



**Workshop:**

***Soil Biology and Soil Health within our Transition to  
Dryland in the Southern High Plains***

**March 24, 2020**

**USDA-ARS Cropping Systems Research Laboratory**

**Lubbock, TX**



Soil Biology and Soil Health within our Transition to Dryland in the Southern High Plains



## Program

8:00-8:30 am **Welcome remarks and introduction of USDA-ARS-Lubbock's mission in the SHP**  
Alejandro Rooney (Director) and Robert Lascano (Research Leader, Wind Erosion and Water Conservation Unit)

8:30-9:00 am **ARS role in selecting systems with improved functions related to soil health, biodiversity and productivity**, Dave Knaebel, ARS National Program Leader, Soil biology

***Morning session 1: Climate Variability and Alternative Management within Water Transitions in the SHP (no-till, cover crops, forages)***

9:00-9:30 am **Response of living component within our management transitions to dryland production**, Verónica Acosta-Martínez, Soil Microbiologist, ARS Lubbock TX

9:30-9:45 am **Climatic variability effects on the soil microbial component and functions in the SHP**, Lumarie Pérez-Guzmán, Soil Microbiologist, ARS Lubbock TX

9:45-10 am **Soil health and cotton production on the SHP**, Katie Lewis and Joseph Burke, Soil Scientist, Texas AgriLife

10-10:15 am **Soil microbial response to long-term conservation tillage and cover crops in cotton systems of the SHP**, Lindsey Slaughter, Soil Microbial Ecologist, Texas Tech University

10:15-10:30 am **Citizens project: Soil health assessment within the SHP**, Natasja van Gestel, Quantitative Ecologist, Texas Tech University

***Questions/Break 10:30-10:50 am***



***Morning session 2: Soil Health Management Perspectives from other Regions***

10:50-11:20 am **Cover crop research from the Northern Plains: soil biology, fertility, and cash crop performance**, Mike Lehman, Soil Microbiologist, ARS Brookings SD

11:20-11:50 am **A brief survey of soil biological health in Ontario Canada**, Lori Phillips, Microbial Ecologist, Agriculture-Agri Food Canada (AAFC)

***Questions before lunch 11:50-12:00 pm***

***Lunch 12:00-12:45 pm***

***(Provided by The Ogallala Aquifer Program)***

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***Afternoon session 1: Management Options for the SHP region***

12:45-1:05 pm **When to plant cotton? Best management for SHP summer temperature conditions**, Steven Mauget, Climatologist, ARS Lubbock, TX

1:05-1:25 pm **Forages options for transitioning to dryland management**, Chuck West, Thornton Distinguished Chair in Plant and Soil Science in forage systems, Texas Tech University

1:25-1:40 pm **Native bee and human relations in grasslands: Why soil matters**, Scott Longing, Entomologist, Texas Tech University

1:40-1:55 pm **Potential of specialty crops in west Texas**, Sukhbir Singh, Vegetable Physiologist, Texas Tech University



***Panel with Producers/Stakeholders***

2:00-3:15 pm **Discussion of our challenges to improve our soil health and soil biology resilience and to maintain sustainable agriculture in this region transitioning to dryland.**

Producers: Tom Gregory, Rob Warren, and Kris Verett

Moderators: Chuck West (Texas Tech University) and Kater Hake (Cotton Inc.)

***Future Research and Resources to Improve Soil Health, Soil Biodiversity and Water Conservation. Where do we go from here?***

3:15-4:15 pm: **Concluding Remarks and Adjourn** (5 minutes overview from different groups)

5:00-6:30 pm: **Reception at TTU International Center** at 601 Indiana Ave, Lubbock, TX 79409

*Provided by the Department of Plant and Soil Science, Texas Tech University*



## ***Our speakers and panelists***



**Alejandro Rooney**

*Lab director, Cropping Systems Research Laboratory in Lubbock, Texas*

Dr. Rooney began his career with ARS in 2002, as a Research Geneticist in the Microbial Genomics and Bioprocessing Research Unit at the National Center for Agricultural Utilization Research (NCAUR) in Peoria, IL, where he also served as the Curator of Bacteria for the ARS Culture Collection. In 2010 was appointed as the RL for the Crop Bioprotection Research Unit at NCAUR. He served in that position until 2019 when he came to the CSRL. He has a distinguished publication record that includes nearly 150 refereed journal articles. The majority of his

work has focused on the molecular evolution, population genetics, systematics and taxonomy of microbial pathogens, as well as on the discovery and development of microbial agents for the biological control of insect vectors of disease and plant pathogens.



**Robert J. Lascano**

*Research leader, Wind erosion and water conservation unit*

Dr. Lascano obtained his PhD in soil physics from Texas A&M University and worked as faculty in the Soil and Crop Science Department. In 2008, he joined the ARS continuing research on water conservation and site-specific crop management at a landscape scale. His research pioneered using stable isotopes to evaluate the water use efficiency of cropping systems. He is Fellow of the American Society of Agronomy. Dr. Lascano has authored 135 refereed journal articles, 100+ conference proceedings and edited an irrigation monograph and three books on Advances in Agricultural Systems Modelling. Has

served on the Graduate Committee of > 20 students and supervised 30 students (MS and Ph.D.) as adjunct Professor at Texas Tech, Texas A&M and Wageningen University.





**Dave Knaebel**

*National Program Leader for Soil Biology in the Natural Resource & Sustainable Agricultural Systems Program Area in the USDA-ARS.*

Dr. Knaebel provides vision and strategic leadership for ARS teams addressing critical agricultural soil and air research problems in the Soil and Air National Program. He seeks to help frame and then lead research to understand agricultural and natural soil ecosystems and their processes related to carbon turnover, nutrient dynamics and related phenomena that are influenced by soil ecosystem community. His goal is to enable the use of this knowledge for development of science-based

management tools for these soil ecosystems – tools that are integrated for agricultural landscape productivity, sustainability, and ecosystem service outcomes - that enable and enrich farmer profitability, and provide a better environment for our nation and world.



**Verónica Acosta-Martínez**

*Soil Microbiologist, USDA-ARS Lubbock, TX*

Dr. Acosta-Martínez has been the soil microbiologist at the ARS in Lubbock since 2001. Her research is focused in obtaining a better understanding of how the soil microbial component responds to the complex interactions of management practices and climate extremes. Specifically, she evaluates biological indicators of soil health, and functions related to nutrient (biogeochemical) cycling, organic matter dynamics and productivity in semi-arid climates. She is involved in different efforts to provide a national soil health assessment with the Soil Health Institute and NRCS-Soil Health division. Currently, she is

one of 40 collaborators in the Ogallala Water Coordinated Agricultural interdisciplinary research project to address issues of water decline and long-term agricultural sustainability.







**Lumarie Pérez-Guzmán**

*Soil Microbiologist from USDA-ARS in Lubbock, Texas*

Dr. Pérez-Guzmán, obtained her PhD in Ecosystem Science with specialty in Soil Microbiology from The Ohio State University. She studied the effect of biochar amendments on microbial abundance, diversity and activity in agricultural soils under different management practices. She has studied soil microbial communities using culture-independent techniques and high-resolution microscopy. At Dr. Acosta-Martínez's lab she helped develop a combined assay to simultaneously determine the activity of four enzymes to be used as a biogeochemical index. Her main project evaluates soil management-climate interactions on microbial diversity and functions, and is a collaboration with Drs. Lori Phillips from AAFC and Steven Mauget from ARS, Lubbock. She is currently evaluating Tier 2 and emerging biological indicators of soil health to facilitate comparisons between labs that may employ different methods.



**Katie Lewis**

*Soil Scientist, Texas Tech University*

Dr. Lewis is interested in enhancing the agricultural sustainability of the Texas High Plains region that is extremely important to both Texas and the nation, while helping educate future scientists, farmers, society, and policy-makers. She is continually striving to enhance her understanding of the critical challenges currently facing agriculture and society, and to improve agricultural management practices of farmers facing production challenges. As the daughter of a South Texas farmer, she was introduced at an early age to the challenges of sustainable agriculture and how they affect society. As a research scientist and wife of a Southern High Plains farmer, she is more involved and dedicated as ever before. Research conducted in the Soil Chemistry and Fertility program at the Texas A&M AgriLife Research and Extension Center in Lubbock, TX, is designed to evaluate alternative soil and nutrient management practices which will improve economic and environmental sustainability of agriculture production.





**Joseph Burke**

*PhD student in Soil Science at Texas A&M University and Texas A&M AgriLife Research*

Joseph studies soil health and fertility in cotton cropping systems. Under the guidance of Dr. Katie Lewis, his research examines the influence of cover crops and tillage on nutrient cycling, water-use, soil health, and cotton yield grown in semi-arid regions. He is an award-winning presenter and teacher whose research has been published in *Agronomy Journal*. Joseph holds a Bachelor's degree in interdisciplinary agriculture and a MS in plant and soil science, both from Texas Tech University where he was a Presidential Fellow in Sustainable

Land and Water Development.



**Lindsey Slaughter**

*Soil Microbial Ecologist, Texas Tech University*

Dr. Slaughter's research focuses on the importance of soil microbial communities in ecosystem functioning, including plant and animal production or community dynamics and biogeochemical cycles. Current projects in her lab span a wide range of topics in plant-soil interactions and soil health across agricultural, urban, and natural ecosystems, such as the efficacy of microbial amendments for increased cotton productivity and soil health, the contribution of soil microbial consumption and production of greenhouse gases (GHGs) to total livestock emissions in grazed cattle pastures, and the response of soil microbial communities and nutrient cycling to prescribed

burning under native warm-season vegetation. She will present research that investigates how differing agricultural management strategies such as reduced tillage and irrigation in semi-arid cotton production systems impact belowground soil microbial community structure and function.







**Natasja van Gestel**

*Quantitative Ecologist, Texas Tech University*

Dr. van Gestel’s research combines empirical data with models using data-model fusion, or inverse analyses, to understand changes to the carbon cycle in order to determine whether terrestrial ecosystems will respond positively or negatively to climate change. She studies how plants and soil microbes influence the carbon cycle, and has extensive background in natural ecosystems, from forests to deserts to polar ecosystems. She applies this perspective to managed ecosystems in the south plains area, such as in cotton production systems. She leads a grower citizen science project focused on cotton, to help rebuild soil health to mitigate the

negative effects of climate extremes on yield.



**Mike Lehman**

*Soil microbiologist at the USDA-ARS in Brookings, South Dakota.*

Dr. Lehman researches the interactions between soil microorganisms and agricultural management practices. The majority of the research is conducted on no-till cropping systems. His research evaluates the potential for cover cropping, crop rotation, and residue retention to influence soil microorganisms, their processes, and ultimately the services they provide in these systems. Two projects involve grassland systems and evaluate how grassland management (grazing, conversion to row cropping) influence microbially-mediated soil processes and the long-term soil health in these systems.

Multiple analytical tools are used to assess microbial communities and their activities including biochemical, microscopic, molecular, and trace gas analytical techniques. Collaborative research projects have involved the role of ground beetle gut bacteria in mediating beetle fitness, and the potential for these gut bacteria to be vectors for antibiotic resistance genes.





**Lori A. Phillips**

*Microbial Ecologist at Agriculture and Agri-Food Canada (AAFC), in Harrow, Ontario.*

Dr. Phillips obtained her Ph.D. from the Soil Science Department at the University of Saskatchewan and, after 5 years as a Research Scientist with the Victorian Department of Primary Industries in Australia, joined AAFC in September 2015. Her research program investigates the soil biological processes that maintain and enhance agro-ecosystem productivity and sustainability. She uses molecular tools to understand how the ecosystem services provided by these biological communities can be managed or optimized at different scales, from the level

of the plant through to the level of the landscape. This research is governed by three primary objectives within the context of soil health: 1) to develop new metrics to quantify the role of soil biology in enhancing soil and ecosystem health, 2) to generate new knowledge on the role of soil biota in supporting agricultural systems that are resilience to environmental and climate stresses, and 3) to provide information that enables farmers to sustainably intensify their production systems.



**Steven A. Mauget**

*Meteorologist at the USDA-ARS in Lubbock, Texas*

Dr. Mauget has been working as a climatologist with the ARS since 1997. His educational background is in Physics (B.S., U.C. Santa Cruz) and Atmospheric Science (M.S., Ph.D., U.C. Davis) and has focused on how weather and climate information can be used in agricultural risk management. His major research includes the analysis of historical temperature, precipitation and streamflow data to test for evidence of intra- to multi-decadal climate variation and climate-change over U.S., South America, and global land areas. He is also interested in crop modeling, and has developed web-based decision support tools.

An example of the latter is the Optimal Ranking Regime (ORR) method, web-based agro-climate application that provides users with statistical climate data over specified growing areas and specified time windows of the growing season.





**Chuck West**

*Thornton Distinguished Chair in Plant and Soil Science, Texas Tech University*

Dr. West specializes in forage systems research. He came to Texas Tech in 2012 after 28 years on the faculty of the University of Arkansas where he was Professor of Forage Production. Dr. West teaches courses in the management, ecology, and research techniques of forage crops and pastures. Dr. West administers the Texas Alliance for Water Conservation, an outreach project to transfer irrigation technology to producers to increase efficiency of water use. His research concentrates on grazing

management to improve forage utilization by cattle and to make most efficient use of limited water supplies to sustain profitable agriculture in the region.



**Scott Longing**

*Entomologist, Texas Tech University*

Dr. Longing's research interests include the assessment and management of insect populations and communities and environmental drivers influencing these biological levels of organization. A current research focus on exposure of bees and their habitats to agrochemicals seeks to better understand risks and impacts to biodiversity, considering habitat fragmentation, bee-plant specialization and species' traits. The influence of soil characteristics, including anthropogenic chemical inputs, on pollinators and their resources remains an understudied area of research. With over 70 percent of the 4000 bee species in North

America depending on soil for building nests, provisioning pollen and rearing brood, it is important to understand how land management including agrochemical use (*e.g.*, fungicides and biologicals) influences belowground soil properties and native bees.





**Sukhbir Singh**

*Vegetable Physiologist, Texas Tech University*

The long-term goal of Dr. Singh’s research program is to determine the parameters (varieties, agronomic practices, etc.) leading to sustainable and profitable vegetable production. The target market for this production is high-quality vegetables for mid-to-high-income consumers including up-scale restaurants and hotels. To achieve this, his research focuses on several aspects of organic and conventional vegetable production in open field, high tunnels and hydroponics. Specifically, he works on sensor-based irrigation management, nutrient management, biotic and abiotic stresses physiology, disease and pest control,

cropping systems, and soil fertility management.



**Kater Hake**

*Vice-President of Agriculture & Environment Research at Cotton Inc.*

Dr. Hake’s academic background includes a BS in genetics and a MS in agronomy from the University of California, Davis, and a PhD in plant biology from University of California, Riverside. He is responsible for the cotton production research program at Cotton Incorporated, and leads a team of eight scientists who develop and support innovative problem-solving research to increase profitability and sustainability of cotton farming in the United States. Kater came to Cotton Inc. from a long career in cotton research and management. Most recently he was the

Vice President of Technology Development at Delta & Pine Land Company. He has also held positions at Texas A&M University, The National Cotton Council, and the University of California.





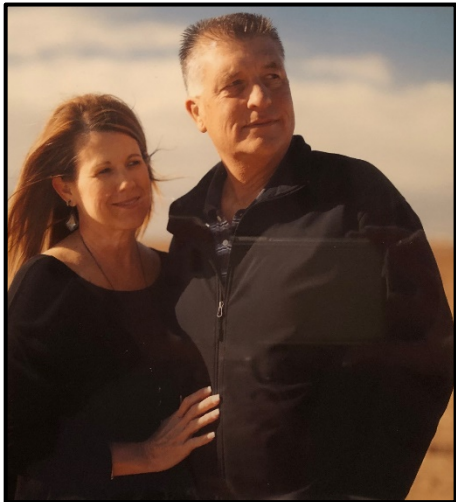


### **Rob Warren**

*Producer and owner, Rob and Laurel Warren Farms, and Desert Willow Vineyards, Seminole, TX*

Mr. Warren graduated from Texas A&M University in 2000 with a degree in Agriculture Development. He is a 4<sup>th</sup> generation farmer in this area and currently farms 6,100 acres of dryland and approximately 1,200 acres of irrigated organic crops in eastern Gaines county with his wife, Laurel. Their 6,100 acres land presents several challenges as it is very sandy, susceptible to wind erosion, and has many playa lakes that fill up with runoff when it rains. He is currently, analyzing ways to make cover crops and no-till farming work in this region. He's determined

to find a system that will improve soil health, decreases erosion, suffice landlords, yet still be economically feasible.



### **Tom Gregory**

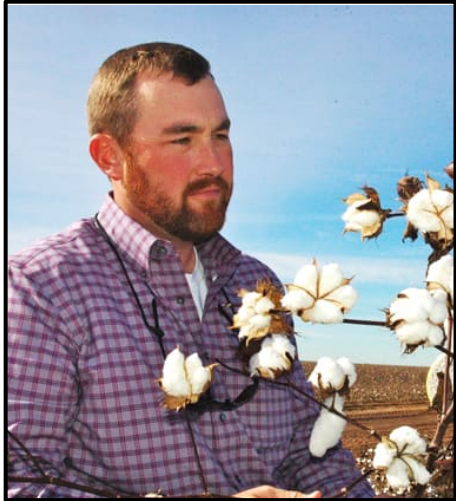
*Producer and owner, Tom and Shannon Gregory Farms*

Mr. Gregory holds a Bachelor of Business Administration from UT Arlington. Along with wife, Shannon they started farming in 1995 after moving back to the family farm in Petersburg, TX. They have 4 children; 1 boy and 3 girls. Shannon also teaches 1st grade at Idalou ISD. In their farm of approximately 5,000 acres in Hale, Floyd and Lubbock counties, they grow corn, cotton, milo, and wheat. Currently, about half of these acres are managed as irrigated with pivot and drip systems. The other half are dry land being planted into cotton and milo. He started his first no-tilled field in 2008 with half cotton and half wheat.

Since then, they have transitioned 90% of their land to no-till, and over the last several years their dry land acres have been 100% no-till.







**Kris Verett**

*Producer, Verett Farms*

Mr. Verett is a fourth-generation operator of Verett Farms in Ralls, TX, where cotton and multi-species covers comprise the majority of the operation. Kris grew up working on the farm and grew to love all things farming. He continued his passion by completing a degree in Agronomy and Entomology at Texas A&M, followed by a masters in Agronomy at Texas Tech. Upon completing his academic training, he knew he wanted to return to the farm to employ his knowledge. After attending R.N. and Ronnie Hopper’s no-till meeting in 2013, Kris became interested in implementing the practice into his operation. Today, nearly every acre follows a rotation of cotton followed by multi-species covers. Kris looks forward to continuing to better utilize our resources and leave the farm better than he found it for his two boys, Charley and Luke.







