forage samples were collected and analyzed for productivity and quality. Ten Kiko wethers (33-35 months old, 62.9±1.56kg BW) were stocked in each study plot one day prior to each observation. On the observation day, animals' diurnal behavior and distribution pattern were recorded once in every 10 minute in pre-formatted data sheets. Data were analyzed using Kruskal-Wallis rank-sum test in R-package (P<0.05). Grazing (46%) was the predominant diurnal behavior shown by wethers followed by staying in shelter (22%), lying (17%), loafing (14%), and browsing (1%). Wethers did not show any debarking of pine trees. Grazing was predominant during post-midday period (1500h-dusk) while staying in shelter was predominant during midday (1100h-1500h). Wethers showed overall distribution evenness index of 0.06. They utilized tree shades and shelter during midday, which signifies the importance of trees or shelter incorporated into the grazing system. Wethers were found safe to stock in southern-pine silvopasture during the warm-season grazing period.

Keywords: browsing, debarking, distribution evenness index, grazing

Metagenomic Screening and Characterization of Novel Cellulase and Xylanase Genes

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The notable aspects of cellulosic bio-fuels as environmentally benign and their significant homogeneity with the existing transportation fuels further depicts their comeliness as a scalable alternative fuel source. Metagenomics has the endless potential to considerably impact agricultural, feed and detergent, polymer, pharmaceuticals and other biotech productions. The discovery and development of novel biotechnological enzymes is anticipated to have a profound favorable effect towards the synthesis of industrial chemical conversion, reducing the energy consumption and generating less toxic side products. The present study aimed to identify, clone, express and characterize genes encoding novel cellulases and hemi-cellulase genes in the goat rumen metagenome. The metagenomic ruminal DNA was isolated, purified and were submitted to the paired end next generation sequencing analysis. The metagenomic library was constructed and functionally screened for cellulase and hemi-cellulase activities. Ten gene clones were encoded for cellulases, and hemicellulases were cloned using TOPO cloning strategy. The recombinant plasmids were transferred into *E.coli* BL 21 (DE3) cells and were further induced with IPTG for enzymatic plate assay and bio-chemical test. The identification of endo 1, 6 beta D- glucanase, endoglucanase D and endoglucanase E putatively responsible for its cellulolytic activity, the cloning and the recombinant expression of the gene in *Escherichia coli*, was characterized revealing a relevant clear halo zone formation around the colonies on phytagel plates. The recombinant proteins were purified and further expressed with the cellulolytic activity. The preliminary findings corroborate that a functional metagenomics approach can be an innovative maneuver to isolate previously uncharacterized cellulases from the rumen environment. This can be effective in closing the functional discrepancies and thus enhance sustainable and eco-benign environmental practices.

Keywords: bio-fuel, cellulase, clone, metagenomes, recombinant protein

Comparison of farm parcels using MODIS Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) of Henry County, Kentucky

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The state of Kentucky has experienced 9.7% increase in population from 2000 to 2010 with variable impacts on the productivity of the landscape. The productivity along with vegetation health is estimated from its primary productivity using MODIS Normalized Difference Vegetation Index (NDVI) and the Enhanced Vegetation Index (EVI) 250 meter, 16-day mean composite data. The data provides relative returns on the relative intensity of photosynthetic activity of the surface, along with forest and agricultural land covers. The objective of this study was to examine the relationship between the size of a given farm parcel on farm productivity. Parcel data was obtained from Henry County, Kentucky. This parcel data is used as the sampling units of observation. These parcel data are categorized according to the respective total land area in acres as small, medium, and large classes. Preliminary results of this study show that big-sized farms are more productive and healthier than the medium and small-sized farms. The medium- and small-sized farms with lower productivity values could indicate that they are less intensively managed. The result of this study suggests that parcel size has a major role in overall crop health and potential farm productivity. The study suggests further research on land fragmentation, land crop use and diversity patterns to inform landowners, farmers, and managers for sustainable farm management.

Keywords: farm productivity, land fragmentation, MODIS, NDVI, parcel

Grazing with Small Ruminants Increased Solar Radiation on Woodland Floor

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The dense woodlands of the Southeast require sound management of understory vegetation to optimize potential benefits. Use of small ruminants in woodlands is one of the management options to minimize the competition of understory vegetation with target trees, curtail forest-fuel build-up, and facilitate light penetration to the ground. Until recently, the use of small ruminants for managing understory vegetation has not been realized much, and a systematic study is lacking to assess its impact on light penetration through the system. The study objective was to determine the effect of woodland grazing with small ruminants on solar-radiation influx into the system. The study was carried out in Atkins Agroforestry Research and Demonstration Site consisting of six woodland plots (0.4-ha each) with mixed longleaf (*Pinus palustris* Mill.) loblolly (*Pinus taeda* L.) pines including 26 non-pine plant species. The non-pine species were either cut to one of the heights from the ground level (0', 3', and 5') or left uncut (control). In each treatment, ten random points were selected, marked, and used for collecting solar-radiation data using LI-1500 Light Sensor Logger. Pre-grazing radiation data were collected one day prior to bringing animals into the plots, and post-grazing data within two days of animal removal from the plots. Eight Kiko wethers (38-40 months, 66 ± 1.8 kg bodyweight) and six Katahdin rams (19-22 months, 83 ± 4.6 kg bodyweight) were stocked rotationally in separate plots (3/species). Data were analyzed in SAS 9.4 using mixed procedure. Radiation influx was different among treatments both pre- and post-grazing, and it increased (28-33%) at post-grazing in non-pine vegetation cutting treatments (0', 3' and 5') ($p < 0.001$). Increased influx of solar radiation through woodland can be an indication of the extent of vegetation removal. It can also promote faster regrowth of understory vegetation for supporting additional grazing. Further studies are going on to determine long-term impacts.

Keywords: light sensor, loblolly, longleaf, Katahdin rams, Kiko wethers

Feeding Value of Some of the Common Tree Fodders in Mid Hills of Nepal

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Goats have long been appreciated for their instinct for selection of palatable fodder. This has not been researched in Nepal around fodder based production systems. An experiment was conducted in Tanahun, Nepal for 12 weeks, to study the feeding value of different fodders on 60 bucks of commonly reared goat breeds of the mid hills of Nepal. The experiment was conducted using a Completely Randomized Design with 4 breeds × 5 fodder species in a factorial arrangement. Results showed that, breed wise, Boer crosses outperformed other breeds for dry matter intake (DMI) after the 12-week period ($p < 0.01$) resulting in the highest average daily gain (ADG) ($p < 0.001$) and with the digestibility of neutral detergent fiber (NDF) ($p < 0.01$). Following Boer crosses, the crosses of Jamunapari also showed spontaneous superiority for DMI, ADG and digestibility. Fodder wise, *Litsea monopetala* showed superior DMI ($p < 0.05$), ADG ($p < 0.001$) and the digestibility of all crude protein ($p < 0.001$), minerals ($p < 0.001$), acid detergent fiber ($p < 0.001$) and NDF ($p < 0.001$). Likewise, the *Ficus lacor* also showed a good degree of excellence in improving the tested parameters for some weeks. In all parameters studied, the interaction of breed and fodder species was observed as significant ($p < 0.05$). Blood serum calcium did not differ by feeding of different fodders, whereas phosphorus level differed ($p < 0.01$) significantly. Short-term intake rate (STIR) of *L. monopetala* has been the highest ($p < 0.01$) compared to other species studied. The results of this study suggest that Boer crosses are more potential for fattening in terms of weight gain and voluntary intake of tree fodders, further supporting the government efforts to promote Boer and their crosses in Nepal. Likewise, *L. monopetala* was found as better fodder in fattening the male goats compared to other fodders.

Keywords: average daily gain, digestibility, tree fodder, short-term intake rate

Biochar Improve Fertilizer Value of Granulated Chicken Manure, Compost and Vermi-compost

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Chicken manure is generally rich in macro and micronutrient, and therefore, can be developed into fertilizers so as to address the issue of poultry litter management. Excreta of Cobb broiler and Bond Brown Layer (BBL) from ten feed treatments (a control and supplementation with 1, 2 and 4% w/w of biochar, bentonite and zeolite) was collected, decomposed for 30 days, air dried and sampled. The fresh excreta from the control diet contained 6% w/dw N and 35% C, which was reduced to 2.6% N and 28% C after decomposition, with C: N ratio changing from 5.9 to 12.1. With granulation, the higher proportion of granules in the size class desired for fertilizer (2-4 mm) was achieved using manure from the 1 and 2% w/w biochar treatments for broiler and (1.18-4.75 mm) 1 and 2% zeolite, and 4% biochar from egg layer trials. The presence of feed additives in the poultry manure enhance manure properties in terms of moisture absorber in chicken shed, and biochar amendments positively impacted granulation pellet recovery. Biochar being a stable carbon source has the potential for impacting soil carbon sequestration when biochar feed poultry manure/litter/granules are applied to the soil as fertilizer. As biochar at 1-2% inclusion rate in the poultry feed provides positive benefits on bird health and productivity and also significantly improves manure quality, the uptake and adoption of biochar feeding could be adopted by large scale poultry operations. Vermi-composting techniques were utilized for converting agricultural waste (fruits and vegetable wastes from wholesale market) to high value fertilizer, producing up to 10% vermi compost for 100kg of waste. A large range of field trials were conducted with biochar amended chicken manure and vermi-compost, which demonstrated significant positive impacts on the crop and soil performance. Granulation of chicken manure and vermi-compost could help extend transportability of the products to the rural and remote areas, where previously the use of manure and compost was limited due to the excessive transport cost of the wet products. These findings from the preliminary research suggest commercial opportunities for formulating granulated chicken manure and vermi-compost containing biochar. This could pave the way towards the development of carbon smart fertilizer for horticultural and broad acre agricultural industries globally.

Keywords: biochar, chicken litter, soil carbon, vermi-composting

Remote Sensing Technology and Application in Agriculture and Other Environment Issues in Nepal

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This is a short note on Remote Sensing Technology, and its application in agriculture and other environment issues. The technology helps in collecting spatial data, especially vegetation. It also helps in estimating different agricultural indices. It is also getting more accessible. The technology is also used in association with other related technologies, e.g. Lidar, Photogrammetry, GIS, and GPS. The remote sensing technology does not answer all the questions, but helps in collecting important data and towards better management. The presentation will discuss its use in different issues, and how to improve its accuracy. It is important to consider choices of images as per resolution, geography, season, year and costs. It may be a good idea for departments of agriculture, forestry, environment, planning, surveying, geology, roads etc. to come together and form a national policy on creation and use of the spatial database.

Keywords: remote sensing, GIS, agriculture indices, policy, database

Performance and Carcass Characteristics of Kiko Wethers Finished on Pasture and Browse

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Raising goats on pastures and other grazing systems for low-input costs is gaining attention in the Southeast recently. However, goats' performance on the grazing system, and the resulting carcass characteristics are least reported from this region. The objective of the study was to evaluate the performance and carcass characteristics of Kiko wethers raised a year-round grazing system. Eleven Kiko wethers were raised on year-round grazing systems from April 2015 to November 2017. Grazing lands consisted of southern pine silvopastures planted with cool- and warm-season forages, woodlands, and a system containing planted pastures and browse species. Wethers were rotationally stocked in these systems based on the available forages. Animal performance data (body weight, FAMACHA score, body condition score) were collected every two weeks. At the end of the grazing study, wethers were slaughtered and carcass characteristics data were collected. Animal performance data were analyzed in SAS 9.4 using MANOVA procedure, and descriptive statistics were calculated for carcass characteristics. Animals gained 110 lbs. body weight during the study period, showing a significant polynomial trendline of body weight with age ($R^2 = 0.98$). Animals showed comparatively higher FAMACHA score and lower body condition score during the first five months vs. later months of grazing. FAMACHA score ranged from 1.5 to 3.1 and body condition score from 1.8 to 2.8 during the study period. Body weight, FAMACHA score, and body condition score were significantly correlated ($p < 0.0001$). Median values for dressing percent, hot-carcass pH, and cold-carcass pH were 50.84, 6.66, and 5.67 respectively. Meat-color values (Means \pm SE) for lightness (L), redness (A), and yellowness (B) were, respectively, 33.0 ± 0.48 , 11.7 ± 0.27 , and 6.2 ± 0.21 . Results showed that it is quite feasible to raise goats on a year-round grazing system when there are enough grazing lands and suitable environmental conditions for growing forages and browse throughout the year.

Keywords: body condition score, dressing percent, FAMACHA, goats, year-round grazing

Do Food Stamp Recipients Consume Healthy Foods? Findings from Nashville, Tennessee

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Supplemental Nutrition Assistance Program (SNAP) from the United States Department of Agriculture (USDA) is aimed at providing nutritional security to nearly 46.5 million poor American families through food purchasing assistance via food stamps and vouchers. However, there has been a debate about whether a significant portion of that support is used towards healthy diet by recipient families. Specifically, with increasing child and adult obesity problems among poor communities, SNAP has been criticized for failing to meet its goal of nutritional security. To examine the food purchasing behavior of poor families, this study conducted a face-to-face interview among low-income households in the Nashville metro area of Tennessee. Information on different food purchase behavior is collected with relevant socio-demographic characteristics of the households; findings are compared between SNAP-recipient and non-recipient, particularly on attributes relevant to healthy food consumption such as shopping for different forms of fruits and vegetables and fruit and vegetable juices. Additionally, we investigate the factors influencing different forms of fruits and vegetables consumption and the role of food stamps. Based on the response from 66 households, mainly from African American communities and using discrete and categorical models, this study tests for the effect of food stamp program participation on healthy food consumption. Then, the study discusses implications of the findings for local and national level policies.

Keywords: food assistance program, fruits and vegetables, healthy food consumption, low-income families, Tennessee

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Nitrogen Fertilization to Crops

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Nitrogen is a major limiting nutrient compared to other nutrients to sustain crop yields and quality. As a result, nitrogen fertilizer is usually applied in large amount to increase crop production throughout the world. Applications of nitrogen fertilizers have increased crop yields and resulted in achievement of self-sufficiency in crop yields in many developing countries, including Nepal. Excessive applications of nitrogen fertilizers beyond crops' demand, however, have resulted in undesirable consequences in soil, water, and air quality. These include soil acidification, nitrogen leaching in groundwater, and emissions of nitrous oxide, a potent greenhouse gas that contributes to global warming. Long-term application of ammonia-based nitrogen fertilizer, such as urea, has increased soil acidity which rendered to soil infertility in which crops fail to respond with further application of nitrogen fertilizers. This is a major problem in southeastern Asian countries, including Nepal, where population density is high and crop production needs to be enhanced to feed the growing population. Another problem is groundwater contamination of nitrate-nitrogen, which can be a health hazard to humans and livestock if its concentration goes above 10 ppm in drinking water. The third problem is nitrous oxide emissions from agriculture from excessive nitrogen fertilization, and nitrous oxide is about 300 times more powerful than carbon dioxide in terms of global warming potential. Therefore, novel nitrogen management practices are needed to enhance soil and environmental quality while sustaining crop yields and quality. This paper will examine the effect of nitrogen fertilization on soil and environmental quality and crop yields and discuss improved management techniques to reduce the rate of nitrogen fertilization to crops so that crop yields and quality can be sustained without deteriorating soil and environmental quality.

Keywords: crop yields, greenhouse gas, nitrogen fertilization, nitrogen leaching, soil fertility

Tillage and Cover Crop Effects on Soil Organic Matter Dynamics under Dryland Corn-Sorghum Rotation

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Reducing tillage and increasing crop diversity could enhance short-term nutrient cycling and improve soil organic matter (SOM) accumulation in agroecosystems. This study aimed to evaluate the nitrogen (N) and carbon (C) dynamics and other soil properties under dryland cropping systems with different tillage management and cover cropping in Eastern New Mexico. The study was established in 2013 at New Mexico State University Agricultural Science Center Clovis with no-tillage (NT) and strip-tillage (ST) management in corn (*Zea mays*)-sorghum (*Sorghum bicolor*) rotation. Cereal rye (*Secale cereal* L.) cover cropping treatments (cover cropping and no-cover cropping) were nested within each tillage system in 2016/17 and 2017/18. All treatments were replicated three times. Soil samples were collected in February, May and October 2017 from 0-15 cm depth. All soil samples were analyzed for soil available nitrogen (N), potentially mineralizable carbon (PMC) and N (PMN), permanganate oxidizable carbon (POXC), soil moisture content, wet aggregate stability (WAS), pH and electrical conductivity (EC). Data showed that ST significantly increased available N and PMN content compared to NT in both crop rotation phases in the May sampling. The PMC content was significantly higher in cover cropping treatments than no-cover cropping in sorghum in the October sampling. Soil pH was not significantly different among treatments at all sampling dates. Soil EC was significantly greater under ST than under NT in sorghum for May sampling. Soil moisture content for all dates, and WAS and POXC in February and May samplings were not statistically different among treatments. Results from this study suggested that diversifying the cropping system and reducing soil disturbance can support C and N accumulation in the soil and thereby support sustainable crop production.

Keywords: cover cropping, nutrient cycling, no-tillage, soil organic matter, strip-tillage

Abstracts: Poster Presentations

Gender Role in Rural Farming System: A Case of Kanchanpur District, Nepal

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Agriculture is the primary occupation for the majority of the Nepalese populace for their livelihood; the case is especially true for rural areas of Nepal. While both male and female engage in diverse agricultural activities, gender-specific roles in agricultural decision-making are significant. A survey study was conducted in three wards of Kanchanpur district (Majhgau-14, Bhuda-02, and Baghphata-19) to examine the gender-specific access to participation in agricultural production activities, decision-making, and control over agricultural resources. Eighty households were chosen by random sampling and a scheduled interview was carried out with about 50-50 male-female ratio. Land preparation, marketing of produce, and fertilizer and pesticide use in cereal production were found to be the major domain of males. Transplantation and weeding were within the females' domain. Both male and female farmers contributed equally and synergistically to irrigation, harvesting, and threshing of cereal crops. The gender roles reversed in vegetable cultivation - most of the activities such as nursery management, transplanting, fertilizer use, harvesting, cleaning, and grading were typically performed by females. Gender difference was also common in livestock production, with higher contribution of females in livestock care as compared to males. In general, males are the overall decision-makers for purchasing land, use of chemical fertilizer and pesticides, livestock care, and marketing, whereas women played a dominant role in decision-making on the crops to be cultivated, seed selection, use of organic fertilizer, plant protection measures, and the rearing and marketing of small livestock. Participation of male and female in animal husbandry was similar in the care of the sick animal. Males were found to have relatively more access to, and control over, farm resources. Among several resources, males access was seen more in fertilizers, mechanized tools, credit, and land, whereas women have relatively greater access to co-operatives, training, and market channel. The findings of this study revealed that there are gender-specific domains in rural farming. Thus, there is a need to develop gender friendly technology and policy while formulating specific project planning and development efforts.

Keywords: gender role, farming, participation, decision-making, access, control

Perception to Adaptation of Climate Change in Nepal: An Empirical Analysis using Multivariate Probit Model

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Although climate change is a global phenomenon, developing countries-like Nepal, are more vulnerable, despite its negligible contribution. As a result, Sustainable Development Goals (SDGs) has incorporated Climate Action as a separate goal, which was not incorporated in previous global agenda – Millennium Development Goal. Acknowledging the unique cause and effect relationship, agriculture is the prime concern of climate change. Though recently climate change adaptations literature is increasing, measuring determinants are yet relatively scarce. The study aimed to assess the farmers' perceptions on climate change, estimate the determinants of and evaluate the relationship among adaptation practices. A survey in 300 agricultural households was carried out covering 10 sample districts considering five agro-ecological belts and vulnerability index. Four adaptation choices (change in planting date, crop variety, crop type and investment in irrigation) were deemed as outcome variables and socioeconomic, demographic, institutional, farm-level information and perception variables were deployed as explanatory variables, and their marginal effects were determined for three climatic variables – temperature, precipitation and drought. A multivariate Probit was deployed using Stata 13 to analyze the data. A majority population perceived temperature alteration (92%), precipitation change (87.67%) and change in drought frequency (66.76%). For all models, null hypothesis for the likelihood ratio test of independence of error terms was rejected and all pairwise correlation coefficients are positive and mostly highly significant. Age, gender and education of head of household, credit access, farm area, rain-fed farming and tenure, are found highly influencing determinants. Multivariate Probit Model provided comprehensive results considering all adaptation options and determinants including interrelationships among adaptation options. The influence of explanatory variables in different models, and for available adaptation-options is unequal. Therefore, policy options and support facilities should be devised according to climatic variables and adaptation options to achieve superior results.

Keywords: adaptation, climate change, multivariate Probit model, Nepal, perception

Effect of Mother Rhizome Retrieval and Seed Treatment on Rhizome Rot and Yield of Ginger

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Ginger (*Zingiber officinale* Rosc.) is an important cash crop and is cultivated throughout the mid-hills, foothills and in the plains of Nepal. Dozens of diseases affect ginger, and among them rhizome rot caused by *Pythium* spp and *Fusarium* spp is the most devastating disease in Nepal. This study was conducted at Ginger Research Program, Kapurkot, Salyan in 2014 and 2015 to identify the effect of Mother Rhizome Retrieval (MRR) and seed treatment techniques on development of rhizome rot disease and yield of ginger. The experiment was laid out in factorial randomized complete block design with three replications. The first factor of treatments consisted of two methods of seed treatments in which one lot seed treatment in one solution and three lot seed treatment in one solution of DM-45 0.25% and Bavistin 0.1% and second factor consisted of five different practices for mother rhizome retrieval from 1.1m and 0.7m ridge, from flatbed 1.2m and no mother rhizome retrieval from flat bed, and from 1.1m ridge bed. The interaction effects showed the significant ($P < 0.05$) result for plant/m², plant height, disease score, diseased rhizome yield, fresh rhizome yield, mother rhizome yield and mother rhizome number. The tillers/clump was non-significant. Highest fresh rhizome yield (36.79 t/ha), lowest disease rhizome yield (0.13 t/ha) and lowest disease score (1.25 in 1-5 scale) was revealed by the treatment one lot seed treatment in one solution with no MRR from 1.1m ridge. While the highest disease rhizome yield (0.81 t/ha), highest disease score (2.50) with low fresh rhizome yield (29.07t/ha) was found in the treatment MRR from flatbed (1.2m) and three lot seed treatment in one solution. This study gives an idea for managing the rhizome rot disease through one lot seed treatment with DM-45 and Bavistin with no MRR from 1.1m ridge.

Keywords: ginger, rhizome rot, rhizome yield, seed treatment

Policy Provision of Food Sovereignty in Nepal: A Way to Achieve Food Security

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Food security and food sovereignty have emerged as major global concerns to end extreme hunger, poverty and malnutrition. Food security focuses on whether there is food available in the market to be accessible to the people, whereas food sovereignty mainly advocates for the rights of people to define their own food and agriculture production with the formulation of ecologically sustainable policies and practices. This is the policy review paper on food sovereignty with respect to food security, which derives pertinent data and information from a variety of secondary sources. Nepal has made increasing efforts, especially in the past decade, to adopt policies appropriate to addressing the issues of food security, particularly through the Agricultural Perspective Plan (APP) (1995-2015), and National Agricultural Policy (2004). However, performance is not satisfactory as Nepal has been a net importer of food grains basically rice. Currently, government has formulated and implemented the Agriculture Development Strategy (ADS 2015-2035). ADS, which is the long-term policy document of the agricultural sector, clearly mentions to achieve food and nutrition security leading to food sovereignty in its vision statement. The Constitution of Nepal has enshrined the right to food as a fundamental right for its citizens focusing on right of food sovereignty as provided by law. Likewise, the fourteenth plan (2016/017-2018/019) of the government has also ensured maintaining food sovereignty and food security in the country. Nepal has diversified climatic conditions, which are suitable for growing a large number of cereal crops. The food balance sheet shows that Nepal is a cereal sufficient country as there is a national surplus of 0.89 million metric tons in 2016/017. However, Nepal seems a food deficit country when viewed from the import aspects of fine milled rice basically from India. In this context, maintaining food security in Nepal should be well linked with food sovereignty through a sustainable production and distribution system.

Keywords: food security, food sovereignty, sustainable production

Cover Crops Effect on Soil Moisture Content, Organic Matter Dynamics and Wheat Yield in a Limited-Irrigated Winter Wheat-Summer Fallow System

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Declining irrigation water, soil organic matter content and wheat yield due to low biomass input and long fallow are challenging the resilience and sustainability of agroecosystems in eastern New Mexico. A field experiment was established at the NMSU Agricultural Science Center in Clovis, NM under no tillage management to evaluate the effects of cover crops (CCs) on seasonal dynamics of soil moisture content (SMC), soil organic matter, nutrient pool, and wheat yield. Eight CC treatments: fallow (no CC), pea (*Pisum sativum* L.), oat (*Avena sativa* L.), canola (*Brassica napus* L.), pea + oat (PO), pea + canola (PC), pea + oat + canola (POC), and six species mixture (SSM) of pea, oat, canola, hairy vetch (*Vicia villosa* L.), forage radish (*Raphanus sativus* L.) and barley (*Hordeum vulgare* L.), were arranged in a randomized complete block design with three replications. Fallow had significantly greater SMC at CC termination in both phases. Additionally, SMC was 27% lower at CC termination than at CC planting, but it was recovered by 115% at wheat planting. When averaged across both phases, fallow had significantly greater available N at CC termination. In addition, available N was not significantly different between CCs and fallow at wheat planting, and wheat harvesting, but it was significantly lower in pea, PC and POC than fallow at jointing stage. Available P was reduced by 70% at CC termination than at CC planting. However, 96% of available P at CC planting was recovered at wheat planting and 98% at jointing stage of wheat. Canola had significantly greater potentially mineralizable carbon (PMC) than PC and POC while SSM had significantly greater permanganate oxidizable carbon (POXC) than canola. CCs had no significant effects on wheat yield and harvest index but 1000-grain weight was significantly greater in oat and pea than all other CC treatments and fallow. CCs add residue to soil, which can retain soil moisture, and improve soil organic matter content and nutrient cycling. CCs can improve the availability of soil moisture and nutrients to following winter wheat, consequently improving the quality component of wheat yield, and sustaining the cropping system in the long run.

Keywords: agroecosystems, soil management, soil moisture, organic matter

Household Nutritional Security and Women's Income Generation through Drip Irrigation for Kitchen Gardens in Syangja District, Nepal

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A kitchen garden is a small plot (<200 m²) which is traditionally managed to grow diverse vegetables and spices. To improve household nutrition, income and study the socio-economic impact, an affordable bucket drip based kitchen garden program has been introduced in Tindobate, Syangja district, where malnutrition, low income and poverty are serious threats. Household survey data were collected from farmers involved in vegetable production in their kitchen garden. We used structured questionnaires and focus groups involving 30 households to whom bucket drip irrigation kits were distributed. Questions were asked about water savings, productivity, and generated income for conventional irrigation methods compared to using bucket drip kits. The observations, key informant interviews and desk review of information of stakeholders were shared with women. 83% of the interviewees were female, and 28% were illiterate. 85% used tap water for irrigation of their kitchen gardens. Drip irrigation kits resulted in a reported 80% mean water savings, increased yield and reduced disease occurrence, paying back for their cost during the first season of the vegetable production. The crops grown in kitchen gardens included nutritious staples such as cucumber, sponge gourd, okra, cabbage and cauliflower. Average production in the plots rose from 54 to 77 kg after the drip irrigation kits were introduced. The proportion of farmers selling produce from the kitchen gardens in the market increased from 31% to 72%. Average income from plots was higher under drip irrigation than under conventional irrigation (1526 vs. 1090 NR). Also cost benefit ratio was found higher with bucket drip kits (3.8) vs. traditionally managed (2.1) kitchen gardens. For nutritional security and income generation, drip irrigation kits for kitchen gardens represent a low-cost, scalable intervention that saves limited water resources and provides nutritional and economic benefits for women and their communities in Nepal.

Keywords: bucket drip, kitchen garden, nutrition, survey, women enterprise

Bucket Drip Irrigation Kit Use for Vegetable Production and Building Women's Enterprise in Drought Prone Kapilvastu District, Nepal

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In rural areas of Nepal, kitchen gardens supply diverse types of vegetables to fulfill the daily requirement of family members, and also provide revenue by the selling of surplus quantity. We worked in Kapilvastu district, located in the lowland (Terai) region, where heat and a long dry season limit water availability and make it difficult for farmers to grow nutritional food in their kitchen gardens. Hence, a bucket drip irrigation system was introduced to save water and provide more of household nutritional needs. To investigate the efficacy of drip irrigation for vegetable production in kitchen garden by women farmers in the drought-prone Kapilvastu district of Nepal, a structured questionnaire was administered to 25 women using the drip irrigation kit. Survey questions focused on water use efficiency of bucket drip kits and production of kitchen garden vegetables. Average production of vegetables was increased by 43% in drip-irrigated plots as compared to traditional manual irrigation used (82 kg as compared to 58 kg/plot). With the use of drip irrigation in kitchen gardens, the percentage of farmers who sold their product in the market increased from 59% to 78%, with the remaining 22% still using the vegetables only for home consumption. Further, the average income of kitchen gardens under the drip irrigation system was NR 1489 as compared to NR 1305 in traditionally managed kitchen gardens. The benefit cost ratio was found to be 2.5 and 1.6 in drip-irrigated areas vs. traditionally managed. Farmers' responses and field observations suggest that higher productivity of drip irrigation is due to the increased water use efficiency, and fewer weedy, host and volunteer plants. Drip irrigation has been found to have a positive impact on resource saving costs of cultivation, yield and farm profitability.

Keywords: karesabari, drip irrigation, survey, household nutrition

Coping Strategies to Climate Change through Indigenous Technology Knowledge in Agriculture

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Climate change has become the greatest environmental and social threats to humanity at present. This study examines (i) the perceptions of rural farmers about climate change and (ii) the role of Indigenous Technology Knowledge (ITK) in adapting to the impacts of climate change in agriculture. To carry out the research at Sahartara Village Development Committee (VDC) of Dolpa district, a mixed research method -- survey and ethnography was adopted. Mann Kendal Test verified that rainfall of the area has been observed in a decreasing trend by 1.254 mm every year from 1984-2012 while minimum temperature is increasing and maximum temperature is decreasing from 1991 to 2013, which is a sign of change in climate variability. Moreover, people have experienced a gradual rise in temperature for a decade and are facing erratic and unprecedented rainfall over the same period. Their traditional methods of terrace farming, animal husbandry, avoiding chemical fertilizer and pesticides, leaving crop residue and fallow land is aiding them to protect land from erosion and landslide along with maintaining soil fertility. Practices such as managing crop timing, selection of the more resilient crops, crop rotation, and intercropping is helping them to fight against the food insecurity likely to be induced by climate change by ensuring at least yield of one crop, controlling pests and maintaining the production. People exchange seeds within the community, thus protecting the gene pool in the community they believe their major strength is the use of a traditional variety of crops, which has already adapted with nature. I deem that these efforts have helped people to adapt to changing environment. I find that while people are aware about the changing environment they nevertheless, have limited knowledge about the terminology of climate change. Consequently, development agencies and government can emphasize programs related to climate change bearing in mind that they are the sources of knowledge regarding climate change and its effect in agriculture. I contemplate promotion of low risk, high benefit irrigation techniques such as sprinkle irrigation and drop irrigation to be done to encourage better yield and zero erosion.

Keywords: adaptation, agriculture, climate change, indigenous technology knowledge

Sweet Orange Production in Central Nepal: An Economic Analysis

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Sweet orange is one of the important fruits grown in the mid-hills of Nepal. It ranks second among the citrus fruits in terms of area and production. A survey study was conducted to examine the economics of sweet orange production in Sindhuli, a representative district in the mid-hill region of central Nepal. Specifically, the study examined production scenarios of sweet orange, cost of cultivation and input usage, gross margins, production and marketing issues faced by orange producers in Tinkanya, Sindhuli. Sixty households were surveyed during the summer months of 2017 by using purposive random sampling. Primary data were collected through the questionnaire survey and other relevant information was extracted from secondary sources. Socio-demographic studies revealed that a majorly (93.3%), both males and females were engaged in sweet orange farming. Nearly all growers (98.3%) in Tinkanya Village Development Committee (VDC) have agriculture as their major occupation. The average land holdings of the farmers was 0.53 ha in which 0.37 ha of land was occupied for sweet orange cultivation. The average sweet orange production across 60 households was 3,739.3 kg per ha. The average per ha cost of production was estimated to be Rs.38,237 and the gross return from the production was Rs.90,628; the benefit:cost ratio of 2.37 supported that the sweet orange production is a profitable farming business in central Nepal. Furthermore, insect attacks, irrigation problems, disease outbreaks, timely availability of inputs, transportation and marketing challenges were identified as major sweet orange production issues. An integrated cropping systems approach is suggested as a necessary first step in addressing these issues to sustain sweet orange production enterprises in the central mid-hills of Nepal.

Keywords: agriculture enterprise, cost-benefit ratio, marketing challenges, sweet orange

Assessment of Food and Nutritional Security Status among Landless People in Chitwan District, Nepal

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Food insecurity still remains a major concern in Nepal. The harsh terrains, the remoteness of settlements of communities, and inequity in income generation have left millions of Nepalese experiencing some level of food insecurity mostly among marginalized populations in both urban and rural settings. A pilot study was conducted within ninety households in four different locations with the purpose to assess the various dimensions of food and nutritional security of landless people living in undocumented land by purposive selection of Chitwan District of Nepal. A semi-structured questionnaire was used to obtain primary data. Secondary data was obtained from Bharatpur Municipality and Madi Agriculture Service Centre in Chitwan. Analysis revealed that 57.8% of households expressed themselves as food secure in terms of their production and source of income while 42.2% were food insecure. The most food insecure ethnic group were the Janajatis (34.2%) followed by Dalits and Brahmins (15.8%). Similarly, 80.0% (36.7% male, 43.3% female) respondents were under-nutritioned and 20.0% (5.6% male and 14.5% female) were nutritionally secure according to calculations using Harris-Benedict principle based on net calories they obtained from their daily meals. Females were more insecure in terms of population size, education, skill, nutrition and diseases followed by males. Of those interviewed, 57.8% households lack production activity and were also food insufficient. The main source of income was off-farm work (40%), followed by remittance (35.6%). Various natural calamities were also the reason behind being landless in the case of some households, and they reportedly migrated from elsewhere. People are still involved in foraging and traditional farming activities with low output. Addressing agricultural production, nutrition awareness, climate change monitoring, livelihoods strengthening and disaster preparedness to ensure access to food are urgent needs even in urban areas like those in Chitwan. Dependence on food imports, away shying from production activities, traditional food sources have to be addressed for Nepal's struggle against food insecurity.

Keywords: calorie, food insecurity, landless, production activity, under-nutrition

Happiness of Nepalese Immigrants Living in Columbia, Missouri, the USA: Themes and Determinants

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Happiness refers to the pleasure of human beings derived from the consumption of a bundle of goods or services. A number of mainstream literatures focus on happiness as the relationship between well-being and life domain factors such as income, job, material welfare, political situation, language, etc. The researchers employed a quantitative approach in an effort to conceptualize the term “happiness.” Happiness itself is a subjective concept; therefore, this paper attempts to explain happiness based on the respondents’ self-assessment of how happy they are with their life by explaining their attitude/perception on happiness, and factors contributing to it. This article draws in-depth qualitative data collected during a one-month period employing grounded theory and document analysis. This paper explores the idea that happiness is the satisfaction and the joy of the success people would get by achieving the goals. The perception on happiness is different from people to people due to the nature and the capacity of the people to design realistic goals. Four themes in a life domain make the core concept “happiness” and those themes are life purpose, family, livelihood, and community. These themes are interrelated with each other, and each theme has its own position and importance from others in a particular time of immigrants staying. This paper provides valuable lessons to policymakers to make/amend immigrant policies in the context of the overall economic development of the nation and as well as to implement strategies for a country like Nepal to check brain drain. Further, it gives a way to policy makers to incorporate happiness as an important aspect in order to define well-being of the people/country along with income and wealth.

Keywords: document analysis, grounded theory, happiness, immigrants

Yield Performance of Okra Varieties during Summer at Rupandehi, Nepal

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Okra (*Abulmoschus esculentus* L. Moench) is an important vegetable crop in Rupandehi District. It has gained considerable interest as an alternative vegetable over many traditional vegetables both in urban and rural areas. As a result of increasing population and people's consciousness about healthy foods, along with the realization of the multiple health benefits offered by okra, the consumption of this vegetable is gradually increasing over time. However, the production is reported to be very low. Productivity of okra is highly influenced by the environment. However, no suitable specific varieties have been recommended yet. The purpose of the study was to identify a high yielding okra variety for Rupandehi. The study was conducted in the horticulture research station of the Institute of Agriculture and Animal Science, Bhairahawa, Nepal, from April to July 2014. Four different commercial Okra varieties: Basanti, *Arka anamika*, Champion and US 7109 were used for the study. The experiment was conducted in one factorial RCBD with four replications. Yield parameters (number of fruits per plant, fruit length and diameter, yield t/ha) were recorded for each variety. The data were analyzed using M-stat and Excel. The results revealed that *Arka anamika* produced more fruits per plant (28.5) with greater fruit length (17.113 cm) and diameter (2.488 cm). Yield (24.1 t/ha) of this variety was higher than other varieties followed by US 7109 (21.2 t/ha), Basanti (20.56 t/ha), and Champion (16.36 t/ha). The findings of this study suggest that *Arka anamika* is superior to the other three varieties included in the study. However, more studies need to be conducted to make further recommendations.

Keywords: M-stat, vegetables production, yield parameters

Pedological Characterization of Tikurwuha Watershed, Blue Nile, Ethiopia: A Case Study for Environment

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Soil samples were taken from five Awuzet profiles (AWP) in 2016/17 at Tikurwuha watershed to analyze selected physicochemical properties. Soil colors were 2.5 YR 3/6 (yellowish red), 10 YR 5/1, 10 YR 2/1, 7.5 YR6 /1 and 7.5 YR 7/1 for AWP04, AWP05, AWP06, AWP07 and AWP08, respectively. Clayey loam for AWP04 and AWP05; clay AWP07 and AWP08 and loam for AWP06 were registered. All profiles were characterized by their strongly acidic nature at the surface except AWP05 and AWP08. All profiles were recorded high cation exchange capacity (43.4 cmol (+)/kg) except AWP04 and AWP07. Very low (0.061%) and high total nitrogen (0.51%) were reordered at the surface of AWP04 and subsurface of AWP08, respectively. The highest and the lowest organic carbon reordered were 5.6 and 4.21% at the surface of AWP04 and subsurface of AWP08, respectively. Available phosphorus was ranged from low (3.2 ppm) to high (35.7 ppm) at the surfaces of AWP07 and AWP08, AWP04, respectively. The pedologic characterization could help to identify soil fertility management options and facilitate soil and water conservation planning for similar regions.

Keywords: characteristics, Ethiopia, pedologic, Tikurwuha

Soil Classification for Soil and Water Management in Tikurwuha Watershed, Ethiopia: A Case Study for Environment

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Soil and water degradation is a major threat for natural resources in Ethiopia. A study was conducted during 2016/17 at Tikurwuha watershed, Blue Nile, Ethiopia to classify soils using FAO/WRB criteria for sustainable soil and water management. Four soil profiles of Awuzet (AP) at eucalyptus plantation, cultivated and grazing lands were described in-situ using FAO/WRB guideline. Soil samples were collected from pedogenic horizons and analyzed for soil color, texture, bulk density (BD), pH and organic carbon (OC). FAO/WRB soil classification legend was used to classify the soils. Surface soil color was 7.5YR4/2 (yellowish red) for AP0-1 and AP0-2 and 7.5YR5/1 for AP0-3. All profiles, except AP0-3, were clay in texture. Highest OC (4.19%) was registered at the subsurface of AP0-3. Bulk densities of AP0-1, AP0-2 and AP0-3 ranged from 0.98 to 1.37, 0.98 to 1.53 and 98 to 1.23 gcm⁻³, respectively. All profiles were characterized by their acidic nature. Generally, AP0-1, AP0-2 and AP0-3 were identified as Luvisols, Vertisols and Cambisols at intensively cultivated land, grazing land and plantation, respectively. The soil classification map could facilitate soil and water conservation planning and sustainable use of water management for the region and similar regions of the country.

Keywords: Ethiopia, soil erosion, Tikurwuha, water

Farmers' Knowledge on Pesticide Safety and Pest Management Practices: A Case Study of Vegetable Growers in Chitwan, Nepal

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Farmers' knowledge on pesticides and their safe use is critical for implementing effective pest management programs. A household survey was conducted using the semi-structured questionnaire to evaluate vegetable growers' knowledge on pesticide safety and pest management practices in Nepal. Results indicated that chemical pesticides were the primary choice of over 80% of growers for pest management. Notably, 90% of growers were aware of adverse effects of pesticides on human health and to the environment. Over 84% of growers used at least one form of personal protection equipment (PPE) during pesticide spray or handling, although the quality and appropriateness of the PPE warrants further investigation. Nearly 17% of growers received at least one short-term trainings on integrated pest management (IPM); however, all of them neither knew the harmful effects of pesticide residues nor practiced proper pesticide disposal methods. Over 90% of growers rely on local pesticide retailers (i.e., agro-vets) for technical know-how about pesticide selection, handling, and use. This study highlighted a need for immediate implementation of strict pesticide use regulations, and recommended educational programs for pest control professionals, growers, and pesticide retailers.

Keywords: integrated pest management, pesticide, PPE, vegetable growers

Influence of Mother Rhizome Retrieval and Organic Treatment of the Retrieved Plants on Economic Yield of Ginger (*Zingiber Officinale*) at Salyan, Nepal

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An experiment was conducted at Salyan, Nepal to assess the mother rhizome retrieval and organic treatment of the same retrieved plant on economic yield of ginger (*Zingiber officinale*) during 2015/16. 'Kapurkot Aduwa-1', a superior Nepalese variety, was used for this experiment. Two dates i.e. 1 September and 7 September and Trichoderma, Jeevatu (mixture of lactic acid bacteria, Azotobacter, phosphorous solubilizing bacteria, potassium solubilizing bacteria, phyto synthetic bacteria and yeast), Bordeaux paste, mixture of Azadirachta indica cake and *Zanthoxylum simulans* dust, vermi-compost, liquid manure (prepared by decomposing 10 types of plants i.e. 500 grams leaves of *Azadirachta indica*, 500 grams leaves of *Melia azadirach*, 500 grams leaves and fruits of *Zanthoxylum simulans*, 500 grams leaves of *marigold*, 500 grams leaves of *Ageratina adenophora*, 500 grams leaves of *Artemisia vulgaris*, 500 grams leaves of *Acorus calamus*, 500 grams leaves of *Aloe vera*, 100s gram of dried pepper and 250 grams of garlic on 10 liters of water for 1 month on closed bucket) and control were seven organic treatments. These 14 treatment combinations were laid out in a randomized block design with factorial arrangement of treatments, replicated three times. Plant height, leaf and tiller number were found to be significantly higher with vermi-compost treatment after harvesting of the mother rhizome whereas the lower was observed with control. Mother rhizome and fresh rhizome yield was found to be significantly higher on vermi-compost applied field with 1.7 t/ha and 22.8 t/ha respectively and lower fresh rhizome yield (15.5. t/ha) was found with no treated field (control). The infection rhizome yield was significantly lower (0 t/ha) and higher (0.2 t/ha) with the control. Benefit cost ratio was found to be significantly higher (1.74) on vermi-compost applied field and lower at control (1.32), which confirms that the use of vermi-compost during mother rhizome harvesting will increase the economic return of the ginger growers.

Keywords: leaf, plant height, spices, tiller

Lygus Research and Outreach Program in Texas: An Integrated Approach to Addressing an Emerging Pest Problem

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Texas A&M cotton entomology research in the Texas High Plains began in 1937, but much of the cotton insect management research in Texas for three decades into the late 1990s emphasized the ecology and management of the cotton boll weevil. Boll weevil has been largely eradicated from the system for over 15 years and the focus of arthropod management research has changed significantly. A potential shift in the insect pest complex has resulted from contributions from boll weevil eradication, new crop technologies, safer pesticide chemistries, high-input cropping systems, and highly efficient irrigation systems. Often, the integration of these approaches has been hindered due to lack of understanding of the biology and ecology of target pests and a heavy reliance on insecticides. The objective of this long-term comprehensive study was to develop an integrated approach to managing an emerging pest, *Lygus hesperus*, in cotton. Our program has used *Lygus* as the model insect to answer various ecological questions. In the past fifteen years (2002-2017), more than 50 research projects were conducted on various aspects of *Lygus* biology, behavior, and ecology. Experiments were conducted in the laboratory, greenhouse, research farms, and growers' fields. *Lygus* research conducted in our program includes host-plant survey, host preference, intercrop movement, feeding biology, cotton plant/*Lygus* interactions, sampling, insecticide resistance, pesticide evaluations, overwintering biology, morphology, molecular ecology, cultural control, landscape structure, and economic threshold development. Our programmatic effort on *Lygus* research has resulted in some significant outcomes for further scientific investigation and for grower adoption, including alternate host identification, characterization of feeding and movement biology, pesticide spray initiation and termination rules, molecular marker development, determination of genetic structure, pesticide resistance monitoring, morphological characterization, life table investigation, and crop protection product evaluation. The Cotton Entomology Program has contributed significantly to assisting Texas cotton producers, crop consultants, Extension agents, and the scientific community by expanding our cotton pest management knowledge and skills through research and outreach.

Keywords: cropping systems, ecological pest management, *Lygus* IPM, research-outreach model

Productivity and Profitability Assessment of Hybrid Maize by Using Nutrient Expert® Maize Model in Eastern Terai of Nepal

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Indiscriminate use of fertilizer and lack of site-specific nutrient management technology has always been associated with low productivity of maize in Nepal. Further, low productivity has also led to low profitability of maize production. This study was planned, executed and accomplished for assessing the productivity and profitability of maize production using Nutrient Expert®-Maize. The experiments on farmers' fields were conducted on hybrid maize to assess the productivity and profitability at two sites of Jhapa district viz. Damak and Gauradaha using Nutrient Expert® Maize model from November 2015 to May 2016. The experiment was laid out in single factorial Randomized Completely Block Design consisting of twenty replications with two treatments viz. NE (Nutrient Expert recommendation) and FFP (Farmer's Fertilizer Practice). The analyzed data revealed significant differences in terms of grain yield, stover yield, gross return, net return and B: C ratio. NE based practices produced significantly higher grain yield (9.22 t ha⁻¹), which was 86.6% higher than FFP (4.94 t ha⁻¹). Similarly, the significantly higher stover yield (12.70 t ha⁻¹), gross return (NRs. 224049 ha⁻¹), net return (NRs. 128970 ha⁻¹) and B: C ratio (2.36:1) were also recorded in NE based practice. Thus, NE based practice could be adopted for obtaining higher productivity and profitability of hybrid maize in eastern Terai and similar agro-climatic regions of Nepal.

Keywords: benefit cost ratio, grain yield, hybrid maize, net return, Nutrient Expert®

Growth Parameter and Yield Attributes of Rice (*Oryza Sativa*) as Influenced by Different Combinations of Nitrogen Sources

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Nitrogen is one of the yield limiting factors in rice production. Adequate nitrogen improves yield attributes and growth parameters while excessive nitrogen increases the cost of production as well as leads to environmental degradation. Therefore, the adequate rate, appropriate source and timing of application play a crucial role in rice production. There is an increasing trend of using excessive inorganic source of nitrogen in rice, which is detrimental to environment and costly. So, there is a need for identifying alternative N source that is ecologically sound as well as economically viable. The objective of the study was to determine the response of rice as influenced by different combinations of organic and inorganic nitrogen sources. The study was carried out in an agronomy farm of IAAS, Paklihawa Campus Nepal. The study consists of three nitrogen sources i.e., urea, farmyard manure and blue green algae at different levels comprising seven treatments in randomized complete block design with three replications. Rice seedlings were raised in wet nursery beds and transplanted in experimental plots. Growth parameters, yield attributing traits and grain yield of rice were recorded. Data were analyzed using Duncan's Multiple Range Test in MSTAT-C. Result indicates that treatment combination of 75% of recommended dose of nitrogen (90kg/ha), farmyard manure (5tons/ha) and blue green algae (9kg/ha) has significantly higher plant height (96.13cm), effective tiller per square meter (345.6), filled grain per panicle (180.9), grain yield (4.787ton/ha), and straw yield (9.07 ton/ha) ($p \leq 0.05$). Also, there was a positive correlation between the grain yield and effective tillers per square meter ($R^2=0.254$), grain yield and number of filled grains per panicle ($R^2=0.315$). Hence, 75% of recommended dose of nitrogen (90kg/ha), farmyard manure (5tons/ha) and blue green algae (9kg/ha) were found to improve plant characteristics, thus improving rice yield.

Keywords: blue green algae, farmyard manure, urea

Diurnal Behavior and Distribution Pattern of Katahdin Rams in Southern-pine Silvopastures during Cool-Season Grazing

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Selection of suitable grazing animals is crucial for successful management of silvopasture systems, agroforestry systems with timber, forages, and grazing animals produced together under a common management unit. Previous studies showed damaging behaviors of Kiko wethers on 12-year-old southern-pine trees during the cool-season grazing in mixed-pine silvopastures, thereby indicating the need for identifying alternative animal species for this system. The objective of the study was to determine the grazing behavior and distribution pattern of Katahdin rams in southern-pine silvopastures during the cool-season grazing period. The study was conducted in spring 2017 in Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, Alabama, USA. Three 0.4ha long leaf (*Pinus palustris* Mill.)-loblolly (*Pinus taeda* L.) mixed-pine (12-year-old) silvopasture plots were planted with three different combinations of cool-season forages in different subplots. Forage samples were collected before bringing animals in the plots, and analyzed for productivity and quality. Six Katahdin rams (12-15 months old, 72.7 ± 4.80 kg live weight) were rotationally stocked in the study plots, and their diurnal behavior and distribution pattern were recorded once in every 10 minutes in pre-formatted data sheets for a day, when they were stocked in each study plot. Microsoft Excel 2016 and Kruskal-Wallis rank-sum test in R 3.4.2 were used to analyze the data. Grazing was the predominant diurnal behavior of rams (44%) followed by lying (39%) and loafing (10%). Rams did not debark pine trees throughout the study. Diurnal behavior of rams was influenced by diurnal period as they spent most of the diurnal time grazing during the post midday period, and lying during the midday period. Rams mostly stayed together irrespective of where they went, showing very little value of distribution evenness index. Katahdin rams were found safe to graze in southern-pine silvopasture systems consisting of 12-year old trees during the cool-season grazing period.

Keywords: debarking, distribution Evenness Index, diurnal period, loafing, lying

Diurnal Behavior and Distribution Pattern of Kiko Wethers and Katahdin Rams in Woodlands

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Small ruminants are mostly raised under pasture-based grazing systems in the southeastern United States. Dominance of seasonal grasses in pastures limits year-round forage availability. Integrating woodlands into the grazing system of small ruminants can offer multiple benefits. However, limited information is available on behavior of small ruminants in woodland grazing systems. The study objective was to determine the diurnal behavior and distribution pattern of Kiko wethers and Katahdin rams in woodlands. The study was carried out in Atkins Agroforestry Research and Demonstration Site consisting of four woodland plots (0.4 ha each) with mixed longleaf (*Pinus palustris* Mill.) loblolly (*Pinus taeda* L.) pine including 26 non-pine vegetation. The non-pine species were either cut to one of the heights from the ground level (0', 3', and 5') or left uncut (control). Diurnal (dawn-dusk) behavior and distribution pattern of Kiko wethers (8, 38-40 months old, 66.21 ± 1.79 kg live weight) and Katahdin rams (6, 19-22 months old, 83 ± 4.63 kg live weight) were observed. Results showed that browsing (59%) was the dominant diurnal behavior of Kiko wethers followed by lying (25%), loafing (12.7%), grazing (3%), and debarking (0.3%). Conversely, loafing (39%) was the dominant behavior of Katahdin rams followed by lying (30%), grazing (26%), and browsing (5%). Rams showed very little value for distribution evenness index compared to wethers. The results suggest that Kiko wethers are more efficient in utilizing woodland browse species than Katahdin rams. Further studies are going on to determine the browsing height, vegetation preference, and animal performance.

Keywords: browsing, debarking, grazing, loafing, lying

NAPA 2016

Nondestructive Estimation of Standing Crop and Fuel Moisture Content in Tallgrass Prairie

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Accurate estimation of standing crop and herbaceous fuel moisture content (FMC) are important for grazing management and for wildfire preparedness. Destructive sampling techniques have been used to accurately estimate standing crop and FMC, but the process is laborious and time consuming. Therefore, our objective was to develop robust models for nondestructive estimation of standing crop and FMC in tallgrass prairie. We calibrated and validated both stepwise multiple linear regression (SMLR) and artificial neural network (ANN) models for standing crop and FMC using data collected in grasslands near Stillwater, OK, USA. Day of year, canopy height, and Normalized Difference Vegetation Index (NDVI) were candidate input variables for the models. Our study spanned two growing seasons and nine patches located within three pastures under patch burn management. For standing crop, the ANN and SMLR models performed similarly (RMSE = 113 g m⁻² versus 117 g m⁻²). For FMC, the ANN models proved better than SMLR models (RMSE = 24.1% versus RMSE = 26.2%). Given the large variability in the underlying datasets, these models may prove useful for nondestructive estimation of standing crop and FMC in other similar grassland environments.

Keywords: artificial neural network, herbaceous fuel moisture content, standing crop, stepwise multiple linear regression

NAPA Special Session

Food Sustainability, Food Sufficiency, Food Safety and Healthy Food in Nepal: Principles and Practices of Food Security

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The purpose of this presentation is to share information on a book publication project entitled, '**Food Sustainability, Food Sufficiency, Food Safety and Healthy Food in Nepal: Principles and Practices of Food Security**' initiated by NAPA at the NAPA's first biennial conference in Oklahoma. The vast majority of the people of Nepal living mostly under a rural subsistence economy are facing serious challenges in sustaining their livelihoods in the current day globalized world. The current state of the food system of Nepal is less than optimal to keep individuals food secure, despite many efforts made for decades by the Government of Nepal and international community. In order to nourish the country's ever growing population, production, processing, preservation, distribution, marketing, access and consumption of food in sustainable, sufficient, safe, healthy and equitable manners is essential. The whole gamut of these processes that are largely controlled by the market infrastructure and forces can also be considerably influenced by healthy public policies, programs, services and innovative technologies. Realizing the need for comprehensive knowledge on principles and practices for a sustainable food system, NAPA has undertaken a project to publish a book on food security in Nepal encompassing food sustainability, food sufficiency, food safety and healthy eating, written by experts and practitioners, mostly Nepali professional experts and scholars from the Americas and abroad. The target readers of the book include government planners, policy makers and decision makers at various levels, non-governmental organization program officers, agricultural officers, food economists, higher education students, civic leaders and intellectuals, food industries, retailers and suppliers and food hospitality stakeholders.

Keywords: food security, health, Nepal, food safety, sustainability

Opportunities and Challenges of Distance Learning Education: NAPA Experiences from Rural Nepal

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There is a growing interest among students to pursue an agricultural technician career in rural areas. However, there is a need for qualified teachers in agricultural sciences in schools and colleges of rural Nepal. While finding qualified teachers is a challenging task, retaining them is even more difficult. Given this situation, the objective of our distance-learning program was to increase the access to quality education via skype, zoom or other internet media in rural schools. Two case studies in Salyan and Okhaldhunga were conducted. In Salyan, two courses, Basic Statistics and Agricultural Extension, were taught using Skype. A total of 36 students (20 females and 16 males) of I. Sc. Agriculture benefitted. Similarly, 'Zoom Online Video Conferencing' from the US was successfully tested in Prabuddha high school offering I. Sc. Ag. Courses), Okhaldhunga that produces grassroots level technicians in agricultural sciences (I. Sc. Ag.). Time conflicts, finding relevant experts and persuading them to teach, and ensuring speedy connectivity to the internet were some of the major challenges discussed in the classrooms with 139 students (technical grade 9-12), instructors, the school management committee, and community leaders. These experiences revealed that i) our host institutions were committed to upgrading their quality of internet connectivity in order to successfully implement online teaching, ii) students were receptive and willing to participate in distance learning, iii) NAPA could mediate and contribute greatly to upgrade the quality of teaching, iv) collaborative teaching, research, and advisory projects can be accomplished, v) a pool of global agri-professional volunteers can be created to overcome such problems, and vi) professionals have an opportunity to develop and upgrade career skills through distance learning technology and online teaching methodology.

Keywords: distance learning education, access to all, no or low-cost technology, virtual learning center

Global Journal of Agricultural and Allied Sciences (GJAAS)

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The purpose of this presentation is to share information on the **Global Journal of Agricultural and Allied Sciences (GJAAS)** (Online ISSN 2575-1670 and Print ISSN 2575-1662), a flagship publication of the **Association of Nepalese Agricultural Professionals of Americas (NAPA)**. The GJAAS is a multi-disciplinary peer-reviewed (double-blind) journal. We publish high-quality original research papers and review articles on various aspects of Agricultural and Allied Sciences. Research articles may report results of original observations/experiments and case studies. Review articles may examine and synthesize current information on a topic or investigate historical trends on a topic of current importance. Prospective authors can submit proposals for writing review articles and the Editorial Board makes the decision on the acceptance of such proposals. NAPA membership is not required for publishing in this journal. More details on Aims and Scope of the journal and Author Guidelines can be found on <http://napaamericas.org/journal-authors-guidelines.php>. Current Editorial Board structure, journal establishment and publication progress, and opportunities for members to engage in publication will be discussed.

Keywords: agricultural sciences, global agriculture, journal

Alphabetical List of Authors

S.N.	Author's name	Page # (s)
1	A. Joshi	17, 63
2	Abdel Mesbah	67
3	Aditya Khanal	60
4	Afouda J. Yabi	1, 34
5	Ajay Dhungana	32
6	Ajay K. Jha	68, 69
7	Akriti Bhattarai	2
8	Aman Bhatta	3, 4
9	Anil K. Singh	59
10	Anil Pokhrel	5
11	Arun GC	6, 64
12	Arun Thapa	86
13	Asha Tillman	52, 82
14	Ashmita Pandey	2
15	Athar Hussain Khan	32
16	B. P. Mishra	27
17	Badri Aryal	7
18	Bal Krishna Joshi	16
19	Bandhu Raj Baral	8
20	Basistha Acharya	65
21	Basu Dev Kaphle	66
22	Bharat Bhandari	16
23	Bharat Pokharel	9
24	Bhawani Mishra	30
25	Bhishma Raj Regmi	81
26	Bhuwan Adhikari	81
27	Bijay K. Pokhrel	10

28	Bijesh Mishra	3, 11
29	Binaya Joshi	20
30	Binod Ghimire	67
31	Binod K. Lamichhane	32
32	Bishal Dhakal	12, 80
33	Bishnu Gautam	32
34	Brant T. Mcneece	29
35	Brian K. Northup	41
36	Buddhi Gyawali	3, 11, 54
37	Buddhi Lamsal	14
38	Chandra Puri	68, 69
39	Charles Pradhan	15
40	D. Midmore	57
41	D. B. Nepali Karki	56
42	D. Bhattarai	24
43	D. Devkota	19, 63, 71
44	D. Parajulee	71
45	David Engle	84
46	Deepak Raj Parajuli	70
47	Dennis M. Jacobs	9
48	Devendra Gauchan	16
49	Devra Jarvis	16
50	Dharmendra Kalauni	17,63
51	Dikshit Poudel	72
52	Dipak Kumar Mishra	32
53	Dirac Twidwell	84

54	Dirgha J. Ghimire	18, 43
55	Dong-Ha Oh	42
56	Drona P. Rasali	85
57	Erik Krueger	84
58	Fan Yang	31
59	Fisseha Tegegne	60
60	Gandhi R. Bhattarai	2
61	Ganesh R. Joshi	20, 34
62	Ganga Ram Kohar	32
63	Gary W. Lawrence	29
64	Gautam K. Joshi	74
65	Ghislain B. Aihounton	1
66	Gizachew Ayalew	75, 76
67	Gopal Bhusal	81
68	Gopi Upreti	21
69	H. Ali	24
70	H. Riaz	24
71	Hari Gurung	78
72	Hari Poudel	22
73	Hongtao Hu	30
74	Hui Li	53
75	I. Kadariya	24
76	J. D. Carlson	84
77	J. He	24
78	J. Wang	24
79	J.J. Liu	24
80	James P. S. Neel	41
81	Japhet Laizer	25
82	Jean L. Steiner	41, 45
83	Jeffrey Basara	45

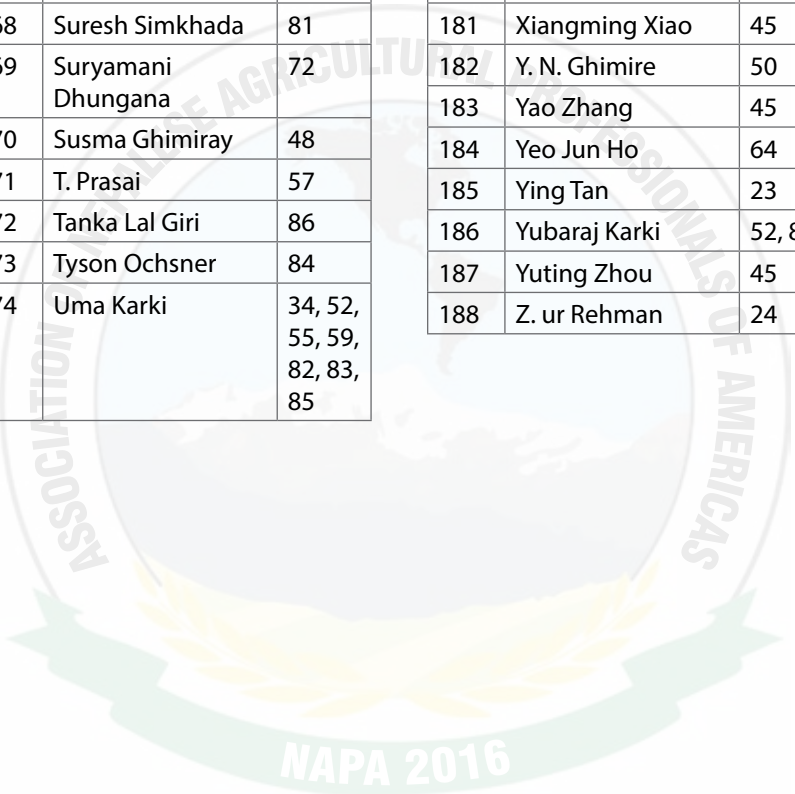
84	Jhalendra P. Rijal	77
85	Jiban Shrestha	32, 65
86	Joshua OHair	53
87	Kedar Devkota	71
88	K. M. Tripathi	27, 57, 72
89	K. Walsh	57
90	Kalpna Khanal	26
91	Kanchan Joshi	26
92	Kanhaiya P. Singh	74
93	Kenneth E. Turner	41
94	Keshav Bhattarai	28
95	Keshav Sharma	29
96	Kiran Ghimire	6
97	Krishna D. Puri	77
98	Krishna Kaphle	72
99	Krishna L. Poudel	30
100	Krishna Paudel	23, 35, 36
101	Kshitiz Dhakal	32
102	Lal Prasad Amgain	12, 80
103	Laxman Adhikari	33
104	Lila B. Karki	1, 20, 34, 59, 85, 86
105	Madan Marasini	47
106	Madhav Regmi	31
107	Maheshi Dassanayake	42
108	Man Kumari Giri	9
109	Manoj Basnet	78
110	Mark Schafer	35, 36

111	Mathias Gogounga	1
112	Megha N. Parajulee	17, 19, 37, 71, 79, 85, 87
113	Menuka Bhandari	32
114	Michael Adedotun Oke	38
115	Mina Nath Paudel	16
116	N. R. Devkota	19, 56
117	Nabin Poudel	81
118	Narahari P. Ghimire	39
119	Nir Y. Krakauer	68, 69
120	Nityananda Khanal	40
121	Ntam Baharanyi	25, 34
122	Orville Lindstrom	33
123	Parbati Adhikari	8
124	Peeyush Soni	5
125	Prabisha Shrestha	3
126	Pradeep Wagle	41, 45, 87
127	Pramod Pantha	42
128	Pramod Wagle	65
129	Prasanna H. Gowda	41
130	Prem B. Bhandari	7, 43, 85, 86
131	Priyanka Manjunatha	41
132	Purna B. Nepali	44
133	R. P. Ghimire	56
134	Ramashish Sah	56

135	Rajan Ghimire	62, 67, 77
136	Rajen Bajgain	45
137	Rajendra Regmi	77
138	Raju Adhikari	85
139	Ram Acharya	46, 85
140	Ram B Khadka	47, 48
141	Ranjana Rawal	47, 48
142	Rebecca Thornton	43
143	Rudra B. Shrestha	49
144	Russel Doughty	45
145	S. Bhattarai	57
146	S. H. Ghimire	56
147	S. J. Zhang	24
148	S. Subedi	50
149	Saaruj Khadka	3, 51, 54
150	Sajal Sthapit	16
151	Sam Fuhlendorf	84
152	Samjhana Khanal	12, 80
153	Samudra Lal Joshi	17
154	Sangita Karki	81
155	Sanjok Poudel	52, 55, 59, 81, 83
156	Santosh Thapa	53
157	Sarabjit Bhatti	53
158	Shailes Bhattarai	55, 59, 74, 83
159	Shankar R. Pant	29
160	Shanthi Johnson	85
161	Shrawan Kumar Sah	72

162	Sonisa Sharma	84
163	Sudan Gyawaly	77
164	Sujata Poudel	77
165	Suping Zhou	53
166	Suraj Adhikari	60
167	Suresh Khadka	86
168	Suresh Simkhada	81
169	Suryamani Dhungana	72
170	Susma Ghimiray	48
171	T. Prasai	57
172	Tanka Lal Giri	86
173	Tyson Ochsner	84
174	Uma Karki	34, 52, 55, 59, 82, 83, 85

175	Ummey Honey	60
176	Upendra M. Sainju	61
177	Uttam Khatri	86
178	Vesh R. Thapa	62
179	Vincent P. Klink	29
180	William G. Axinn	43
181	Xiangming Xiao	45
182	Y. N. Ghimire	50
183	Yao Zhang	45
184	Yeo Jun Ho	64
185	Ying Tan	23
186	Yubaraj Karki	52, 82
187	Yuting Zhou	45
188	Z. ur Rehman	24



Alphabetical List of Authors' Institutions and Countries

S.N.	Institution and Country	Page #(s)
1	Agriculture and Agri-Food Canada, Canada	40
2	Agriculture and Forestry University, Nepal	7, 17, 19, 24, 27, 56, 57, 63, 68, 69, 71, 72 77, 81
3	Asian Institute of Technology (AIT), Thailand	5
4	Bioversity International, Nepal	16
5	Bioversity International, Italy	16
6	Booz Allen Hamilton, USA	21
7	Brandeis University, USA	44
8	Central Queensland University, Australia	57
9	City University of New York, USA	68, 69
10	Commission for the Investigation of Abuse of Authority (CIAA), Nepal	20
11	Debre Tabor University, Ethiopia	75,76
12	Entomology Division, Government of Nepal, Nepal	17
13	Fort Valley State University, USA	59
14	FORWARD, Nepal	2
15	Grazinglands Research Laboratory, USA	41, 45, 85, 87
16	Huazhong Agricultural University, People's Republic of China	24
17	Institute for Global Agriculture & Technology Transfer (IGATT), USA	68
18	Institute of Agriculture and Animal Science, Tribhuvan University, Nepal	12, 72, 74, 78, 80
19	Iowa State University, USA	14
20	Kansas State University, USA	84

21	Kentucky State University, USA	3, 4, 11, 51, 54, 58
22	Kyungpook National University, Republic of Korea	64
23	Local Initiative for Biodiversity Research and Development (LI-BIRD), Nepal	16
24	Louisiana State University, USA	23, 31, 35, 36, 42
25	Macquarie University, Australia	26
26	Ministry of Agricultural Development, Government of Nepal, Nepal	6, 39
27	Ministry of Population and Environment (MOPE), Nepal	20
28	Mississippi State University, USA	29
29	Mountain Research and Development Foundation, Nepal	15
30	MRC-Mitochondrial Biology Unit, Wellcome Trust /MRC Building, UK	24
31	National Agriculture Genetic Resources Centre, Nepal	16
32	Nepal Agricultural Research Council, Government of Nepal, Nepal	5, 8, 32, 47, 48, 50, 56, 65, 77
33	Nepal Polytechnic Institute, Purbanchal University, Nepal	71
34	New Mexico State University, USA	46, 62, 67, 77, 85
35	Nichols College, USA	26
36	North Carolina A & T State University, USA	77
37	Ohio State University, USA	47, 48
38	Oklahoma State University, USA	41, 45, 84
39	Prabuddha Madhyamik Vidhyalaya, Okhaldhunga, Nepal	86
40	Regional Agricultural Research Station (RARS), Nepal	71
41	RMIT University, Australia	85
42	Shiva Jan Higher Secondary School, Salyan, Nepal	86
43	South China Agricultural University, China	23

CONFERENCE PROCEEDINGS

Global Food Security Through Agricultural Transformation

44	Southern Illinois University, Carbondale, USA	70
45	Tennessee State University, USA	9, 53, 60
46	Texas A&M University, USA	17, 19, 29, 71 85, 87
47	Texas A&M University AgriLife Research and Extension Center, USA	37, 79
48	Texas Institute for Applied Environmental Research, USA	10
49	Tuskegee University, USA	1, 20, 25, 34, 52, 55, 59, 74, 81, 82 83, 85, 86
50	United Health Group, USA	2
51	University of California Cooperative Extension & Statewide IPM Program, USA	77
52	University of California-Davis, USA	77
53	University of Central Missouri, USA	28
54	University of Connecticut, USA	2
55	University of Illinois at Urbana-Champaign, USA	43
56	University of Michigan, USA	7, 18, 43, 85, 86
57	University of Missouri, USA	22, 30, 73
58	University of Nebraska-Lincoln, USA	84
59	University of Oklahoma, USA	45
60	University of Parakou, Benin Republic	1, 34
61	University of Regina, Canada	85
62	USDA, Agricultural Research Service, USA	61
63	USDA Forest Service, USA	9
64	USDA-ARS Grazinglands Research Laboratory, USA	61
65	West Virginia State University, USA	32
66	Winrock International, Farmer-to-Farmer Program, Nepal	86

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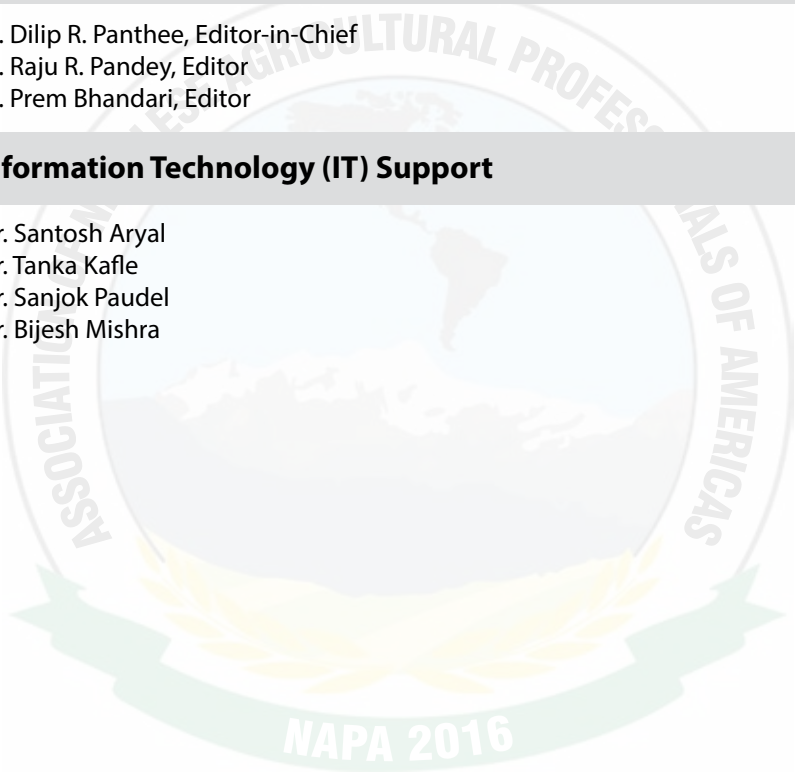
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Prem B. Bhandari, Ph.D., Chair

Dr. Bhandari is a Social Demographer at the Institute for Social Research, University of Michigan. He holds a Ph.D. (Rural Sociology and Demography) from the Pennsylvania State University, USA (2006). He is also an Adjunct Professor at the Agriculture and Forestry University, Nepal. His major research interests include social research methods; socio-economic and cultural determinants of migration, fertility, and population health; rural social change; population and environment; and sociology of agriculture. Prior to this, he worked as an Instructor at the Department of Rural Economy, University of Alberta, Canada. From 1987-2000, he worked as the Lecturer of Agricultural Economics at the Institute of Agriculture and Animal Science (IAAS), Tribhuvan University, Nepal. He has published a number of articles in peer-reviewed journals and presented dozens of papers in national and international scientific conferences. He is the *Editor of International Journal of Women's Health and Wellness and Global Journal of Agricultural and Allied Sciences* and International Advisory Board member of *Dhaulagiri Journal of Sociology and Anthropology*, Nepal. He is also serving as an Occasional Reviewer of over a dozen international journals. Currently, he is serving as the General Secretary of the Association of Nepalese Agricultural Professionals of Americas (NAPA). He is also serving as the Member Secretary and Editor of '*Food Sustainability, Food Sufficiency, Food Safety and Healthy Food in Nepal: Principles and Practices of Food Security*' - a book under publication by NAPA. He is a member of the Population Association of Americas (PAA), American Sociological Association (ASA), Population Association of Nepal (PAN) and NAPA.



Ramjee Ghimire, Ph.D., Member

Dr. Ghimire is a Research Associate at the Department of Community Sustainability at Michigan State University. He holds a Ph.D. (Community, Agriculture, Recreation and Resource Studies) from Michigan State University, USA (2016). His major research interests include agricultural extension; competency assessment of students and staff; program evaluation; and food security. He has published a number of articles in peer-reviewed journals and presented dozens of papers at scientific conferences. He has moderated professional seminars. Currently, he serves as the reviewer for the *Journal of International Agricultural and Extension Education*, *Journal of Communication Informatics*,



and *Journal of Agricultural Science and Technology*. He is also serving as the Editorial member for the Research and Policy Brief in the Association of Nepalese Agricultural Professionals of Americas (NAPA). Prior to this, he served for over fifteen years at the Department of Livestock Services in Nepal, coordinating, monitoring and evaluation activities and providing an oversight to district programs. He is a member of NAPA, the Association of Asian Studies, American Association for Adult and Continuing Education, North American Colleges and Teachers of Agriculture, American Evaluation Association, Association for International Agricultural and Extension Education, and Nepal Veterinary Association.

Suman Rimal Gautam, Ph.D., Member

Dr. Rimal Gautam is a water resources specialist based in the Washington, D.C. area. She holds a Ph.D. from Wageningen University in the Netherlands (2016) in Environmental Sciences focusing on water resources management. She has more than twenty years of experience working as a practitioner, as well as a policy researcher in water issues in different countries in Asia and Africa. Her key expertise and interests lie in irrigation, water supply and sanitation, water/irrigation policy reforms, water resources management, and gender issues in natural resources management. She is a member of Women Professionals in Land-use Sector, Nepal, and also serves as external reviewer for a peer-reviewed international journal in water. She has developed guidelines in mainstreaming gender in water, agriculture and related infrastructure projects, as well as coordinated a pilot project to integrate gender concerns for a project in Nepal. Suman has several publications in water issues including a book: *"Incorporating Groundwater Irrigation: Technology Dynamics and Conjunctive Water Management in Nepal Terai"*, a book chapter in "Controlling the Water: Matching Technology and Institutions in Irrigation Management in India and Nepal", and as co-editor for "Diverting the Flow: Gender Equity and Water in South Asia". She is also serving as an Editorial member for the Research and Policy Brief in the Association of Nepalese Agricultural Professionals of Americas (NAPA).



Margaret Holler Stephens, Ph.D., Member

Dr. Margaret Holler Stephens is a freelance professional journalist and a retired Associate Professor of English at Alabama State University in Montgomery, where she taught for 15 years. She has served as a newspaper feature writer and page editor and copy editor on *The Kansas City Star* in Missouri and as an editorial assistant for *The Wildlife Society Bulletin*, a scholarly scientific journal. She earned her Ph.D. in English from Auburn University in Alabama, her Master's degree in English from



the University of Missouri-Kansas City, and her Bachelor's degree in journalism from the University of Missouri-Columbia. She is a volunteer for SIFAT (Servants in Faith and Technology organization), which supports sustainable agriculture and global health. Dr. Stephens enjoys taking courses in natural history and ecology through Osher Lifelong Learning Institute (OLLI) at Auburn University. Recently, she served as a language editor for the *"Handbook for Training Field Extension and Technical Assistance Personnel in Sustainable Agroforestry Practices in the Southeastern United States: Training Handbook."* She also was a language editor for a *"Handbook for Training Field Extension and Technical Assistance Personnel on Sustainable Year-Round Forage Production and Grazing/Browsing Management for Goats in the Southern Region."*

Lila B. Karki, Ph.D., Member

Dr. Karki is an Agricultural Extension Economist, Research and Extension Program Coordinator, and State Financial Educator at the College of Agriculture, Environment, and Nutrition Sciences, Cooperative Extension at Tuskegee University. He holds a Ph.D. in Agricultural Economics from Justus-Liebig University, Germany. Prior to coming to Tuskegee, Dr. Karki worked as a Planning Analyst at University of Maryland, Eastern Shore (MD); Adjunct Professor of Macro and Micro Economics at Georgia Military College, Columbus Campus (GA); Institutional Research Statistician at Alabama State University, Montgomery (AL); Adjunct Professor of Macro and Micro Economics at the University of

Phoenix at Birmingham Campus (AL) and Columbus Campus (GA); and Research Analyst at Gordon State College, University System of Georgia. Previously, he served as the Under Secretary, Ministry of Agricultural and Cooperatives, Nepal and served in various capacities for nearly two decades. Additionally, he also gained experiences from private industry, NGOs, and INGOs. He has published a number of papers in peer-reviewed journals, dozens in magazines, newspapers, and extension bulletins, has contributed four book chapters and presented dozens of papers in conferences. He was an editor of *Issues and Challenges in Rural Development in Farming and Rural Systems Economics* (Volume I (86) and II (87)). Currently, he is the President of the Association of Nepalese Agricultural Professionals of Americas (NAPA) and is a member of American Economic Association (AEA), Agricultural & Applied Economics Association (AAEA), Southern Agricultural Economics Association (SAEA), Southern Rural Sociological Association (SRSA), Association for Financial Counseling, Planning and Education (AFCPE), National Extension Association of Family and Consumer Sciences (NEAFCS), The Alabama Sustainable Agriculture Network (ASAN), Alabama Asset Building Coalition (AABC), and Nepal Agricultural Economics Society (NAES). He is the immediate Past President of the Blood Donors of America, a public charity [501 (c) 3] organization.

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Association of Nepalese Agricultural Professionals of Americas (NAPA)

Introduction

Founded in 2016, the Association of Nepalese Agricultural Professionals of Americas (NAPA) is a non-profit, non-governmental, non-religious, and non-political professional organization dedicated to serve mankind through educational, scientific, developmental, and charitable initiatives. NAPA is incorporated under the laws of the Secretary of State of Louisiana (LA) and is tax exempt from federal income tax under Internal Revenue Code Section 501(c) (3).

Mission

To foster/enhance the quality of human race and environment through scientific research, capacity building, dissemination, and charitable initiatives.

Goal

To improve the quality of life of human race and environmental conditions.

Objectives

- ✓ Promote the advancement and progress of agriculture and allied disciplines through state-of-the-art cutting edge scientific research
- ✓ Generate empirical evidence through research
- ✓ Build capacity of stakeholders
- ✓ Foster intellectual discourse
- ✓ Organize seminars, workshops, conferences, and training programs

- ✓ Disseminate research results
- ✓ Raise/generate funds through competitive grant writings
- ✓ Collaborate with organizations in education, research, and training
- ✓ Engage in charitable activities

Membership Eligibility

- ✓ Anyone who has at least an undergraduate or a bachelor's or an equivalent degree in agricultural and/or allied discipline
- ✓ NAPA welcomes and encourages membership from any region or country

Major Disciplines

- ✓ Agricultural engineering
- ✓ Agricultural economics
- ✓ Agricultural education and extension.
- ✓ Agricultural sciences and technology studies
- ✓ Agronomy, plant breeding, biotechnology
- ✓ Animals science, veterinary science.
- ✓ Environmental sciences, natural resources
- ✓ Food sciences
- ✓ Forestry and agro-forestry
- ✓ Horticulture
- ✓ Plant protection
- ✓ Research methods, agricultural statistics
- ✓ Rural social sciences, sociology
- ✓ Sustainable agriculture
- ✓ Others



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