TEXAS TECH UNIVERSITY
Office *of* International Affairs™

International ARIDLANDS Conference

August 13 - 14, 2018
International Cultural Center
601 Indiana Ave., Lubbock, Texas

TEXAS TECH UNIVERSITY
Office *of* International Affairs
ICASALS™

WELCOME

On behalf of Texas Tech University and the Office of International Affairs, I am happy to welcome all of you to the International Aridlands Conference, held on the Texas Tech campus in Lubbock, Texas.

Texas Tech has long prided itself on its focus on issues affecting arid and semi-arid environments, and this conference also showcases the commitment of the university to internationalizing all of its activities. With presenters from Africa, Asia, Europe, and North and South America, this event will forward the discussion of issues such as water availability and use and biodiversity, modern tools such as remote sensing, future impacts of changing climate and land-use, and the role of education in addressing current and future challenges.

We are extremely pleased to host this conference and all of its guests on our campus, and look forward to long-term collaborations in teaching and scholarship of aridlands around the globe.

Dr. Sukant Misra
Vice Provost for International Affairs

THINK GLOBAL
THINK TEXAS TECH

Dr. Sukant Misra is the Vice Provost for International Affairs at Texas Tech University. He oversees the Office of International Affairs, including the new campus in Costa Rica, International Enrollment Development, International Student and Scholar Services, International Research and Development, International Relations, International Grants Administration and International Arts and Culture, and K-12 Global Education Outreach and OIA Operations, as well as the academic center in Sevilla, Spain.

International ARIDLANDS Conference

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August 13 - 14, 2018
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601 Indiana Ave., Lubbock, Texas

Monday, August 13, 2018

8:00 AM	–	Hall of Nations	–	Welcome: Dr. Gad Perry
8:15 AM	–	Hall of Nations	–	Plenary: Dr. Katharine Hayhoe, TTU
9:00 AM	_	Hall of Nations	–	Remote Sensing Session
10:00 AM	–	ICC Galleries	–	Break
10:15 AM	–	Hall of Nations	–	Soil and Land Degradation Session
11:45 AM	–	Hall of Nations	–	Lunch
1:15 PM	–	Hall of Nations	–	Rural Health Session
2:00 PM	–	ICC Galleries	–	Break
2:30 PM	–	Hall of Nations	–	Biodiversity and Restoration Session
3:45 PM	–	ICC Galleries	–	Break
6:00 PM	–	Museum of TTU	–	Reception Poster Session Exhibition Tour

Tuesday, August 14, 2018

9:00 AM	–	Hall of Nations	–	Plenary: Dr. Jacqueline McLaughlin, Penn State
9:45 AM	–	ICC Galleries	–	Break
10:45 AM	–	ICC 105 A, B	–	Water Session
11:45 AM	–	Hall of Nations	–	Lunch
1:00 PM	–	ICC 105 A, B	–	Collaboration Workshop: Teaching
2:30 PM	–	ICC Galleries	–	Break
3:00 PM	–	ICC 105 A, B	–	Collaboration Workshop: Research
4:30 PM	–	Hall of Nations	–	Closing Remarks: Provost Dr. Micheal Galyean Vice Provost for International Affairs Dr. Sukant Misra

Optional Tours | Wednesday, August 15, 2018

8:00 AM	–	Lubbock Landmark | Native Habitat Restoration | Dr. Eileen Johnson
8:00 AM	–	New Deal Farm | Pasture Research | Dr. Chuck West
8:00 AM	–	NSRL | Regional Biodiversity | Dr. Robert Bradley
8:00 AM	–	Engineering | Water | Dr. Venkatesh Uddameri

Plenaries

The conference will have two invited plenary talks. On the morning of the 13th, Dr. Katharine Hayhoe (Texas Tech University, Department of Political Science) will open the conference with her talk, *Mitigate, Adapt -- or Suffer: Connecting Global Change to Aridlands Impacts and Solutions*. On Tuesday the 14th, Dr. Jacqueline McLaughlin (Penn State University Lehigh Valley, Department of Biology) will present *Exposing Students to Environmental Realities: Developing, Implementing, and Evaluating International Course-based Undergraduate Research Experiences (I-CUREs)*. Dr. Hayhoe will unfortunately have to fulfill some other commitments immediately after her talk, but Dr. McLaughlin will be with us for the duration and will also moderate the education-themed collaboration workshop on the afternoon of the 14th.

Mitigate, Adapt -- or Suffer:
Connecting Global Change to Aridlands Impacts and Solutions

Dr. Katherine Hayhoe,
Texas Tech University, Department of Political Science

Climate is changing—throughout Texas, across the United States, and for the planet as a whole. Temperatures are increasing, rainfall patterns are shifting, and extreme precipitation and heat wave events are becoming more frequent. Climate change isn't just a problem for polar bears or future generations any more - it's affecting us, here and now. Not only that, but the choices we make today will have profound impact on our future: the faster we cut our carbon emissions, the less adaptation will be needed, and the more suffering we can avert. In such a politically charged environment, are we still able to act on climate? Or is it too late? Katharine Hayhoe will untangle the complex science connecting our choices to future impacts and highlight the actions that are being taken to combat this critical issue today.

Photo Source: *www.ttu.edu*

Dr. Katharine Hayhoe is an atmospheric scientist whose research focuses on developing and applying high-resolution climate projections to understand what climate change means for people and the natural environment. She is a professor and director of the Climate Science Center at Texas Tech University and has served as a lead author for the Second and Third U.S. National Climate Assessments. Her work has resulted in over 120 peer-reviewed publications that evaluate global climate model performance, develop and compare downscaling approaches, and quantify the impacts of climate change on cities, states, ecosystems, and sectors over the coming century. She has been named one of TIME's 100 Most Influential People and the Foreign Policy's 100 Leading Global Thinkers, as well as one of POLITICO's 50 thinkers, doers, and visionaries transforming American politics and one of Fortune's 50 World's Greatest Leaders. Katharine has also received the National Center for Science Education's Friend of the Planet award, the American Geophysical Union's Climate Communication Prize, and the Sierra Club's Distinguished Service award. She is currently serving as lead author for the upcoming Fourth National Climate Assessment and producing the second season of her PBS Digital Studios short series, Global Weirding: Climate, Politics and Religion.

Exposing Students to Environmental Realities: Developing, Implementing, and Evaluating International Course-based Undergraduate Research Experiences (I-CUREs)

Dr. Jacqueline McLaughlin,
Penn State University Lehigh Valley, Department of Biology

Course-based undergraduate research experiences (CUREs) have emerged as one viable mechanism to increase student access to discovery-based opportunities in STEM. Interestingly, and despite the reported benefits of CURES in post-secondary STEM instruction, most documented CUREs have been developed and implemented in the United States in the traditional classroom. This presentation will: (i) provide a conceptual-practical model detailing the central features of CUREs and a suggested mechanism for their implementation; (ii) offer two vignettes of international CUREs (I-CUREs) focused on water issues in China that have been successfully implemented through short-term study-abroad experiences using the above model; and, (iii) offer recommendations for the development, implementation, and evaluation of I-CUREs. Collectively, these objectives are designed to foster conversation around how to best create undergraduate international experiences that engage students in real-world conservation realities through rigorous and relevant scientific research.

Photo Source: *https://news.psu.edu*

Dr. Jacqueline McLaughlin is best known for her endless enthusiasm for science, tireless devotion to conservation, and fervent passion for teaching and undergraduate research. She is an Associate Professor of Biology at Penn State Lehigh Valley where she has been educating undergraduates both formally (classroom) and informally (in the field) for nearly 25 years. To her credit, she is the Founding Director of Connecting Humans and Nature through Conservation Experiences (CHANCE), Penn State's award-winning, international environmental education program with over 50 governmental, non-governmental, academic and corporate partners and/or collaborators around the world. She has developed and led research intense, study abroad programs to Alaska, Australia, China, Costa Rica, Cuba, Ecuador, Galapagos Islands, Panama, Peru, and Tanzania. She has been bestowed numerous awards for her excellence in teaching, research, and service including the most recent 2017 Higher Education Environmental Educator of the Year from the North American Association of Environmental Education and a 2017/18 term as a National Academies Jefferson Science Fellow, serving as a science advisor on foreign policy and international development issues to the United States Department of State. For the last ten years, she has also been a visiting professor at Jiangnan University, Wuxi, China.

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Day 1
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Monday, August 13, 2018

Abstracts for Remote Sensing Session
International Aridlands Conference, Lubbock, Texas, USA
13 August 2018, 9 -10 AM
Hall of Nations

Moderator: Dr. Carlos Portillo-Quintero, TTU

Human Health and Green Infrastructure

Eric A. Bernard
Department of Landscape Architecture, Texas Tech University, College of Agricultural Sciences and Natural Resources, Lubbock, Texas, USA

Healthy human populations are key in economic health and development and minimizing financial burdens on individuals, governments, and NGOs (NIH, 2011). Green infrastructure has been shown to have positive effects on mental and physical health, and environmental quality issues related to air, soil and water. As populations have shifted from rural to urban locations and mega cities become more common (UN DESA, 2018), peoples' access to nature and green infrastructure has changed, been limited or eliminated. The Trust for Public Land's ParkServe® platform (https://ParkServe.tpl.org) maps parks and 10 minute walk access to parks for over 13,000 urban areas in the United States. The platform also provides optimized locations for new parks for populations most in need of park access to improve human health. These locations should be evaluated to understand human environment interactions and maximize opportunities to incorporate green infrastructure in new parks. This presentation illustrates aspects of remote sensing in the ParkServe® platform development, and proposes leveraging web mapping and analytical products of ParkServe® toward future park developments to maximize green infrastructure capacity to further improve human and environmental health.

The Ecological Response to the Interaction of Streamflow and Groundwater

Tie Liu
Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi, PEOPLE'S REPUBLIC OF CHINA (liutie@ms.xjb.ac.cn)

Because arid land receives less precipitation to feed the nature ecosystem, the local ecosystem directly depends on the groundwater and indirectly relies on nearby streamflow. In order to accurately describe the relationship between water allocation and ecosystem, this study carried out a hydrological simulation which can combine the bi-directional link between streamflow and the groundwater to describe the response of cumulative LAI to groundwater resources temporally and quantitatively. The spatial changes in land use and LAI were implemented in the MIKE-SHE model. As results, the cumulative LAI has corresponding trends with the change of local groundwater resources with considerable delay. As the conclusion, a question is raised whether the restoration initiative is a short-duration action which just wastes water resources by evaporation of a large fraction of the available water through lake storage. Nevertheless, the increase in groundwater level is more sustainable and beneficial for the restoration of the ecological systems along the lower Tarim River.

Remote Sensing of Neotropical Dry Forests: Insights from a Decade of Research

Carlos Portillo-Quintero[1] and **Arturo Sanchez-Azofeifa**[2]
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[2]Department of Earth & Atmospheric Sciences, University of Alberta, CANADA

The tropical dry forest (TDF) is a forest ecosystem with compositional and functional adaptations to months of scarce rainfall. TDF has had a close relation to human cultural and economic development in the Neotropics as a source of fertile lands, food and water resources, and in consequence, its degrees of legal protection are low or absent in most regions. Only 44 % of the original TDF is left in the Americas. Remnants of what were once large continuous tracts of forest cover in lowlands, and submontane areas are now highly fragmented across the subcontinent and under high anthropogenic pressure. But TDF still sustains important levels of biodiversity and carbon storage capacity, plus cultural and aesthetic values to indigenous and post-colonial societies. In this presentation, I will summarize results and insights from work within the Tropi-Dry Collaborative Research Network (http://www.tropi-dry.org/), an international effort to document and understand ecological processes and human dimensions of this endangered ecosystem. The presentation will be centered on discussing applied remote sensing research for understanding the ecosystem's current distribution, land cover dynamics, conservation status and response to climate change. I will discuss lessons learned and its implications for remote sensing of drought-adapted ecosystems in tropical and subtropical regions.

Application of Unmanned Aerial Systems for Estimating Soil Water Content in the Southern High Plains

Abir Raihan[1], **Wenxuan Guo**[1], **Sanjit Deb**[1], **Zhe Zhu**[2], **Jasmine Neupane**[1], **Zhe Lin**[1], **Yazhou Sun**[1], and **Charles P. West**[1]
[1]Department of Plant and Soil Science, Texas Tech University, Lubbock, Texas, USA

[2]Department of Geoscience, Texas Tech University, Lubbock, TX, USA

Estimating soil water content is critical for decision support of effective irrigation management. The integrated application of multispectral and thermal sensors can provide valuable information of soil moisture at various temporal and spatial scales. In this study, images from a multispectral sensor and a thermal sensor onboard an unmanned aerial system were obtained acquired from a drip-irrigated field and a center pivot irrigated field. Preliminary results showed that UAS images can estimate soil water content with reasonable accuracy.

Abstracts for Soil and Land Degradation Session
International Aridlands Conference, Lubbock, Texas, USA
13 August 2018, 10:15 - 11:45 AM
Hall of Nations

Moderator: Dr. Chuck West, TTU

Possible Changes in Land Use on the Texas High as Water Availability from the Ogallala Aquifer Declines

David Brauer
Manager of the Ogallala Aquifer Program, Acting Laboratory Director, Cropping Systems Research Laboratory, Lubbock, Texas, and Conservation and Production Research Laboratory, Bushland, Texas, USA

Advances in well and irrigation technology and the presence of the Ogallala Aquifer enabled farmers to expand irrigated acres on the Texas High Plains after the drought of the 1950s. Irrigated acres increased until the mid-1970s but has declined since. The decline in irrigated acres is associated with decreases in water availability from the aquifer with estimates that peak water withdrawals occurred in the early 2000s. Predictions are that areas capable of irrigating crops will continue to decreases as the 21st century progresses. Understanding the economics of current land use may provide insights into future land use as acres that are currently irrigated are re-tasked to other uses. Analyses tend to indicate that dryland farming is more profitable and has better safety nets than ranching. Therefore, many of the irrigated acres may revert to dryland crop production. Farmers in many of the Texas counties over the Ogallala Aquifer receive significant income from easements/leases as part of the Conservation Reserve Program (CRP). Many of these leases/easements started in the 1990s and have been renewed for a second 15 year lease. It is unlikely that all of these acres will remain in CRP through the 2020s because of decreases in the total acres for enrollment and changes in the priority matrix that favor installation for water quality issues. The effects of these changes in land use are likely to affect the overall farm economy especially in those areas in which income is more from crop production than livestock operations.

Comprehensive Improvement and Utilization of Saline-Alkali Soil in Arid Area by Halophyte

Wenxuan Mai
Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi,
PEOPLE'S REPUBLIC OF CHINA (maiwenxuan@sina.com)

Soil salinization is a common problem in arid regions all over the world. The area of saline-alkali soil in Xinjiang reaches 4035 * 104 ha, accounting for 40.7% of the total saline-alkali soil area in China. Therefore, the scientific improvement and rational utilization of saline-alkali soil are crucial for sustainable development of agriculture and ecological construction in Xinjiang. However, with the increasing shortage of water resources, the traditional management mode such as "use water for leaching salt" is difficult to continue. On the other hand, Xinjiang has a rich source of halophyte, that about 320 species were found. Euhalophytes are considered as a promising tool for bio-improvement of saline-alkali soil, and the "absorbing salt from soil and hindering salt accumulating

in the upper soil profile" are the main mechanisms involved in this process. We have screened some of the Euhalophytes, and have achieved high-yield cultivation combined with drip irrigation, which can take away a large amount of salt from the soil (such as the *Suaeda salsa* can take about 4800 kg salt per hectare), and the halophyte planted has good application value; for example, Suaeda salsa can be used as forage grass. But with the deepening of research, we found these mechanisms cannot fully explain the euhalophyte's biological improvement effect. We speculate that the rhizosphere processes of euhalophytes may play an important role in bio-improvement of saline-alkali soil, but the related research is still limited, so, we hope to further study the rhizosphere process of Halophytes in the future.

Irrigation Rates, Soil Physical Properties and Topography Effects on Cotton Yield in the Southern High Plains

Jasmine Neupane[1], Wenxuan Guo[1], Fangyuan Zhang[2], Sanjit Deb[1], Zhe Lin[1], Abir Raihan[1], Yazhou Sun[1], and Charles P. West[1]

[1]Department of Plant and Soil Science, Texas Tech University, Lubbock, Texas, USA

[2]Department of Mathematics and Statistics, Texas Tech University, Lubbock, Texas, USA

With the depletion of the Ogallala Aquifer, more intensive management of water resources for irrigation is critical for sustainable crop production and economic viability in the Texas High Plains. A study was conducted in a 195 ha field to determine how cotton yield was affected by irrigation rates, soil physical properties, and topography in the Texas High Plains in 2017. Three irrigation rates with two replications were applied across the entire field. Soil apparent electrical conductivity, slope, soil physical properties and yield data were collected. Although cotton yield was not significantly different for different irrigation rates, it was significantly different among different topographic positions, electrical conductivity and soil properties. Cotton yield was positively correlated to soil apparent electrical conductivity and negatively correlated to slope and sand content. The interaction of topography and soil properties affected cotton yield given the same amount of irrigation. The results of this study indicated that variable rate irrigation can improve optimization of crop production.

Identifying Soil Properties Using Proximal Sensors in the Southern High Plains

Yazhou Sun[1], Wenxuan Guo[1], David Weindorf[1], Fujun Sun[2], Sanjit Deb[1], Zhe Lin[1], Jasmine Neupane[1], Abir Raihan[1], and Charles P. West[1]

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[2]College of Land and Environment, Shenyang Agricultural University, PEOPLE'S REPUBLIC OF CHINA

Efficiently quantifying spatial variation of soil properties is a prerequisite for site-specific management of soil and crops for optimized crop production. Application of proximal sensing provides a useful tool for monitoring soil properties at different spatial scales. In this study, 230 soil samples were collected from a 190 ha field in the Southern High Plains in 2017. These samples were scanned using two proximal sensors (portable X-ray fluorescence (PXRF) and visible near-infrared diffuse reflectance spectroscopy (Vis–NIR DRS)). We analyzed the relationship between soil properties using laboratory analysis and the scanning results from the PXRF and VisNIR instruments. Preliminary

results indicated integrating spectral reflectance and proximal sensing data can effectively quantify spatial variation of soil properties with reasonable accuracy.

Dryland Soil Management for Cropping in the Semi-Arid Texas South Plains

Calvin Trostle
Texas A&M AgriLife Extension Service, Lubbock, Texas, USA

The Texas South Plains is a semi-arid region of West Texas with annual median rainfall of 400-500 mm. Much of the region's agriculture is dependent on the Ogallala Aquifer for irrigation. But the trend is toward a return to predominantly dryland agriculture as the aquifer declines. Most dryland cropping practices rely heavily on tillage to form deep furrows to protect against wind erosion. Organic carbon (C) is ≤0.5% in most cases. Soils are mostly sandy loam and even some loamy sand texture. The objective is to describe suggested practices to manage this dryland farmland sustainably and also to produce enough income to justify farming. The alternative is to seed the farmland back to permanent grass pasture. Suggested practices include crop rotation with crops that produce more residue than cotton as well as the limited implementation of some cover cropping coupled with reduced tillage. These practices can stabilize the soil resource and reduce erosion. With proper management and improved farming practices for highly drought tolerant crops of cotton, guar, and hybrid pearl millet, sustainable crop production can be achieved.

The Arid Climate of the Department of Tarija and the Region of Its Central Valley, Impact on the Environment and Future Economic Growth

Jaime Villena Morales and David Stolpa
Departamento de Ingenierías y Ciencias Exactas, Universidad Católica Boliviana "San Pablo"
Unidad Académica Tarija, BOLIVIA

The climate of the Central Valley of Tarija in southern Bolivia is considered to be semi-arid based on precipitation and temperate based on average extremes in temperature. The Central Valley is drained by the Guadalquivir River and its tributaries. The climate of a region can impose certain limitations on economic growth, but other factors such as the proximity to trade routes and the presence of other valuable natural resources can also influence. The human (pre-Columbian indigenous) population of the Central Valley was sparse. The population increased during the Spanish conquest when the area was settled and the City of Tarija was established in 1574 as a fort to protect the trade route to the south from the Chiriguano Indians. The population remained fairly static but did exhibit slow steady growth. The predominant economic activity was self-sustainable agriculture with small family plots clustered around water. Many of these small plots included vineyards that produced wine mainly for local consumption, but some commercial production, although small and unorganized, did exist. Tarija was considered "remote," and trade was limited by a poor, sparse transportation network. The relationship between the human activity in the Central Valley and the environment was ideal for some time. However, abuse to the environment started during the colonial times with gradual deforestation to provide timber for the mines of Potosi and overgrazing near population centers. Combined, these two abuses resulted in the development of badlands that were susceptible to erosion. Three milestones marked a change in the status quo. The first was the birth of the commercial wine industry in the Central Valley in 1963.

The second was the construction of San Jacinto Dam and Reservoir (1996). The two together represented a potential start for planned, sustained growth. The third milestone was the discovery of gas reserves in eastern Tarija in the late 1990s. The inrush of money and uncontrolled growth simply overwhelmed the poorly prepared national and local government officials. The result is an environment that is more stressed than ever especially in regard to the demand for water that the climate may not be able to provide. This paper provides a case study on the climate, its impact on the environment and economic activity of Tarija, and a prognosis for the future.

Abstracts for Rural Health Session
International Aridlands Conference, Lubbock, Texas, USA
13 August 2018, 1:15 - 2:00 PM
Hall of Nations

Moderator: Dr. Mary Murimi, TTU

ACCION for Rural West Texas

Theresa Byrd, Liesl Wyett, and Ron Cook
Department of Public Health, Texas Tech Health Sciences Center, Lubbock, Texas, USA

ACCION is funded by the Cancer Prevention Research Institute of Texas (CPRIT) and includes no cost community education, Fecal Immunochemical Tests (FIT) and colonoscopy testing, and patient navigation. Trained community health workers (CHWs) provide education and FIT for uninsured residents of 9 rural counties in west Texas. A patient navigator conducts reminder calls for FIT return, and schedules those with positive FIT or with a strong family history for colonoscopy. Strong community partnerships with rural Federally Qualified Health Center (FQHCs), churches, food banks, and other community-based organizations have facilitated the project. Colonoscopies are provided by one gastroenterology group in Lubbock, with plans to add rural clinics and hospitals who agree to do colonoscopy in their counties. To address the distances and costs of travel for recruitment, we have instituted a patient referral system with all of our partner organizations, primarily our rural FQHCs. ACCION has (since January 2016):

- Provided 1881 FIT
- Achieved a FIT return rate of 61%
- Completed 174 colonoscopies
- Removed 212 Adenomatous Polyps
- Found 3 Cancer-positive patients, all now successfully navigated to cancer treatment

We have developed strong connections with our community partners and expanded the number of colonoscopy providers partnered with our program. Because of our partnerships, especially with providers and FQHCs in our area, we have been able to focus on the national screening initiative of The National CRC Roundtable (NCCRT). This initiative, “80% by 2018”, challenges providers to screen 80% of all eligible individuals by the year 2018. Provider partnership with our program is helping to reach and exceed this national goal.

Rural Illness and Poverty in Arid Lands: Case Studies of Northwest China

Hongru Du[1], Lu Zhang[1]

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[2]University of Chinese Academy of Sciences, PEOPLE'S REPUBLIC OF CHINA (zhanglu113@mails.ucas.ac.cn)

The purpose of our study is to clarify the linkages between rural illness and poverty by offering an objective review of field survey in arid lands of Northwest China. On the one hand, due to the arid climate, air pollution and water pollution have led to an increment in the incidence of waterborne and foodborne illnesses. What's worse, increased droughts have led to increased risks of agricultural and livestock production and thus caused the shortages of food and water resources. On the other hand, influenced by both economic and traffic development, some villages have less contact with the outside world and stay in the relative closed state. As a result, congenital illness caused by consanguineous marriage is widespread in those villages. Affected by the above reasons, the health status of peasants in Northwest China has been declining. What's worse, treatment cost and the lack of labor caused by illness and disability have increased burdens on families and thus affected household incomes and caused families to become poorer. Furthermore, peasants who have already lifted themselves out of poverty might return to poverty again due to occurrences of acute or chronic illness. Our study shows that illness is the primary driver for households to return to poverty. As a result, sustainable poverty alleviation is proposed in our study. For instance, the incidence of diseases is expected to be reduced by constructing rural infrastructure and covering serious illness insurance. Moreover, an industrial poverty alleviation strategy to increase sustainable household income is necessary.

Reaching the Rural Somali Pastoralists with the Gift of Eyesight: Mobile Eye Clinic Project in Ethiopian Somali Regional State

Abdulaziz Ibrahim[1], Anbissa Muleta[2], and Natnael Tadesse[2]

[1]President, Jigjiga University, ETHIOPIA

[2]Jigjiga University, ETHIOPIA

The prevalence of blindness in the Somali region, according to 2006 national survey, is 5.0% and low-vision is 9.7% which is the highest in Ethiopia. The main causes of blindness in the Ethiopian Somali region were found to be cataracts, trachoma, glaucoma, and refractive errors. We sought to provide excellent eye services to needy and poor people who cannot afford the cost associated with cataract operations. By developing a team of health workers equipped with skills and the necessary medical equipment to carry out campaigns on eye care, and conduct cataract operations, combat causes of blindness and conduct follow-up of visits to the project beneficiaries. About 41 pastoral districts out of 93 districts have benefited with a total population of 38,950 beneficiaries. A total of 10,250 cataract surgeries were performed, 6,150 corrections of vision with eye glasses were performed, and 12,300 other related treatments performed as needed. Challenges include low or poor health facilities to perform surgery at the rural health centers and lack of transportation for the pastoralist community to access service; the lack of electricity in the rural areas and low or lack of follow up after the cataract surgery; and providing adequate training for health professionals working at pastoral health centers to at least identify

cataracts early. Project goals include conducting assessment in the areas covered by the eye clinic to document the effectiveness of the service and respond to problems developed after the cataract surgery is performed, and by providing health education to pastoral community on ways to prevent cataract, eye infection, and trachoma.

The Association between Household Food Insecurity (HHI) and Children Nutrition and Health Status in Shebelle zone, Ethiopian Somali Regional State

Hyunjung Lee[1], Mary Murimi[1], Abdulaziz Ibrahim[2], Anbissa Muleta[2], Natnael Tadesse[2], and Seile Yohannes[2]

[1]Department of Nutritional Sciences, Texas Tech University, Lubbock, USA

[2]Jigjiga University, ETHIOPIA

The prevalence of undernutrition among children in the Somali region of Ethiopia is the highest in the country with 23 percent of children wasting as compared to 10% at the country level. In addition, 42 percent of Somali region is registered as food insecure due to prolonged drought. Despite the high prevalence of undernutrition and food insecurity, there is scare research that has been conducted in the Somali region to examine the interactions between underlying factors of child undernutrition. We sought to determine the levels of food insecurity among pastoralists and the association between poor water and hygiene conditions (WASH) and nutritional status of the targeted population. The cross-sectional study was conducted among pastoralists in the Shebale zone in June, 2018. Household Food Insecurity Access Scale, Dietary Diversity, WASH, and demographic questionnaires were used. Participants were mothers and their children under five years who are permanent residents of the Shebale zone. Descriptive statistics will be used to examine the frequency of distribution of the study's primary independent variables (HHI and WASH), and dependent variables (childhood stunting, wasting and underweight). Multivariate logistic regression will be performed to assess the association between household food insecurity, WASH, and nutritional status. Our findings will help to develop preventive nutrition intervention incorporating the environmental factors of WASH, based on its regional risk factors of child undernutrition in the study area.

Training Ethiopian College Instructors in a Constructivist Approach to Early Childhood Education: Successes and Challenges of a Cross Country Approach

Stephanie Shine[1], Yigzaw Haile[2], Beide Malaku[3], Della Frye[4], and Helen Jennings[1]

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[2]College of Education and Behavioural Studies, Jigjiga University, ETHIOPIA

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[4]Director of Early Childhood Programs, Midland Independent School District, Texas, USA

The period from birth to eight years is considered to be the foundation of human development, greatly impacting children's health, growth, and well-being. According to the National Scientific Council on the Developing Child (2007), children who are exposed to "rich language, positive social interactions, and early literacy" are more likely to develop the brain architecture needed to

succeed in school. Developing countries have been working proactively to develop high quality early childhood education (ECE) to promote children's development, learning, and school readiness, and to use ECE as a strategy to reduce long-term poverty. The Ethiopian government is increasingly devoting attention to strengthen and improve the quality of early childhood education, particularly in the training of effective early childhood teachers. To address the need for high quality pre-primary education in government funded schools in Ethiopia, a team from Texas Tech University and Jigjiga University joined with the Ethiopian Ministry of Education to produce professional development for 63 instructors from Colleges of Teacher Education (CTE) across the country. The focus of the professional development was a constructivist approach to early childhood education. While many aspects of a constructivist approach have been adopted by the Ministry of Education, there has been little opportunity for hands-on training. A gradual release model was used to encourage the CTE instructors to take on increased responsibility for designing schedules, classroom environments, materials, and activities appropriate for pre-primary classrooms. In our presentation, we describe the successes, challenges, and next steps of this unique cross-country and cross-cultural collaboration.

Abstracts for Biodiversity and Restoration Session
International Aridlands Conference, Lubbock, Texas, USA
13 August 2018, 2:30 - 3:45 PM
Hall of Nations

Moderator: Dr. Kerry Griffis-Kyle, TTU

Comparative Dispersal and Survival of Fledgling Golden Eagles in Two Arid Regions of North America

Clint Boal[1], Natasia Mitchell[2], Dale Stahlecker[3], Robert Murphy[4], and Ben Skipper[5]

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Little ecological information is available for Golden Eagles *(Aquila chrysaetos)* in the southern Great Plains and Trans Pecos regions of North America. In 2015 and 2016, we used GPS transmitters to assess the survival rates, dispersal patterns, and habitat associations of 21 fledgling eagles. Survival across the first six months ranged from 72 – 80%, with first year survival of 60%. Sex had no influence on survival, but there was a temporal affect with 50% of mortalities occurring during the first two months. Home range sizes were highly variable between cohorts, with an average 15,137km^2 during the first 6 months for the 2015 cohort but only 3,070km^2 for the 2016 cohort. Further, eagles in the southern Great Plains had a substantially greater risk of encountering wind energy facilities than those in the Trans Pecos. We found 39% and 72% of the marked

eagles in the southern Great Plains had home ranges that overlapped, respectively, 5km and 50km buffers around turbine fields; the closest approach detected by GPS locations was 10m. In contrast, the closest any marked eagle from the Trans Pecos approached a wind energy center was 86km. We suspect topography and dominate land cover in the different regions of origin were highly influential on home range and habitat associations. Eagles in the Trans Pecos appear to be more sedentary due to the favorable habitat conditions of remote and contiguous arid grasslands situated between rugged mountain ranges. Eagles in the southern Great Plains are highly mobile due to the dispersed availability of foraging areas among a landscape dominated by crop and livestock production; however, this mobility may lead to higher encounters with risk factors such as wind energy centers.

Restoring Diverse Plant Communities in Arid and Semi-arid Lands

Robert Cox

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Large-scale restoration in arid and semi-arid landscapes is often constrained by time, money, technology, or all three. Among other effects, these constraints especially limit the potential diversity of the restored plant communities. For example, most of the species in an area are relatively uncommon, but seeds, propagules, or transplants of uncommon plants often are not readily available for restoration projects, thus requiring more time or money to procure. In addition, seeding or planting a diverse mix of species might require either more specialized equipment, or more time to plant by hand, than planting a less diverse mix. Therefore, accomplishing higher-diversity restoration plans often requires more money, time, or inputs of technology than lower-diversity plans. Resolving these constraints requires creativity in designing novel solutions and a thorough understanding of the limiting factors at each site. Nevertheless, site-specific case studies can aid in the development of some general principles for increasing diversity in restoration efforts in arid and semi-arid landscapes. We review several case studies regarding restoring plant diversity in arid and semi-arid landscapes, and then discuss general principles for including higher diversity in restoration plans for these areas.

Effects of Climate Change on Ecosystems Through Directional Changes in Amount and Variability of Precipitation

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Climate change will result in directional changes in precipitation and temperature leading to warmer and drier arid and semiarid ecosystems. In addition, Climate change will result in increased precipitation variability with more extreme events. Major droughts and floods will become more frequent as a result of the increase in greenhouse gas concentration, as predicted by models and as already observed in several regions around the world. There will be larger precipitation events interspersed with longer periods of droughts within a year, and there will be sequences of extreme dry years followed by multi-year extremely wet periods.

Here, I will report on long-term experimentation in the grasslands of the South West USA. A twelve-year rainfall manipulation study showed that ecosystem responses depend on the time of exposure to chronic resource alterations. Difference in total aboveground net primary production (ANPP) among precipitation treatments increased within the first three years of manipulation. Sustained drought or wet years had different effects on grass and shrub ANPP with grasses accounting for most of the change in total ANPP. On the contrary, shrub ANPP had little or no response to changes in water availability until the last two years when, unexpectedly, shrubs under drought treatment show significant increases. The years 2013 and 14 were wetter than the previous 4 years, but grasses that had been exposed to drought for 6 years were not able to respond to this increase in soil water suggesting that grasses have crossed a threshold and lost their ability to respond to an increase in precipitation. Results from our enhanced-precipitation variability experiment showed a strong negative effect of precipitation variability on total ANPP even though precipitation mean remained constant, and this effect increased through time. Surprisingly, increased precipitation variability benefited shrubs, but their positive response was overshadowed by the negative response of grasses. The enhanced precipitation variability treatment increased species diversity, particularly the evenness component.

Could a Failure in a Post-mating Isolation Protein Allow Hybridization in Deer Species in Texas?

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White-tailed deer (*Odocoileus virginianus)* and mule deer *(Odocoileus hemionus)* occur naturally in Texas. Hybridization is thought to commonly occur between these two species in the Trans-Pecos region and along the edges of the Llano Estacado. Given that hybridization occurs, perhaps the molecular mechanism that serves as a post-mating isolation barrier fails, allowing the two species to mate. One of the genes involved is zonadhesin (ZAN), a sperm protein that is crucial in species-specific binding of the spermatozoa with the zona pellucida of the egg during fertilization. ZAN is the only mammalian protein which shows species specificity across multiple taxa and may act as a potential post-mating isolation mechanism that prevents two species from interbreeding. If the ZAN pathway fails and no longer serves as a barrier for reproductive isolation, then presumably the sperm cell of one species is able to recognize the egg cell of the other species, allowing fertilization to potentially occur. The focus of this study is to evaluate ZAN, a candidate gene that acts as a post-mating isolation barrier, relative to gametic specificity. ZAN sequences will be analyzed for differences (nucleotide and amino acids) between hybridizing taxa. Furthermore, ZAN sequences of parental and hybrid individuals will be generated to study the level of divergence to determine if the presumptive failure of ZAN allows introgression to occur. Additional molecular markers will be utilized to develop a multi-locus genotype, which will determine the directionality and level of introgression (F1, backcross, multi-generation backcross) between the two deer species.

The Biological Soild Crusts in Central Asia and its Relationship with Vascular Plants in a Typical Temperate Desert

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Factors that influence plant community composition have long been sought by ecologists, and the concept of assembly rules has influenced much recent thought. The first step in plant establishment is successful seed dispersal/germination, and identifying controls in this stage is critical in understanding drivers of vascular plant community structure. Most studies examine how disturbance and plant-plant/plant-animal interactions affect assembly rules. However, we suggest that in drylands, plant-biocrust-disturbance interactions determine plant community composition by controlling what seeds enter the soil bank. We compared plant and seedbanks composition on four surface types (uncrusted, cyanobacteria, lichen, and moss). We also characterized seed weight, size, or plant life form; none of these factors influenced plant community or seedbank composition on the different surfaces. We observed that the highest diversity and richness of plant species and seeds in the seed bank was found on recently disturbed areas that were either uncrusted or covered by early successional cyanobacterial crusts, whose low biomass has little influence on soil characteristics. In contrast, diversity and richness of plants and seeds in the seedbank dropped significantly in late successional lichen- or moss-covered soils due to the lack of plant seeds with appendages. Lichens and mosses greatly stabilize, while reducing permeability of, soils, reducing the opportunity for seeds to be buried. However, disturbance readily resets biocrusts to an early successional state. We propose that the structure, and thus function, of this dryland region is substantially influenced by the tension between the forward forcing of biocrust succession and the backward forcing of disturbance that creates a shifting mosaic of patches with different plant, biocrust, and soil characteristics through time and space and across multiple scales. Therefore, we posit that the interaction between biocrusts and disturbance is an underlying assembly rule for this, and likely most, temperate deserts.

Evening at the Museum

MUSEUM
OF TEXAS TECH
UNIVERSITY

The *Museum of Texas Tech University* has graciously agreed to co-sponsor the conference by hosting the evening event between 6-8 pm on the 13th of August. The Museum is closed to the general public at that time. The evening's events will include our poster session, access to the Museum with emphasis on two special exhibits focused on arid lands, and a no-host reception. The museum is located at 3301 4th Street, Lubbock, TX 79415, on the edge of campus and next to the International Cultural Center, where the rest of the Conference will be located.

Poster Session

Presenters are invited to hang their posters starting at 5:45 pm. Poster boards will be provided, and so will push-pins. Each poster needs to be vertical in orientation (longer than it is wide). Please make sure that each poster is no wider that 36 inches / 90 cm and no longer than 48 inches / 125 cm. If you have already printed a poster that has different dimensions, please contact Gad Perry (Gad.Perry@ttu.edu) as soon as possible so we can plan to accommodate you. We ask that presenters plan to spend the time between 7-8 pm by their poster, so other attendees can discuss the work with them. Please plan on taking down your poster at 8 pm, as the museum galleries have to be ready for regular visitors the next morning.

Special Exhibits

Information about our venue, the *Museum of Texas Tech University*, is available at *http://www.depts.ttu.edu/museumttu/*. In addition to their regular exhibits, two special displays are perfectly timed to coincide with our conference. *Grasslands of North America and Africa* uses taxidermy specimens, photographs, and videos to illustrate the kinds of mammalian biodiversity present in grasslands. Topics that have the potential to have a major interest to the Lubbock community and conference participants, such as dustbowls, biodiversity in a monoculture agricultural system verses biodiversity in a grassland, the role of hunting, and the official Texas bison herd, are presented in order for our visitors to learn more about our local grasslands and what they can do to help preserve and promote grassland conservation. More about the exhibit is at *http://www.depts.ttu.edu/museumttu/exhibitions/2018/grasslands.php*. *The Art and Science of Restoration Ecology* is the result of a unique collaboration between two Texas Tech University faculty, one a restoration ecologist and the other from the School of Art. It examines the way a graduate art and an ecology course combined to develop an understanding of how art can help to encourage the process of ecological restoration and how ecological restoration can be an inspiration for art. Both professors and their students will be on hand to discuss the project. More about the exhibit: *http://www.depts.ttu.edu/museumttu/exhibitions/2018/artecology.php*.

Reception

A variety of hors d'oeuvre and non-alcoholic drinks will be offered during the event. This will be an informal, no-host opportunity for conference attendees to mix and discuss shared interests.

Abstracts for Poster Session
International Aridlands Conference, Lubbock, Texas, USA
13 August 2018, 6 - 8 PM
Museum of Texas Tech

Low Impact Development in Arid/Semi-Arid Climates: A Residential Case Study in Albuquerque, New Mexico

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Department of Landscape Architecture, Texas Tech University, College of Agricultural Sciences and Natural Resources, Lubbock, Texas, USA

Development policy, construction practices and social-cultural preferences are highly variable in the arid to semi-arid southwestern US and have significant impacts on sustainability, adaptability and resilience. Santa Fe, NM and Tucson, AZ are progressive communities in planning, development and construction policies successfully reducing per capita water use while maintaining a local ecosystem and aesthetic identity. These two communities account for only 5% percent of 2000 census populations of Arizona, New Mexico and west Texas. This residential case study aimed to understand options and possibilities for low impact development for housing/residential development for the 95% of people living outside progressive policy areas. Project goals were to understand: development and building policy, accepted and market preferred residential construction practices, options to achieve net zero energy use, green roofs with native plant options, gray water use to achieve limited irrigation, and stormwater management to achieve zero runoff. The residence is located in the Mesa Del Sol development south of the Albuquerque Sunport (airport) and conformed to Mesa Del Sol Master Plan and Community Design Guidelines and became Albuquerque's first: permitted gray-water residence, solar powered house on the US Smart Grid, and Zero Runoff lot, residential native plant green roof.

Insect and Soil Microbial Community Size in Native and Introduced Pastures

Krishna Bhandari, C.P. West, S.D. Longing, and V. Acosta-Martinez
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The decline in water supply for irrigation in the Texas High Plains is encouraging some growers to produce dryland grasses for cattle. 'WW-B.Dahl' Old World bluestem [OWB, *Bothriochloa bladhii* (Retz) S.T. Blake] is a drought-tolerant grass in dryland and limited-irrigation conditions. This grass reportedly repels red imported fire ants (RIFA, *Solenopsis invicta Buren*); however, reactions of insect pollinators and soil microbes associated with OWB have not been investigated. We compared ground-active insects and insect pollinators over 3 yr, and soil microbes at 0–5 cm and 10–15 cm depths in June and December of 2016 in OWB, OWB-alfalfa (*Medicago sativa* L.), alfalfa and native mixed grass pastures. Pastures containing OWB had fewer ($P<0.01$) ground-active insects than the alfalfa and native mixed grasses. Numbers of red imported fire ants and harvester ants (*Pogonomyrmex* spp.) were greatest in the native mix and near zero in pastures containing OWB. OWB always had the lowest insect pollinators although not always statistically significant. Soil microbial biomass carbon (MBC) describes the total size of the soil microbial community.

OWB-alfalfa had higher number of MBC, although pasture treatments differences were not always statistically significant. The presence of OWB apparently provided an unfavorable environment for colonization by fire ants and harvester ants while still favoring soil microorganisms. OWB had a minor negative effect on insect pollinators. Strong deterrence of harmful ants promotes resilience of OWB stands. OWB is a desirable grass in the Southern Great Plains because of its drought tolerance and deterrence of harmful ants.

Glyphosate and Glyphosate-Based Herbicides Stimulate Growth of Prymnesium Parvum, a Toxic Bloom-Forming Microalga

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Aquatic habitats of the southwestern United States, an arid/semiarid lands region, are among those most severely impacted in North America by toxic blooms of the microalga, *Prymnesium parvum*. Glyphosate-based herbicides (GBHs) are widely used around the globe and in the US; they rank first for agricultural use and second for household use. Certain species of harmful algal bloom-forming cyanobacteria are not only tolerant to, but their growth can be stimulated by GBHs. This study examined the growth response of *P. parvum* to technical-grade glyphosate and two GBH formulations [Roundup Super Concentrate (SC) and Roundup Ready-to-Use (RtU)] at low, environmentally relevant concentrations. The results showed that glyphosate and GBHs in fact stimulate growth of *P. parvum* at concentrations as low as 10 µg l-1 (in SC). At equivalent concentrations of glyphosate, the response to SC (inactive ingredient = 50%) was more vigorous that the response to RtU (inactive ingredient = 98%), suggesting that the higher level of inactive ingredient (or additional constituents) present in RtU interfere with the ability of glyphosate to stimulate growth. Results of this study indicate that management strategies for *P. parvum* bloom prevention or control need to consider the possibility that runoff discharge or direct applications (e.g., to control aquatic plant infestations) of GBHs to surface waters may be contributing to the development of harmful algal blooms and the degradation of aquatic habitats.

Can Interseeded Alfalfa Deplete Water in Semiarid Grassland?

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Interseeding alfalfa *(Medicago sativa L.)* can improve grasslands by adding a high-protein species but runs the risk of soil water depletion. The objective of this research was to evaluate effects of cultivar and row spacing on volumetric soil water content and leaf water potential ($\Psi leaf$) of two upright-type alfalfas, WL440HQ, Numex Bill-Melton, and prostrate-type Falcata-Rhizoma blend, no-till interseeded into blue grama (*Bouteloua gracilis* Willd.), sideoats grama (*Bouteloua curtipendula* Michx.), buffalograss (*Bouteloua dactyloides* Nutt.), and green sprangletop (*Leptochloa dubia* Kunth.). Water content was measured weekly in 2017 by using a portable capacitance probe in a clay loam soil near Lubbock, Texas. Midday $\Psi leaf$ between 1200 and 1400 h was monitored weekly

from August to October for grass and alfalfa using a pressure chamber. Forage was harvested in June, July, August, and October. Soil water content was significantly greater at 71-cm row spacing (lower alfalfa density) than at 36-cm row spacing between two harvests, from mid-June to mid-July, last week of July to mid-August, first and third week of September, and 3 d after the October harvest owing to lower moisture depletion in wider row spacing. However, soil water content was not affected by cultivar on any dates. Soil water content was reduced significantly by adding alfalfa compared with the no-alfalfa control during above-mentioned time windows that matched active alfalfa growing periods. Midday alfalfa Ψ_{leaf} was more negative at 36-cm than 71-cm row spacing mostly during the dry period; however, the difference wasn't found up to 2 d after the rainfall event. Grass Ψ_{leaf} was more negative in alfalfa plots than in no-alfalfa control in selected dates in August, September, and October. Depressions of soil water content and Ψ_{leaf} at high alfalfa density and in presence versus absence of alfalfa provide evidence that alfalfa is more competitive than native grasses for soil water. Interseeding alfalfa into semiarid grassland can exacerbate soil water depletion, especially at high planting density.

Landscape Connectivity and Isolation: Management of Waters for Wildlife in the Sonoran Desert

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Connectivity of aquatic resources in the Sonoran Desert has been severely altered by humans; water resources that were once ephemeral are now permanent while others, that were once permanent, are now gone. In general highly connected landscapes have been considered beneficial to wildlife, but there are also negative consequences to connectivity. Hyperconnectivity, that greater than what naturally occurred, has led to the expansion of invasive species, such as the American bullfrog, and diseases, such as the fungus *Batrachochytrium dendrobatidis*, across the landscape, causing declines in native species like the federally listed Chiricahua Leopard frog. Connectivity and isolation are both natural elements of the landscape, but we may need to manage these at different scales because of these tradeoffs between the need for dispersal and protection against invasives and diseases. Using graph theory and distances based on reported American bullfrog vagility, we analyzed Sonoran desert wetland networks. From this we have identified clusters of connected wetlands important for native amphibians based on various structural metrics such as stepping stones, hubs, and cutpoints. We are also working on identifying likely routes of dispersal for the American bullfrog such that we can identify clusters of aquatic resources that are at increased risk from bullfrog invasion based on distance from other clusters and distance from bullfrog source populations. Identification of important areas of connectivity, both for native populations and for invasives, can help managers plan for the functional connectivity of resources in a way that addresses sometimes conflicting management goals using a nested framework. This landscape based approach improves the ability of wildlife biologists to manage limited aquatic resources in our changing desert landscapes. Informed management based on connectivity is important, especially so as funds and the resources being managed become increasingly scarce.

Testing a Model for the Prediction of Isolated Water sites in the Sonoran Desert

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Water is an extremely limiting resource in arid regions and wildlife managers need accurate inventories to better manage natural resources. Many of the water sources in the Sonoran Desert are tinajas, solid rock bottom pools of varying sizes. These and other isolated and ephemeral water resources are essential for desert wildlife. We developed an approach to predict the location of unidentified isolated waters in the Sonoran Desert of Arizona, USA. We used Mahalanobis distance based on topographic wetness and slope to indicate groups of pixels in GIS that are the most similar in these aspects to locations of currently known waters. We tested this model in southwestern Arizona on the Barry M. Goldwater Range, U.S. Air Force, comparing polygons of predicted waters with random polygons and had a 74% success rate of finding a location of standing surface water within the predicted polygon versus a 28% success rate of finding standing water in random polygons. This modeling technique could have broad application across arid lands management and conservation sciences, providing a new tool for researchers and land managers to use for wildlife conservation goals.

Large Mammal Site Selection of Water in the Sonoran Desert

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The Sonoran Desert is an environment of extreme heat and aridity and conditions are getting hotter and drier with global climate change. Freestanding water for wildlife in this desert is thought to be crucial to the success of at least some wildlife populations. The management of this water is becoming increasingly important due to the changing environment. Current management practices include maximizing retention of water in isolated natural sites (e.g., tinajas), and constructing and maintaining new water sites (catchments). We examine how differences in attributes of these different types of water sites influence use by desert mammals. We collected camera trap images at 23 water sites (8 tinajas, 15 catchments) for two years on the Barry M Goldwater Range – East (USAF), Department of Defense. We documented visitation by a number of species including our seven focal desert mammal species: bobcat *(Felis rufus)*, Coues white-tailed deer *(Odocoileus virginianus couesi)*, coyote *(Canis latrans)*, desert bighorn sheep *(Ovis Canadensis nelsoni)*, javelina *(Pecarita jacu)*, mountain lion (*Puma concolor*), and mule deer *(Odocoileus hemionus)*. Desert bighorn used tinajas more than expected, while javelina exclusively use catchments; the remaining focal species visited catchments more often than natural sites. Structure and location of the waters were associated with mammal use including type of water, slope at the site, density of waters, and elevation of the site. This study highlights the importance of both site structure and landscape arrangement of desert waters for wildlife populations. The utility of new arid land water sites can be improved by planning - identifying target species and focusing on the attributes at the site and how it is placed in the landscape.

The Role of Wetland Habitat Quality in Evaluating Functional Connectivity for Desert Amphibians

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Water is a critical resource for amphibian reproduction and is extremely limited in desert environments where isolated ephemeral waters comprise a dynamic network of unpredictable breeding resources. Desert amphibians appear to be somewhat plastic in their breeding site selection as long as the wetlands are within their ability to move. Further, these wetlands are important for dispersing amphibians, supporting gene flow between isolated populations. Establishment of anthropogenic water sites for target species other than amphibians increases connectivity between potential breeding sites and populations. We explored how these anthropogenic water sites have improved structural connectivity of the landscape using graph theory for 122 water sites, identifying sites most important for connectivity. We then evaluated habitat quality and amphibian use of water sites. The construction of water sites has greatly increased the opportunities amphibians have for reproduction, improving connectivity on the landscape. The top 20 stepping-stones, 20 hubs, and all cutpoints (n = 5) were identified, 16 of which were catchments. Adult amphibians were recorded at the majority of sites sampled using remote detection (game cameras and audio loggers). We found tadpoles at 87% of tinajas and 29% of the catchments sampled. Catchments with tadpoles were located < 5 km from natural waters. Structurally, natural waters and anthropogenic catchments were very different, which had drastic impacts on water quality. Ammonia concentrations in anthropogenic catchments were 10 times as high as the U.S. EPA's recommended criteria for aquatic freshwater life, based on pH and temperature ranges of the system, and well above levels found toxic for many aquatic species. This work suggests that improved connectivity has attracted amphibians into breeding sites that may not produce metamorphs. Hence, land management to promote connectivity for wildlife may have inadvertently created ecological traps for amphibians -- locations that attract amphibians, but will not support successful reproduction.

A Case Study in Arid Land Stream Instability: Sediment Bed Load in an Ephemeral Stream

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A continuing case study visits the site of a small highway bridge crossing an ephemeral stream in an arid area of Texas, over a period of approximately 10 years. The bridge has presented chronic problems and maintenance issues since construction. An attempt to address these problems, and the results of that attempt, are documented. Bed load sediment transport through the reach

adjacent to the bridge appears inhibited, causing aggradation of the channel and avulsion of the stream. The authors conclude that the reestablishment of favorable hydraulic geometry is necessary for an effective solution. Despite these recommendations, a construction project using only conventional bank armoring took place in 2009-2010. The continuing case study revisits the site as it exists in 2017, documenting the performance of those measures. A case study was presented at the 7th TRB International Bridge Engineering Conference 2010, and a subsequent case study at the 9th International Conference on Bridge Maintenance, Safety, and Management in 2018. This provides a unique opportunity to critique the performance of bank armoring in areas of extreme bed sediment load, document the stability state of the stream at another point in time, and further study the fragile nature of ephemeral streams in arid areas.

Evaluating the use of UAV-Based Remote Sensing System to Detect Rangeland Plant Species in the Texas Panhandle

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Modern rangeland management in the Texas Panhandle is using new technology to help monitor plants and track wildlife. Recent technology in the fields of remote sensing, UAVs (Unmanned Aerial Vehicles), and data processing has given land managers more efficient ways of evaluating rangeland health and diversity. We are using a Phantom 3 Professional UAV paired with a Parrot Sequoia multispectral camera to capture true color and infrared imagery of the Texas Tech Native Rangeland. Flights have been flown monthly since April 2017 to test the seasonal impact of detecting plant species at the site. Each month, flights were conducted at altitudes of 30, 60, and 100 meters to test the impact of spatial resolution on detection as well. Recent innovations in supervised classification techniques in ArcGIS are being tested to determine the viability of detecting distinct plant species. Using Image Segmentation with Random Trees and Machine Learning classifiers, we expect to be able to map distinct species across the site. Our study is focusing on Honey mesquite *(Prosopis glandulosa)* and non-native Yellow Bluestem *(Bothriochloa ischaemum)*. Having the ability to detect and quantify unique species on rangelands can lead to more effective management techniques that will benefit native shortgrass prairies in the Texas Panhandle.

Evaluation of Different Models for Quantifying Water Retention and Thermal Properties of Semi-Arid Pasture Soils

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A variety of empirical models have been developed to estimate soil water retention and thermal properties of unsaturated soils. These soil properties are essential for studies of water flow, and heat and solute transport in soils but often are not measured because of financial and practical constraints associated with time- and labor-intensive methods and spatio-temporal heterogeneity of soil. In this study, four widely-used soil water retention curve (SWRC) models, i.e., Brooks and

Corey (BC), van Genuchten (VG1 and VG2), Kosugi (LN), and Fredlund and Xing (FX) models as well as four soil thermal conductivity (l) models, i.e., Johansen, Cote and Konrad, Balland and Arp, and Lu et al. models were evaluated in semi-arid pastures with different soil types. Soil samples (0-20 cm) collected during the 2016-2017 experimental period from pastures under a variety of forage management practices were used to quantitatively compare the performance of both SWRC- and l-models on pasture soils. Differences in the measured SWRCs in pasture soils were primarily attributed to soil texture, bulk density, and organic matter content. Model parameters were optimized by fitting the SWRC- and l-models to the measured data. Overall, all the selected SWRC- and l-models agreed well with measured data, suggesting that selected SWRC- and l-models could provide reliable estimates of soil water retention and thermal properties across the soil water contents in the 0 to -15,000 cm H_2O range for semi-arid pasture soils under different pasture management practices.

Morphometric and Genetic Variation in Eight Breeds of Etheopian Camels (*Camelus dromedarius*)

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In arid and semi-arid regions of Africa, recurrent drought has forced pastoralists to prioritize camel *(Camelus dromedarius)* production. Camels remain especially promising animals for food security in a future impacted by climate change, and countries in arid and semi-arid regions need to explore the unique production traits potential of the one-humped camel. Systematic information of this nature is lacking in many countries, including Ethiopia, where dromedaries provide milk and meat of high nutritional and medicinal content and also offer social and cultural values. We examined seventeen morphometric variables to determine intraspecific variation among eight pastoralist-designated breeds of Ethiopian camels and examined mitochondrial cytochrome-b six nuclear microsatellite DNA loci to assess genetic diversity and phylogenetic relationships. Examination

of 525 individuals revealed significant morphometric differentiation in Afar as compared to the remaining seven breeds. Analysis of cytochrome-b sequences failed to recover monophyletic groups associated with pastoralist-recognized breeds. Analysis of six microsatellite loci from 104 individuals depicted no resolution of distinct genetic lineages concordant with geographical or pastoralist designated breeds. Overall, separation of two ecotypes based on the morphometric data was supported. However, genetic analysis of cytochrome-b and microsatellite data failed to support any unique genetic lineage or statistically significant population structure.

Effects of Compost Manure on Soil Microbial Community and Soil Health in a Semi-Arid Improved Pasture Ecosystem

Rael Otuya and Lindsey Slaughter

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Animal agriculture significantly supports the livelihoods of producers in the semi-arid Texas Southern High Plains (SHP) and substantially contributes to the U.S. Gross Domestic Product (GDP). Economic and environmental constraints such as increasing cost of grain-based feeds and manufactured fertilizer inputs coupled with limited precipitation have incentivized producers to rely more on forage-based animal production systems in an effort to reduce water and nutrient input requirements. Yet, maintaining high productivity without compromising soil health and sustainability remains a challenge in semi-arid ecosystems with increasingly limited water and nutrients. It is imperative to develop sustainable and cost-effective pasture management practices while maintaining soil health in these ecosystems. In this study, we evaluated the effect of added compost and legume presence in grazed semi-arid pastures on soil microbial community structure and function. Composted cattle manure was applied at a rate of 1.5 tons/acre to pastures plots established with WW-B. Dahl old world bluestem *(Bothriochloa ischaemum)* either in monoculture or interseeded with alfalfa *(Medicago sativa)* and yellow sweet clover *(Melilotus officinalis)*, excluding a 20 ft^2 area covered with a tarp during application. Soil samples collected in June and October 2017 were analyzed for soil microbial biomass and community structure, extracellular enzyme activities, total carbon and nitrogen stocks, the size and stability of soil aggregates, and forage yield. Our findings will illuminate how management decisions such as the use of composted manure and legumes will influence soil health and forage production in the SHP and other semi-arid and arid agricultural ecosystems of the world.

Three Decades of Biological Work on Guana Island, British Virgin Islands: An Overview

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Dry tropical forest, of the kind typical of Caribbean Islands, is severely threatened by human activities. On Guana Island, a small privately-owned island in the British Virgin Islands (BVI), decades of scientific research have provided an exceptionally broad understanding of island

ecology. We highlight some of the most significant findings and successful conservation actions of the program, which has thus far produced over 200 peer-reviewed scientific papers and one book describing the island's biology. Basic research on Guana has focused on understanding the island's ecology and evolutionary biology, defining patterns and processes of dispersal, speciation, adaptation, trophic relationships, and community structure. Conservation biology on Guana has focused on endangered species, invasive species, and restoration ecology. Species reintroduced by the program include the Anegada Rock Iguana *(Cyclura pinguis)* restored to Guana, a reef of Elkhorn coral *(Acropora palmata)* restored to Guana's near-shore waters, and Caribbean flamingos *(Phoenocopterus ruber ruber)* restored to the BVI. For each species restoration, associated population and community changes are continuously studied, resulting in growing understanding of their biology and improved chances for long-term survival. These and other individual studies, such as documenting the migratory birds that stop on Guana during the fall migration, have been ongoing for several decades. The resulting data allow interacting drivers of ecological change, such as those associated with climate change, to now be studied.

Associations between the Ratio of Organic to Inorganic Nitrogen and Growth of the Ichthyotoxic Golden Alga

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Golden alga (GA, *Prymnesium parvum*) is a harmful bloom-producing microalga typically found in brackish waters, including dryland river ecosystems of the southwestern USA. Nitrogen (N) is essential for GA growth but the relative importance of its organic (No) and inorganic (Ni) fractions is uncertain. Previous studies reported negative associations between GA and Ni (in field and laboratory) and positive associations with No (in field). Thus, while field and laboratory observations indicate that GA growth is negatively associated with Ni (at relatively high levels), the positive association with No requires experimental confirmation. This study examined the influence of different ratios of No: Ni on GA growth performance under standard laboratory conditions. Ratios varied from 0% No: 100% Ni to 100% No: 0% Ni, while keeping total N constant. Growth endpoints measured were exponential growth rate (r, day^{-1}) and maximum cell density (cells ml^{-1}). Growth rate was not affected by changes in initial No: Ni ratio. Maximum cell density, however, gradually increased with increasing relative content of No up to 75%, followed by a decline at 100%. In conclusion, while GA can grow in cultures containing exclusively No or Ni, optimal growth occurs when both are present and No is the predominant fraction. These laboratory findings are consistent with field observations and provide context for a better understanding of the association between nutrient stoichiometry and GA growth. This information may useful to natural resource and wastewater managers in their design of strategies to prevent or control harmful algal blooms.

Salinity Adaptation in the Ichthyotoxic Golden Alga

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Golden alga (*Prymnesium parvum*) is a toxin-producing species responsible for fish-kills worldwide. The US region most adversely affected by golden alga is the arid-semiarid southwest. Although thought to have originated in high salinity habitats, cell densities in the dryland Pecos River basin (Texas and New Mexico) peak at ~10 psu. It is unclear, however, if *P. parvum* growth can adapt to long-term exposure to high salinity. This information is necessary to understand the inland distribution of golden alga and its association with desertification and salinization trends. A Texas strain of *P. parvum* maintained at 5 psu Artificial Seawater (ASM) was subjected to the following treatments over 5 continuous cultures: ASM-5 psu, ASM-30 psu, ASM with gradually-increasing salinity to 30 psu (5-psu/batch), and Instant Ocean® (IO)-30 psu. Cell density was measured every 3 days to determine growth rate and maximum density. Growth rate was reduced when salinity directly increased from 5 to 30 psu in ASM but compensation occurred during the second culture. Gradual adjustment did not influence this outcome; inhibition at 30 psu was still observed when ASM salinity increased from 25 psu. Inhibition of maximum density was observed in ASM-30 psu after direct transfer or gradual adjustment. Growth rate and maximum density in IO-30 psu were generally similar to observations in ASM-5 psu. In conclusion, adaptation to high salinity in ASM was observed for growth rate but not maximum density, and relatively complex salt mixtures (e.g., IO) can compensate for the inhibitory effects of increased salinity.

Molecular Systematics of Geomys based on Mitochondrial and Nuclear DNA Sequences

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Phylogenetic relationships among members of the genus *Geomys* have been difficult to discern for decades because of a conservation of morphological characters, presumably a result of their fossorial lifestyle. Previous studies of chromosomes and allozymes generated a few phylogenetic hypotheses, but most were hindered by taxonomic sampling and low resolving power of characters, due to homoplastic events. In a recent study, DNA sequence data obtained from two mitochondrial genes (12S ribosomal RNA and cytochrome-b) and one nuclear gene (retinoid-binding protein 3), were used to construct a phylogeny of all members in the genus. Herein, a second nuclear marker is examined, the coding region of the alcohol dehydrogenase gene (*Adh*-1), and the four datasets were analyzed in a phylogenetic context. Using a combination of molecular markers and phylogenetic analyses, twelve species of *Geomys* and one species of *Cratogeomys*, a sister genus,

were examined. Results appear to produce a robust and well-supported phylogeny, resolving the perplexity of species relationships within *Geomys*.

Landscape Water Use and Conservation Alternatives in Lubbock County, Texas

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Arid and semi-arid regions of the United States have some of the highest per capita water use because of landscape irrigation (US EPA, 2018). In Lubbock, Texas, per capita average water use increases 38.3 percent from 128 gallons per capita per day (gpcd) (October-April) to 177 gpcd (April-September) during the growing season (City of Lubbock, 2013). Agricultural water use in the High Plains Underground Water Conservation District continues to outpace aquifer recharge with 2017 reported average aquifer level declines of 0.52 feet (0.16 meters) (HPWCD, 2017). Water availability and water scarcity are growing concerns in the region given population and projected growth (ESRI, 2017) and sporadic observed weather patterns with 4 of the last 10 years receiving less than average precipitation (West Texas Mesonet, 2018). This case study investigates existing agricultural and residential land uses, land cover and water uses per type to understand water use under alternative future land uses and land covers. Residential cases compare water use of existing typical residential landscapes to proposed hybrid typical and xeric, to fully xeric landscape designs. Agricultural land uses and land covers, or crop choices, are compared using typical crops grown and irrigation technologies in the region.

Traditional Husbandry Practices of African Civets (*Civettictis civetta*) in Ethiopia

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African civets *(Civetticits civetta)* are only found in Africa. They inhabit semi-arid parts of Ethiopia, where they have long been used in musk production by extraction from captive animals. Husbandry practices often follow tradition, rather than scientific information regarding feed and musk production. We documented the traditional husbandry practices used in a major African civet farming area in Ethiopia to identify concerns and opportunities for improvement. Between June and September 2010, we conducted semi structured interviews with 53 civet framers in four districts. Approximately 98% of the civets in those farms are males and about half are adults. Mostly farmers get civets from commercial markets, as a gift and by trapping. The traps used were traditional locally made spring (rope) traps that caused death, physical injury and psychological stress on animals. Feeding varies, with 72% of farmers using a five-day cycle: three days of maize soup, one day of meat soup, and one day of meat. Most respondents give supplementary feed, typically (57%) whenever they can afford to do so. Improved husbandry methods could help increase yields and improve animal welfare. There is no evidence that capture for this industry has negative impacts on wild populations.

Day 2
International Aridlands Conference
Tuesday, August 14, 2018

Abstracts for Water Session
International Aridlands Conference, Lubbock, Texas, USA
14 August 2018, 10 - 11:45 AM
ICC Room 105

Moderators: Drs. Venki Uddameri and Annette Hernandez, TTU

A GIS-based Decision Support Framework for Fit for Purpose (FFP) Assessment in Brackish Groundwater Units

Karim Abdullah[1,2] and Venki Uddameri[1]

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[2]California Department of Transportation, Sacramento, CA, USA

Brackish groundwater resources are actively being studied as an alternative source of water to reduce the stresses on fresh groundwater resources, especially in semi-arid regions. The deeper brackish groundwater resources are finite, and proper water management decisions are required to use this resource optimally. Also use of the brackish groundwater is limited by its inferior quality. In this study, a GIS-based Fit for Purpose (FFP) assessment framework (free from eclipsing and ambiguity problems) using distance-based multi-criteria decision making (MCDM) technique was developed to assess the fitness of water in meeting the prescribed water quality standards for three major uses: agriculture, municipal and unconventional oil and gas production. The developed framework was applied to study Dockum-Hydrostratigraphic Group (HSG) as an alternative resource to increase the existing life of the over-exploited Ogallala Aquifer in the Southern High Plains (SHP) region of Texas. Results showed that Dockum HSG water was entirely fit for slickwater-based hydraulic fracturing. Minimum treatment is required to use Dockum HSG water for gel-based hydraulic fracturing. Dockum HSG water can also be considered as an important supplemental source of water to irrigate the five major crops grown in the SHP of Texas and the order of compatibility was winter wheat > corn > sorghum > cotton > peanut considering the locations where these crops are currently being grown but its use is limited due to elevated levels of dissolved solids and Sodium Absorption Ratio (SAR). Dockum HSG water did not meet the standards prescribed for municipal purpose, but can be used regionally after proper treatment. The developed framework is generic and can be used to study other brackish groundwater resources.

Modeling Sustainable Adaptation Strategies Towards a Climate-Smart-Agriculture in the Southern High Plains of Texas, USA

Kushal Adhikari and Venki Uddameri

TTU Water Resources Center and Department of Civil, Environmental and Construction Engineering, Texas Tech University, USA

Food, water and climate systems are well integrated and play a fundamental role in determining societal health and economic well-being. Current and potential changes in future climate, the land use practices and the globally increasing population have built a considerable stress and challenge to the global crop yield and environmental sustainability. The increasing temperature and

the rise in CO_2 concentration have brought a CO_2 fertilization effect and have improved the crop yield in some parts of the world; however, there has been noticeably declined yields in most parts of the globe. The semi-arid Southern High Plains (SHP) in Texas relies mostly on groundwater pumping for irrigation, and the declining groundwater availability has added an extra challenge in proper management and optimization of available water resources for sustaining agricultural production in the region. Thus, there has been an increasing interest in food security under future climate scenarios while optimizing the available water resources and maximizing the crop yield. As part of a larger USDA funded study, the Soil and Water Assessment Tool (SWAT) was used to develop a watershed model for the Double Mountain Fork (DMF) watershed in semi-arid Southern High Plains (SHP) of Texas. A multi-objective calibration focused on history matching streamflow, Evapotranspiration and Crop Yields was developed and carried out with reasonable success. Model simulations were performed to quantify the effects of climate change impacts on water yield and crop productivity and to develop guidelines for future water use.

Modeling Soil Processes at a Molecular Basis

Adelia Aquino

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Humic substances (HS) play an important role for the adsorption process in soils being key agents in determining the fate of pollutants such as pesticides. Due to the flexibility of HS, various nano pores and holes can be formed in their structure. Water molecules can establish a stable network of hydrogen bonds within these structural units that can be viewed as "wet regions". Thermal analysis and proton NMR relaxation show the importance of intermolecular crosslinks via bridges of water molecules. In this contribution the polar functionality of HS is modeled by carboxyl groups aligned along an acrylic acid trimer chain or by singly carboxyl groups attached to the ends of aliphatic chains. DFT optimizations and DFTB dynamics simulations have been performed to determine the thermodynamic stabilities of these aggregates. Additionally, the stabilizing effect of Ca^{2}+ bridges between carboxylate groups is discussed for varying water content.

Using a General Ecosystem Model to Evaluate Management of Aridlands Under Multiple Stressors

Cade Coldren

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The Ecological Dynamics Simulation (EDYS) model has been used to evaluate the impacts of multiple stressors, both anthropogenic and natural, on arid ecosystems across the western United States. EDYS was designed to simulate ecosystem processes, and this mechanistic approach has allowed its use in a variety of ecosystem types, including deserts, grasslands, shrublands, forests, and tundra. The basic algorithms of EDYS focus on realistic plant dynamics, at a range of spatial (from $1m^2$ to entire watersheds) and temporal (using daily time steps, and extending runs

for hundreds of years) scales. Critical for plant dynamics, particularly in arid systems, are realistic hydrological simulations, and validation studies have supported the value of EDYS simulations in predicting both plant and water dynamics. Stressors and management activities simulated in recent years include drought, climate change, fire, urbanization, livestock grazing, invasive brush treatment, reseeding, seedling plantings, and fertilization. Water quality and quantity have been important outputs in aridland simulations of EDYS, and specific applications have looked at ways to increase aquifer recharge while limiting erosion effects from surface flows. EDYS has also been used to look at the impacts of stressors and human activities on biodiversity, with applications addressing such divergent issues as invasive plant species dynamics and the effectiveness of various treatments, to the forage availability for threatened desert tortoise *(Gopherus agassizii)*.

Using a DPSIR Model for Sustainable Management of Water Resources in the Semi-Arid Upper Colorado River Basin, Texas

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For water resources management, sustainability implies a notion of equilibrium that simultaneously satisfies the needs of water uses and the preservation of the water resources system. This research is using the driving force–pressure– state–impact–response (DPSIR) framework to meet this goal. The DPSIR approach is derived from the stress-response frameworks of the late 1970s. It has been successfully applied to facilitate system-scale understanding in many environmental applications. While constant growth of population and developments in agriculture and industry are considered as driving forces, overconsumption of water is as an internal source of pressure. The declining state of surface and groundwater resources in Texas will have significant impacts on several levels of the society from economic effects such as a loss in agriculture income to environmental effects such as land degradation. Coming up with appropriate responses to tackle the ongoing water crisis and to have sustainability in water resources management will be the final goal of this research. The DPSIR framework is developed using existing data and will be augmented with stakeholder preferences. The model integrated several decision-theoretic approaches such as multi-objective optimization and multi-criteria decision making approaches to evaluate integrated management of surface water, groundwater and treated municipal water resources in the upper Colorado River Basin. This basin serves the water needs of the Odessa-Midland region and the competition for water between municipal, oil and gas and agricultural sector is intense in this semi-arid region. The proposed research is the first step towards the development of a statewide decision tool for water resources management that can be used in the implementation of the State Water Plan recommended Water Management Strategies.

Application of Swat Model for Simulating Streamflow and Crop Yield in the Palo Duro Watershed, Texas

Ali Ghaseminejad and Venki Uddameri
TTU Water Resources Center and Department of Civil, Environmental and Construction Engineering,
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The Soil Water Assessment Tool (SWAT), a physically-based distributed hydrological model, was developed by the U.S. Department of Agriculture (USDA) with the purpose of simulating the complex watersheds and river basins. The main purpose of this study was to evaluate the performance and feasibility of the SWAT model for prediction of hydrological water balance in the Palo Duro Watershed with the area of 1076 square miles located in norther portions of Texas that is part of the Great Plains region, draining to Palo Duro Creek river which is a tributary of North Canadian River. Soil Survey Geographic Database (SSURGO), 2006-Cropscape-Cropland layer and National Climatic Data Center dataset (NCDC) were used as model inputs to represent the soil characteristic, land-use and weather data, respectively. Also, some modifications were applied with respect to SWAT rain-gauge assignment procedure because it was found that selection of nearest rain-gage to the subbasin centroid does not guarantee the selected gage to be the most representative of the precipitation in that area. The model was calibrated with sequential uncertainty fitting (SUFI-2) algorithm, included in SWAT-CUP package, using daily streamflow records from 2003 to 2013 and validated over a 3-year period between 2014 and 2016. In addition, the annual countywide crop yield data obtained from USDA was used to evaluate the SWAT crop growth simulation. The results show the adequate performance of SWAT to model the daily streamflow and annual crop yield. The calibrated model can be used for investigating the effects of climate change and different land management scenarios on streamflow and soil erosion.

Overview of Non-Conventional Water Resources Utilization Technologies in Biological Sand Control in Xinjiang, Northwest China

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**Presentation will be delivered by Gui Dongwei.*

Water plays a very important role in the desert ecological properties and processes. Located in the hinterland of the Eurasian continent, Xinjiang is covered with vast sandy deserts and dotted with some patchy oases. The sandy area reaches 43.3×104 km^2, accounting for 26% of the total area of Xinjiang, and 60% of the total sandy desert of China. Its climate is extremely dry with annual precipitation about 150 mm, and annual evaporation more than 2000 mm. Because of the rapid growth of population and irrational exploitation of water and soil resources, the land desertification problem is becoming serious. Although mostly conventional water resources are used in industry and agriculture, in contrast, the proportion for ecological construction is quite low, and water

used in combating desertification is restricted. Therefore, it is critical to develop non-conventional water resources utilization technologies in biological sand control. There are different sources of non-conventional water resources in Xinjiang. After 30 years of research, a series of technologies formed: (1) The non-irrigation afforestation technology using moisture stored in the wet sand layer, and the afforestation technology using melt water and rainfall, were developed in Gurbantunggut Desert, Northern Xinjiang. (2) The flood irrigation afforestation technology using summer flood, and the drip irrigation afforestation technology using underground brackish water were developed in Taklimakan Desert, Southern Xinjiang. These various non-conventional water resources utilization technologies in biological sand control in Xinjiang can provide technical references for combating desertification in the areas short of water resources around the world.

Workshops

Two workshops will close the conference. The goal of both will be to establish long-lasting collaborations that span countries and institutions and focus on issues affecting arid lands.

Collaboration Session: Teaching

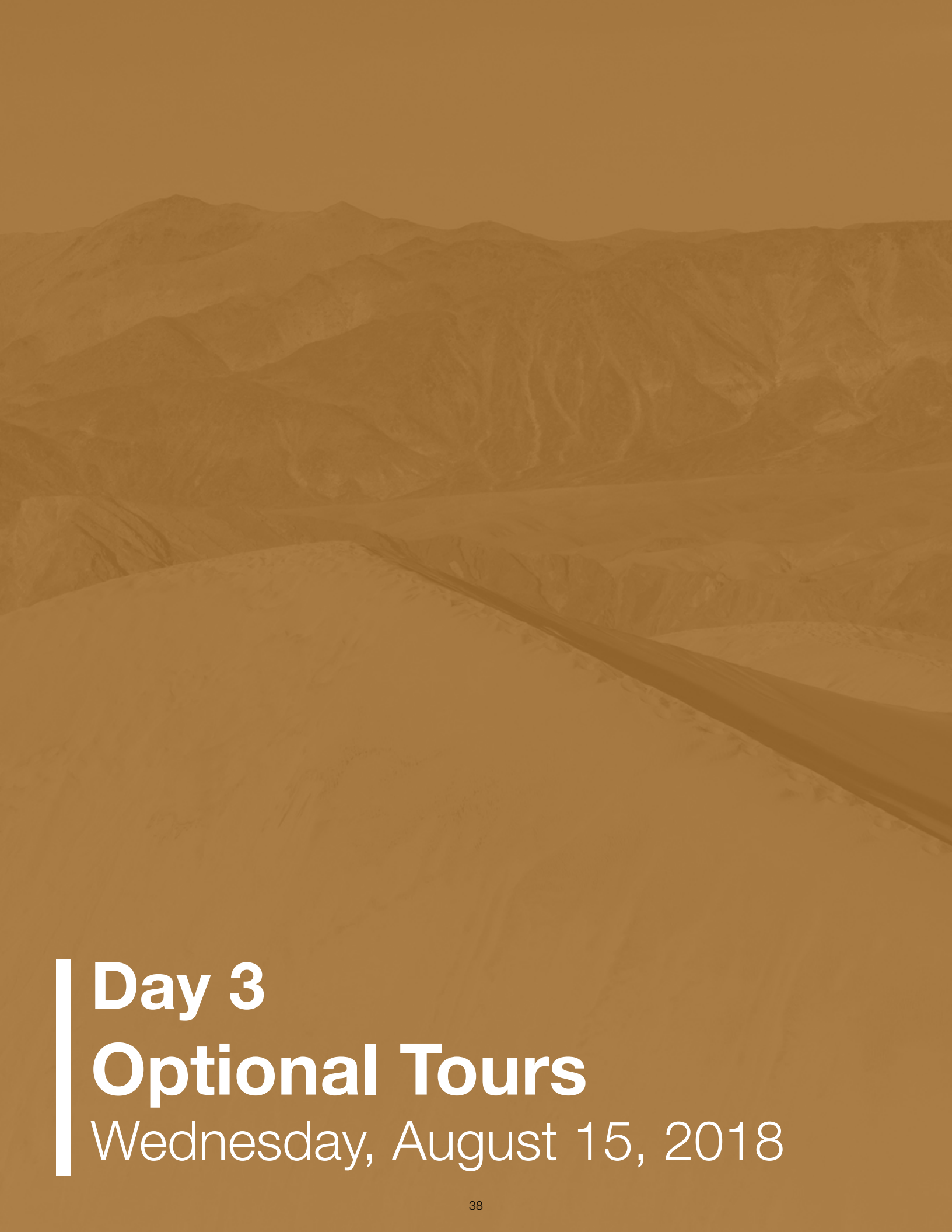
Moderators: Dr. Jacqueline McLaughlin, Penn State University Lehigh Valley
Dr. Gad Perry, TTU

There are relatively few programs that explicitly aim at addressing issues affecting arid lands at any levels. Among them are three that are represented at this conference. The course-based undergraduate research experiences (CHANCE) program at Penn State (http://chance.psu.edu/) continues to gain notoriety, with short-term study abroad experiences being popular and China being a leading destination. At Texas Tech University, the Masters of Arid Lands (MSALA) interdisciplinary program provides an especially flexible option for a next step (http://www.depts.ttu.edu/gradschool/Programs/INDS_PreDesigned.php). The Arid Lands Resource Sciences (ALRS) PhD at University of Arizona (https://alrs.arizona.edu/) can be the culmination of an educational arc. The workshop will explore how to create such programs and, more importantly, who to connect them for maximum impact.

Collaboration Session: Research

Moderators: Dr. Jianfang Qiao, Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences
Dr. Gad Perry, TTU
Ms. Laura Bilbao, TTU

Arid and semi-arid lands form a large portion of the planet and house a large percentage of its human population and its biodiversity. Although many of the problems such regions face are similar, most studies are local in nature. With presenters from Africa, Asia, Europe, South America and North America, we have an opportunity to discuss joint interests and funding opportunities, and perhaps even begin to forge teams that will jointly apply for funding to pursue collaborative and comparative projects.



Day 3
Optional Tours
Wednesday, August 15, 2018

Optional field trips will be held on the morning of 15 August. All tours will leave from the International Cultural Center at 8 AM.

Please contact Diane Cano *(diane.cano@ttu.edu)* to reserve a spot.

Trip 1: Lubbock Lake Landmark *(http://www.depts.ttu.edu/museumttu/lll/)*
Host: Dr. Eileen Johnson, Director, Lubbock Lake Landmark

A unit of the Museum of Texas Tech University, Lubbock Lake Landmark is an archaeological and natural history preserve at the northern edge of Lubbock. The Landmark contains evidence of almost 12,000 years of occupation by ancient peoples on the Southern High Plains. It is listed on the National Register of Historic Places and is a designated National Historic and State Archeological Landmark. Excavations are conducted on an annual basis, some of the findings are displayed at the on-site Interpretive Center, and the site offers there are 4.5 miles (7.2 km) of trails, much of it passing through restored native vegetation.

Trip 2: New Deal Farm *(https://www.depts.ttu.edu/pss/research-pages/new-deal.php)*
Host: Dr. Chuck West, Professor and Thornton Distinguished Chair of Plant & Soil Science; Director, CASNR Water Center

At the New Deal farm, Dr. West will demonstrate research on improving nutritional quality of grazed grasslands in low-irrigation and dryland management by integrating the use of selected grasses, legumes and annual crops. The hypothesis is that improving nutritional quality of the forage reduces the amount of water needed to produce beef.

Trip 3: Natural Science Research Laboratory *(http://www.nsrl.ttu.edu/)*
Host: Dr. Robert Bradley, Director and Curator of Mammals, Natural Science Research Laboratory, Museum of TTU

The NSRL is a division of the Museum of Texas Tech University that archives biological samples and their associated data. It houses four major collections: Mammals, Birds, Invertebrate Zoology, and Genetic Resources. These collections serve as a library of our natural heritage for education and research purposes. Bird and mammal specimen types include skin/skull/skeleton vouchers, fluid-preserved specimens, and taxidermy. The Genetic Resources Collection contains > 370,000 samples and is currently being transitioned from -80°C mechanical freezer storage to liquid nitrogen storage at -190°C. The NSRL is normally closed to the public, so this is a unique opportunity to visit it.

Trip 4: Water Resources Center *(http://www.depts.ttu.edu/waterresources/)*
Host: Dr. Venkatesh Uddameri, Professor of Civil Environmental and Construction Engineering; Director, Water Resources Center

The WRC was established by the Board of Regents in 1965 to conduct basic and applied research on water availability and water quality issues in surface water, groundwater, soil and contaminated sediments. Recent research activities are focused on emerging areas of food-energy-water nexus, water reuse in hydraulic fracturing, emerging contaminants and environmental applications of nano-materials.

Thank You.

Putting together a conference with a hundred presenters from five continents (Africa, Asia, Europe, North America, and South America!) is not a project for a single person. The entire staff of the Office of International Affairs at Texas Tech has been involved in one aspect of this or another, and we are thankful to them all.

The organizers would also like to thank the Museum of Texas Tech for hosting the evening reception and poster session, and the four people who have volunteered to lead the optional post-conference tours: Drs. Bradley, Johnson, Uddameri, and West.

Finally, we thank the managements of the MCM Elegante and Overton hotels for providing attendees special rates.

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