Invited Speaker: Dr. Forbes Walker, University of Tennessee, Knoxville, USA

Title: Is Regenerative Agriculture the Future for Tennessee Agriculture?

Abstract: Since the 1980s Tennessee has been a leader in the development and implementation of no-till systems and other conservation practices such as the use of cover crops and crop rotations. Today, no-till systems are practiced on over 90% of all row-crop acres in the state. In the past five years the term regenerative agriculture has been receiving a lot of interest in the popular press, as well as industry. This presentation will review the current widely accepted definition(s) of regenerative agriculture and compare it with current and future agricultural production practices in Tennessee.

Biography: Dr. Forbes Walker is a Professor and Extension Soil Specialist with the University of Tennessee Extension since 1998. As the Environmental Soil Specialist, he is responsible for coordinating educational and research programs in Tennessee in soil management, cover crops and soil health, nutrient and manure management, the appropriate use of alternative fertilizer materials, waste utilization, nutrient cycling, water quality and climate smart agriculture. In the past year he has been actively involved with a multi-disciplinary team of scientists assisting agricultural producers recover from the sometimes-devastating effects of Helene.

Invited Speaker: Dr. Sebastián Cambareri, National Institute of Agricultural Technology (INTA), Argentina

Title: Closing the Loop: Pecan Agroforestry as a Model for Circular and Regenerative Farming at the Southeastern Pampas of Argentina

Abstract: Pecan (*Carya illinoinensis*) orchards represent a promising model for integrating circularity and regeneration into agricultural systems of Argentina. As a long-lived nut tree species, pecans naturally link carbon storage, biodiversity, and soil health, offering an opportunity to demonstrate how perennial systems can recycle nutrients, strengthen resilience, provide food and eventually wood or energy to fuel diverse systems. Based on field studies conducted in Southeastern Buenos Aires (Argentina), this presentation explores the relationships between management practices, greenhouse gas (GHG) emissions, soil carbon sequestration, tree growth, and canopy structure. The dataset includes trunk diameters, tree height, crown volume, and fertilization regimes providing a comprehensive view of how pecan trees interact with their environment across seasons. Through the combination of these measurements, we aim to develop a predictive framework to anticipate ecological outcomes under different management scenarios. Although still in progress, this approach seeks to bridge empirical observation with data-driven insight, helping design more efficient and circular orchard systems. The results illustrate how pecan-based agroforestry can reduce external inputs, recycle organic matter, and promote carbon retention in soils. Ultimately, pecan orchards demonstrate that tree crops (when managed within a regenerative and circular paradigm) can contribute meaningfully to smart agriculture and to the redesign of farming landscapes towards long-term sustainability.

Biography: Dr. Gustavo Sebastián Cambareri is an environmental scientist and agronomist whose research bridges soil processes, sustainable agriculture, and climate mitigation. He earned his Ph.D. in Environmental Sciences from the University of Guelph, Canada, under the supervision of Dr. Claudia Wagner-Riddle, where he investigated nitrous oxide emissions in maize systems fertilized with liquid dairy manure. Earlier, he completed a Master's in Plant Production and a degree in Agronomic Engineering at the National University of Mar del Plata (Argentina). Currently, Dr. Cambareri serves as a researcher at the Instituto de Innovación para la Producción Agropecuaria y el Desarrollo Sostenible (IPADS Balcarce, INTA–CONICET), focusing on carbon sequestration, greenhouse gases dynamics, and the development of regenerative production models. His recent work centers on pecan (*Carya illinoinensis*) agroecosystems, evaluating carbon balance, tree growth, canopy architecture, and management effects on environmental performance. These studies aim to create predictive tools to improve orchard efficiency and resilience. He has authored publications in journals such as Frontiers in Soil Science, Canadian Journal of Soil Science, and Pecan South, contributing to the understanding of carbon storage and climate-smart management in perennial systems. Beyond research, he mentors students through international programs including the Global Research Alliance on Agricultural Greenhouse Gases (GRA). Dr. Cambareri's career integrates empirical fieldwork, international collaboration, and public engagement, advancing circular and regenerative pathways for the future of agriculture.

Invited Speaker: Dr. Jie (Joe) Zhuang, University of Tennessee, Knoxville, USA

Title: Restructuring Soil Pore System to Increase Carbon Sequestration Capacity of Soils

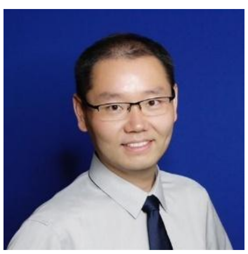
Abstract: A key process of soil regeneration is restructuring of soil pore systems. Without optimal soil pore system (e.g., hierarchical structure comprising pores with a wide range of sizes), soil chemical and biological restorations are impossible or extremely slow. Organic carbon sequestration through surface-coating and pore-filling is an effective process that reshapes soil pore systems by changing the distribution of soil aggregate fractions. The changed pore systems can exert feedback effect on further sequestration of organic carbon, enhancing soil carbon sequestration capacity. Under certain conditions (e.g., no-tillage, crop residue return to soil, and manure application), this carbon-pore synergy increases soil water hysteresis and drought tolerance. Often ignored processes that significantly influence carbon-pore interactions are the formation and stability of macroaggregates arising from organic carbon input and transformation. This presentation will address how the carbon-pore interactions vary with time, organic carbon input, soil disturbance, and nitrogen input. Our results provide an insight into the role of macroaggregates (an instable carbon pool) in facilitating new carbon transfer into microaggregates (a stable carbon pool) and increasing carbon sequestration.

Biography: Dr. Jie (Joe) Zhuang is a Professor in the Department of Biosystems Engineering and Soil Science, Director of environmental and soil science graduate studies, Member of the Advisory Council of University of Tennessee (UT) Institute of Agriculture, and Faculty Lead of the cluster hire initiative of resilient agriculture and forest systems (RAFS) at UT. He received his B.S., M.S., and PhD degrees in soil science from Shenyang Agricultural University (China). His research topics range from food-energy-water nexus to the fate and transport of contaminants (such as viruses, bacteria, organic pollutants, heavy metals, engineering nanoparticles, and nutrients), soil hydrology modeling, pore-scale carbon-water interactions, crop-water relations, and physical foundation of phage-host interactions. In recent years, he links soil science to food-energy-water nexus by innovating strategies or solutions for soil restoration, safe reclaimed water irrigation, and soil resilience to environmental stresses. Currently, Dr. Zhuang leads projects aiming to develop climate-smart food-energy-water nexus on small farms within the framework of circular bioeconomy. In teaching, he provides undergraduate and graduate students with transdisciplinary training for understanding the complexity and impacts of food-energy-water nexus, circular agriculture, and food circular bioeconomy.

Invited Speaker: Dr. Xi Zhang, University of Tennessee, Knoxville, USA

Title: The Role of Cover Cropping in Shaping Soil Structure and Subsurface Water Dynamics for Building Resilient Agroecosystems

Abstract: Crop production is highly susceptible to extreme weather conditions. United States is experiencing increasing variability in rainfall, which can lead to more frequent soil water deficits during the growing seasons and increased the risk of yield losses. To close crop yield gaps, it is critical to develop management practices that buffer against short-term water stress and sustain crop production. Cover cropping has potential in increasing soil organic matter and improving soil structure and thus enhancing soil water retention. However, cover crops transpire water for their growth, and conserve soil water after they are terminated if the residues are retained on soil surface. The overall impacts of cover cropping on yield due to changes in soil water storage, availability, and recharge for cash crops are complex and context dependent. It is unclear whether the adverse effects of cover cropping on water balance can be offset by improved soil water retention to mitigate drought impacts. This work aims to untangle cover cropping and soil water dynamics interactions for evaluating the benefits of cover cropping for crop production in humid subtropical southern regions. This study provides insight into optimizing cover cropping management to build resilient agroecosystem and sustain crop production in a changing climate.



Biography: Dr. Xi Zhang is an Assistant Professor in the Department of Biosystems Engineering and Soil Science at the University of Tennessee, Knoxville. The central theme of his work has been to understand how environmental changes (e.g., climate, land cover) and perturbations (e.g., land use, agricultural management) in the Anthropocene govern the functioning of the Earth's critical zone and how this interaction influences soil physical environment evolution, hydrologic cycles, biogeochemical processes, soil-climate feedback loops, and ecosystem services.

Invited Speaker: Dr. Eminé Fidan, University of Tennessee, Knoxville, USA

Title: Transdisciplinary Teamwork in the Era of AI: A Way to Empower Communities and Mitigate Disaster Limitations with Respect to FEW systems

Abstract: Transdisciplinary collaborations are a powerful tool for understanding community operational and organizational strengths. These information resources can be leveraged and focused to empower communities and mitigate disaster limitations with respect to Food, Energy, and Water (FEW) Systems. In the face of complex and compounding effects of multiple disasters, integrating transdisciplinary frameworks with artificial intelligence (AI) offers new opportunities for data-driven decision-making, predictive modeling, and community-informed resilience planning. This presentation explores how AI-enabled analytics, when coupled with participatory and cross-sectoral collaboration, can help identify system vulnerabilities, optimize resource distribution, and enhance adaptive capacity across FEW systems. By bridging disciplinary boundaries and technological innovation, this work highlights pathways for empowering communities to understand, anticipate, withstand, and recover from disruptions more effectively.

Biography: Dr. Eminé Fidan is an Assistant Professor of Ecological Systems Engineering at the University of Tennessee. Her research leverages data analytics and AI to understand how extreme weather and disturbances impact agriculture, water resources, and ecological communities. Her prior research includes quantifying water-quality impacts from Hurricane Florence (2018), characterizing flood dynamics in agricultural landscapes during Hurricane Matthew (2016), and co-designing community-based resilience interventions in Puerto Rico following compound hurricane events. She is presently engaging with agricultural producers impacted by Hurricane Helene (2024) to support recovery of agroecosystems.

Invited Speaker: Dr. Charels Cao, University of Tennessee, Knoxville, USA

Title: AI-Enabled Precision Agriculture Management: From Disease Detection to Smart Farming

Abstract: The integration of AI and Internet of Things (IoT) technologies is transforming precision agriculture, including livestock management, row crops, among others. This presentation discusses practical AI-based IoT-based solutions for smart farming, with a focus on disease detection and control in dairy cattle. I will present our earlier work on SocialCattle, an AI-IoT-based framework that uses wearable sensors and social behavior analytics to detect and predict mastitis infections in dairy herds. By tracking cattle movement patterns and social interactions through GPS sensors, we developed probabilistic models that can identify high-risk animals for early intervention, reducing disease spread and treatment costs. The talk will cover: (1) practical sensor deployment strategies for small farms, (2) data-driven decision making for disease management, (3) integration of AI/ML for predictive analytics, and (4) lessons learned from real-world deployments. I will also discuss our ongoing USDA-funded precision dairy farming project and emerging opportunities for AI-powered agricultural monitoring systems. The presentation aims to bridge the gap between academic research and practical implementation for small farm operations.

Biography: Dr. Charles Qing Cao is an Associate Professor in the Department of Electrical Engineering and Computer Science at the University of Tennessee, Knoxville. He received his Ph.D. in Computer Science from the University of Illinois at Urbana-Champaign in 2008. His research focuses on Gen-AI, Internet of Things (IoT), cyber-physical systems, and applications in precision agriculture and smart farming. Dr. Cao leads multiple federally funded projects including a USDA/NIFA precision dairy farming initiative on real-time disease monitoring and diagnosis, and an NSF AI-ENGAGE project on AI based holistic agricultural response validation systems. Dr. Cao's research emphasizes practical, data-driven solutions that can be deployed in real-world agricultural settings to improve farm productivity and animal welfare.