OKLAHOMA NSF EPSCoR

2015 ANNUAL STATE CONFERENCE

THURSDAY, DECEMBER 3, 2015 * J.D. McCARTY CENTER * NORMAN, OKLAHOMA

PUTTING OUR MARK
ON CLIMATE RESEARCH

NSF GRANT NO. IIA-1301789

OKLAHOMA EPSCoR

NSF

OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION
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2015 ANNUAL STATE CONFERENCE AGENDA

7:30 A.M. **Registration & Continental Breakfast**

OPENING SESSION

8:20 A.M. **Welcoming Remarks**
Ray Huhnke, Project Director & PI, Oklahoma NSF EPSCoR

Moderator: **Garey Fox, Director, Oklahoma Water Resources Center; Professor, Dept. of Biosystems & Agricultural Engineering, OSU**

8:30 A.M. **Socio-Ecological System Panel**
Dawn Jourdan, Assoc. Professor & Director, Division of Regional & City Planning, OU
"A Socio-Ecological Approach to Planning for Climate Change"

Sam Fuhlendorf, Professor, Dept. of Natural Resource Ecology & Management, OSU
Mike Sorice, Asst. Professor, Department of Forest Resources & Environmental Conservation, Virginia Tech
"Increasing Grasslands Resiliency in the Southern Great Plains"

Rachata Muneepeerakul, Assoc. Professor, Agricultural & Biological Engineering, University of Florida
"A Modeling Framework for Coupled Natural-Human Systems"

10:00 A.M. **BREAK--15 MINUTES**

10:15 A.M. **Socio-Ecological System Panel Discussion (Cont.)**

10:45 A.M. **Adaptation to Climate Variability: The Role of the USDA Southern Plains Climate Hub**
Jean Steiner, Supervisory Soil Scientist, Grazinglands Research Laboratory, USDA

11:15 A.M. **Downscaled Climate Data: What is Available and How to Use it**
Renee McPherson, Assoc. Professor, Dept. of Geography & Environmental Sustainability, OU

11:45 A.M. **LUNCHEON**

12:30 P.M. **Luncheon Speaker: Tim VanReken, Program Director, National Science Foundation**
"NSF EPSCoR Update & Upcoming Funding Opportunities"

1:15 P.M. **POSTER SESSION HIGHLIGHTING STUDENT/POST-DOC RESEARCH**

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AFTERNOON SESSION (CONT.)

Moderator: **Ray Huhnke, Project Director & PI, Oklahoma NSF EPSCoR**

2:30 P.M. **EPSCoR Outreach Highlights**
Gina Miller, Outreach Coordinator, Oklahoma NSF EPSCoR

2:50 P.M. **OneOklahoma Cyberinfrastructure Initiative (OneOCII) & Research Informatics: EPSCoR Data Catalog**
Evan Linde, Research Cyberinfrastructure Analyst, OSU
Mark Stacy, Sr. Analyst, EPSCoR Informatics, OU
Henry Neeman, Director, OSCER; Asst. VP for IT-Research Strategy Advisor, OU
Dana Brunson, Asst. VP for Research Cyberinfrastructure; Director, High Performance Computing Center, OSU

3:20 P.M. **Introduction to the Watershed Websites**
Ron Miller, Postdoctoral Research Fellow, OSU
Emma Kuster, Program Coordinator, Oklahoma NSF EPSCoR

3:30 P.M. **BREAK--15 MINUTES**

3:45 P.M. **Our Path Moving Forward & How You Can be Involved**
Chris Zou, Asst. Professor, Dept. of Natural Resource Ecology and Management, OSU
"*Vulnerability & Resiliency of Wetlands under Changing Climate in the Cimarron River Basin of Oklahoma"*

Mike Treglia**,** Research Associate, Dept. of Biological Science, TU
"*Development of Lidar Derived Products for Oklahoma Researchers"*

Heather McCarthy, Asst. Professor, Dept. of Microbiology & Plant Biology, OU
"Linking Land Use & Management, Water Resources & Human Wellbeing in Oklahoma City"

Duncan Wilson, Research Scientist, South Central Climate Science Center, OU
"Topology of Coupled Human & Natural Systems"

5:00 P.M. **ADJOURN**

Presentations & abstracts can be accessed online after the conference at:
http://www.okepscor.org/research/presentations/2015-epscor-presentations-abstracts

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DR. RAY HUHNKE

PROJECT DIRECTOR & PI, OKLAHOMA NSF EPSCoR

DIRECTOR, BIOBASED PRODUCTS & ENERGY CENTER
PROFESSOR, BIOSYSTEMS & AG ENGINEERING
OKLAHOMA STATE UNIVERSITY, STILLWATER, OK

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Dr. Ray Huhnke is a professor in Biosystems and Agricultural Engineering at Oklahoma State University. Since 2000, he has been a team leader on several multidisciplinary, multi-institutional projects in converting low-cost biomass into liquid fuels and other value-added products using a gasification-fermentation process. In 2008, he was named Director of OSU's Biobased Products and Energy Center. From 2008-2013, Huhnke was the research coordinator on a five-year NSF EPSCoR Research Infrastructure Improvement Plan, "Building Oklahoma's Leadership Role in Cellulosic Bioenergy." In July 2013, he assumed the role of project director for the current Research Infrastructure Improvement Plan "Adapting Socio-Ecological Systems to Increased Climate Variability."

DR. GAREY FOX

CO-LEAD RESEARCHER, OKLAHOMA NSF EPSCoR

DIRECTOR, OKLAHOMA WATER RESOURCES CENTER
PROFESSOR, BIOSYSTEMS & AG ENGINEERING
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Dr. Garey Fox is a Biosystems and Agricultural Engineering researcher and Buchanan Endowed Chair in Biosystems and Agricultural Engineering at Oklahoma State University, and Director and Thomas E. Berry Endowed Professor of the Oklahoma Water Resources Center. He is the lead researcher on the Oklahoma NSF EPSCoR Research Infrastructure Improvement Award No. IIA-1301789 (2013-2018), “Adapting Socio-Ecological Systems to Increased Climate Variability.” Dr. Fox has a Bachelor’s Degree and Master’s Degree in Agricultural Engineering, both from Texas A&M University. He received his Doctorate Degree in Civil Engineering from Colorado State University in 2003.

Dr. Fox works in the area of environment and natural resources engineering and specializes in stream/aquifer interaction; stream bank erosion and failure; seepage erosion; subsurface nutrient transport; and contaminant transport modeling. He has authored over 90 peer-reviewed publications.

DR. DAWN JOURDAN

ASSOCIATE PROFESSOR & DIRECTOR
DIVISION OF REGIONAL AND CITY PLANNING
UNIVERSITY OF OKLAHOMA
NORMAN, OK

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Dawn Jourdan is an Associate Professor and Director of the Division of Regional and City Planning at the University of Oklahoma. Previously, she held a joint appointment between the Colleges of Design, Construction, and Planning and the Levin College of Law at the University of Florida. While at UF, Dawn also served as Director of the Center for Building Better Communities. She began her academic career as an Assistant Professor of Planning at Texas A & M University in College Station, Texas. Before returning to academia, Dawn worked for the State and Local Government Division of Holland & Knight LLPs Chicago offices. Dawn earned a Ph.D. in urban and regional planning from Florida State University in 2004, a joint degree in law and urban planning from the University of Kansas in 2000, and a B.S. in Urban Affairs and Theatre Arts from Bradley University in 1996.

Dawn conducts research which focuses on the impacts of relocation, resulting from natural disasters and policy changes, on families. For the last 5 years, she has studied the ways in which sea level rise in Florida may result in dislocation. She has been working on the ground with communities in northern Florida to help prepare resident to adapt to these changes in climate. Currently, she is working with tribal governments in the State of Oklahoma to help identify and plan for adaptations that may be necessary as a result of anticipated climate events.

DR. SAM FUHLENDORF

PROFESSOR
NATURAL RESOURCE ECOLOGY & MANAGEMENT
OKLAHOMA STATE UNIVERSITY
STILLWATER, OK

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Dr. Sam Fuhlendorf received his B.S. in Agriculture at Angelo State University, M.S. at Texas A&M University in 1992. He completed his Ph.D. at Texas A&M in 1996 with research on the long-term effects of altered fire and grazing regimes on a semi-arid Quercus-Juniperus savanna. After a brief post-doctoral research associate position, Sam took a position at Oklahoma State University in 1997 as an Assistant Professor and was promoted to Associate Professor in 2002 and Professor in 2004. He has published over 100 peer-reviewed articles in international journals, such as Bioscience, Ecosphere, Journal of Wildlife Management, Journal of Applied Ecology, Conservation Biology, Ecological Applications, Proceedings of the National Academy of Science, and Rangeland Ecology and Management.

Sam's current research is generally focused on conservation of grassland landscapes and the wildlife that live on those lands. Specific areas focus on 1) understanding the role of disturbance-driven heterogeneity in the structure and function of grasslands, 2) integrating a landscape perspective into conservation of rangelands and wildlife, 3) fire ecology, 4) wildlife conservation, and 5) understanding how animals use landscapes.

He currently teaches Applied Ecology and Conservation, Landscape Ecology and Ecology of Fire Dependent Ecosystems. Sam actively participates in The Wildlife Society, Ecological Society of America, Society for Range Management, and International Association for Landscape Ecology.

Sam is the Regents Professor and holds the Groendyke Chair in Wildlife Conservation at Oklahoma State University. Sam has received the Outstanding Young Professional Award for the Society for Range Management in 2002, the James A. Whatley Award of Merit for Research from OSU in 2001, the Outstanding Achievement Award for Research from the Society for Range Management in 2010, the Regents Distinguished Research Award at OSU in 2012, and was named Fellow by the DaVinci Institute for Creativity in 2013. Sam's favorite role is being a dad to his daughter Catie and a grandfather to her children Jaden, Kai and Laney.

DR. MIKE SORICE

ASSISTANT PROFESSOR
FOREST RESOURCES & ENVIRONMENTAL CONSERVATION
VIRGINIA TECH
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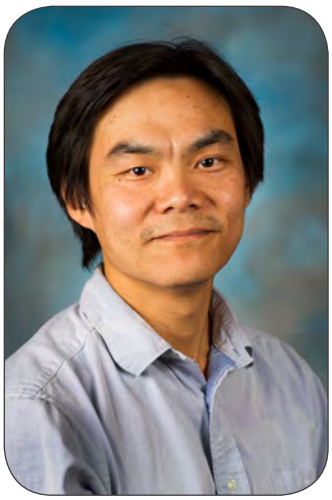
Michael Sorice is an Assistant Professor in the Department of Forest Resources & Environmental Conservation at Virginia Tech. He focuses on environmental stewardship with an emphasis on the role of natural resource users and landowners in protecting biodiversity and imperiled ecosystems. His research in the Southern Great Plains focuses on understanding how heterogeneity across the social landscape influences landcover change via the choices, behaviors, and tradeoffs landowners make.



DR. RACHATA MUNEEPEERAKUL

ASSOCIATE PROFESSOR
AGRICULTURAL & BIOLOGICAL ENGINEERING
UNIVERSITY OF FLORIDA
GAINESVILLE, FL

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Dr. Muneepeerakul has worked on a wide variety of problems, ranging from life to social sciences, from biodiversity patterns in river networks to dynamics of coupled natural-human systems. His primary investigative tools are mathematical and computational models. He is interested in dynamical models, complex networks, game theory, and stochastic processes.

Dr. Muneepeerakul's diverse research interests are reflected in the projects in which he is involved and his publication record. In one project (NSF-CNH), he has been investigating how robust or vulnerable irrigation systems are with respect to rapid changes in disturbance regimes, both social and biophysical; he is expanding this line of research to coupled natural-human systems more generally. Another ongoing project (DoD-SERDP) addresses the biodiversity patterns of aquatic ecosystems in dryland streams whose challenging characteristics include pronounced hydrological seasonality and spatial heterogeneity. In another line of research, he and his colleagues apply complex network approaches to study structure of urban economies. Several other projects are under development, all of which share a common theme of inventing and blending concepts and analytical/computational techniques from different disciplines to achieve meaningful insights.

DR. JEAN STEINER

SUPERVISORY SOIL SCIENTIST
GRAZINGLANDS RESEARCH LABORATORY, USDA
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Jean Steiner is the Director of the USDA-ARS Grazinglands Research Laboratory in El Reno, Oklahoma where she leads the Southern Plains site of the Long Term Agroecosystem Research network. She is Co-Project Director of the Grazing CAP project and Director of the USDA Southern Plains Climate Hub.

DR. RENEE McPHERSON

CO-LEAD RESEARCHER, OKLAHOMA NSF EPSCoR

ASSOCIATE PROFESSOR
GEOGRAPHY & ENVIRONMENTAL SUSTAINABILITY
CO-DIRECTOR, SOUTH CENTRAL CLIMATE SCIENCE CENTER
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Dr. Renee A. McPherson is Associate Professor of Geography and Environmental Sustainability at the University of Oklahoma (OU) and University Co-director of the South Central Climate Science Center. She also is an Adjunct Associate Professor of Meteorology at OU. Dr. McPherson holds a B.S. in Mathematics and B.S, M.S., and Ph.D. in Meteorology. Her research includes regional and applied climatology, mesoscale meteorology, severe local storms, land-air-vegetation interactions, surface observing systems, applied meteorology, and societal and ecological impacts of climate variability and change. She teaches classes in climatology and physical geography, advises graduate students in their research and education, and mentors undergraduate students who are interested in research opportunities. Formerly, she was State Climatologist of Oklahoma and Acting Director of the Oklahoma Climatological Survey.

Dr. McPherson oversees the Consortium-related activities of the South Central Climate Science Center, as a co-governing partner of the U.S. Geological Survey (USGS). Activities include coordination with USGS Headquarters, our USGS Director, our Consortium (Texas Tech University, Oklahoma State University, Chickasaw Nation, Choctaw Nation of Oklahoma, Louisiana State University, and NOAA's Geophysical Fluid Dynamics Laboratory), the six Landscape Conservation Cooperatives within our region, and the seven other Climate Science Centers. She has been principal or co-investigator on over $40 million of grants and contracts from federal and state agencies, universities, private companies, or non-governmental organizations. Dr. McPherson is a member of Phi Beta Kappa, the American Meteorological Society, American Geophysical Union, Association of American Geographers, and the American Association of State Climatologists. She was co-recipient of the Innovations in American Government Award (Harvard University) and Environmental Achievement Award (U.S. Department of the Interior), and she received the Vice President for Research Norman Campus Outstanding Research Engagement Award.

DR. TIM VANREKEN

PROGRAM DIRECTOR, EPSCoR
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Tim VanReken is a Program Director with EPSCoR at the National Science Foundation, where he's worked since June 2014. Within NSF EPSCoR he is the managing program officer responsible for Oklahoma, and currently is the lead on the Research Infrastructure Improvement (RII) Track-2 competition, which focuses on developing focused interjurisdictional research collaborations. Dr. Vanreken also holds an appointment as an Associate Professor with the Laboratory for Atmospheric Research in Washington State University's Department of Civil & Environmental Engineering. His research is focused on atmospheric particulate material and interactions between the biosphere and atmosphere. Dr. VanReken holds a B.S. from the University of Florida and a Ph.D. from Caltech, both in Chemical Engineering. He held a postdoctoral position at the National Center for Atmospheric Research before joining WSU in 2007.

MS. GINA MILLER

OUTREACH COORDINATOR
OKLAHOMA NSF EPSCoR
OKLAHOMA STATE UNIVERSITY
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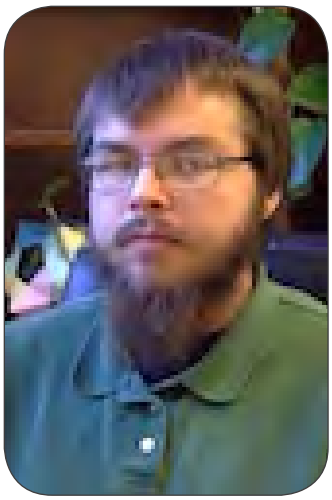
Gina Miller joined the Oklahoma NSF EPSCoR program in 2009 after serving as Executive Director of Stillwater Public School's Education Foundation.

In her role as NSF EPSCoR outreach coordinator, Gina manages, supports, and promotes the education, outreach, and diversity programs of the RII award. She is also in charge of coordinating special events, managing the program's website and social media pages, and for developing communication materials to share the project's outreach and research success with outside audiences.



MR. EVAN LINDE

RESEARCH CYBERINFRASTRUCTURE ANALYST
OKLAHOMA STATE UNIVERSITY
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Evan Linde is a Research Cyberinfrastructure Analyst in the High Performance Computing Center at Oklahoma State University. He has a BS in Mathematics and Computer Science from Northeastern State University.

MR. MARK STACY

SENIOR ANALYST, EPSCoR INFORMATICS
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Mark Stacy is a Senior Analyst in the Informatics group at the University of Oklahoma. In his career, Mark has worked within the federal government, health care, and higher education arenas. His expertise in the data life cycle and information management system has empowered scientist, researchers, and management personnel with the ability to access pertinent information and drive data decision support capabilities. He has a MS in Computer Science from Oklahoma City University and a BS in Physical Therapy from the University of Oklahoma.

DR. HENRY NEEMAN

DIRECTOR, OSCER
ASST. VICE PRESIDENT, IT - RESEARCH STRATEGY ADVISOR
ASSOC. PROFESSOR, ENGINEERING
ADJUNCT ASSOC. PROFESSOR, COMPUTER SCIENCE
UNIVERSITY OF OKLAHOMA, NORMAN, OK

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Henry Neeman is the founding Director of the OU Supercomputing Center for Education & Research (OSCER), Assistant Vice President for Information Technology - Research Strategy Advisor, Associate Professor of Engineering, and Adjunct Associate Professor of Computer Science at the University of Oklahoma (OU).

He received his BS in Computer Science and his BA in Statistics with a minor in Mathematics in 1987 from the University at Buffalo, State University of New York, his MS in CS from the University of Illinois at Urbana-Champaign (UIUC) in 1990 and his PhD in CS from UIUC in 1996.

Prior to coming to OU, Dr. Neeman was a postdoctoral research associate at the National Center for Supercomputing Applications (NCSA) at UIUC, and before that served as a graduate research assistant both at NCSA and at the Center for Supercomputing Research and Development, also at UIUC.

Dr. Neeman and his counterpart at Oklahoma State University, Dr. Dana Brunson, have been appointed joint co-leads of the Campus Engagement program of the Extreme Science and Engineering Discovery Environment (XSEDE), the umbrella organization over the National Science Foundation's national supercomputing centers.

He also collaborates with the Advanced Cyberinfrastructure Research and Education Facilitators (ACI-REF) project led by Clemson University, and serves on the steering committee of the Linux Clusters Institute, as well as the National Science Foundation's Advisory Committee for Cyberinfrastructure.

DR. DANA BRUNSON

ASST. VICE PRESIDENT FOR RESEARCH CYBERINFRASTRUCTURE;
DIRECTOR, HIGH PERFORMANCE COMPUTING CENTER
ADJUNCT ASSOC. PROFESSOR, COMPUTER SCIENCE & MATH
OKLAHOMA STATE UNIVERSITY
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Dana Brunson is the Assistant Vice President for Research Cyberinfrastructure, the Director of the High Performance Computing Center and is an adjunct associate professor in the Computer Science Department and the Mathematics Department at Oklahoma State University (OSU). She earned her Ph.D. in Mathematics at the University of Texas at Austin in 2005 and her M.S. and B.S. in Mathematics from OSU. Dana is co-lead of the OneOklahoma Cyberinfrastructure Initiative (OneOCII) which provides CI resources to academic institutions statewide. She is also a member of the XSEDE Campus Champion leadership team and one of seven new Regional Champions. Dana is PI on OSU's NSF MRI award "Acquisition of a High Performance Compute Cluster for Multidisciplinary Research," 9/1/2011 – 8/31/2015, $908,812 (Award #1126330), resulting in the deployment of the largest externally funded supercomputer in state history. She is also co-PI on Oklahoma's NSF CC-NIE grant, "OneOklahoma Friction Free Network," a collaboration among OSU, OU, Langston and the Tandy Supercomputing Center, 10/1/2013 – 9/31/2015, $499,961 (Award #1341028).

DR. RON MILLER

POSTDOCTORAL FELLOW
BIOSYSTEMS & AGRICULTURAL ENGINEERING
OKLAHOMA STATE UNIVERSITY
STILLWATER, OK

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Ph.D.: Environmental Science, 2012, Oklahoma State University, Hydrogeophysics of Gravel-dominated Floodplains in Eastern Oklahoma

M.S.: Geospatial Science 2006, Missouri State University, Nutrient loads in an urban Ozark watershed : Jordan, Fassnight and Upper Wilson's Creeks, Springfield, Missouri

Currently: Postdoctoral Research Fellow at Oklahoma State University

I am interested in researching changes to stream flow and groundwater as a result of climate variability in Oklahoma, especially how those changes affect the activities and livelihoods of Oklahomans.

MRS. EMMA KUSTER

PROGRAM COORDINATOR
OKLAHOMA NSF EPSCoR
OKLAHOMA STATE UNIVERSITY
STILLWATER, OK

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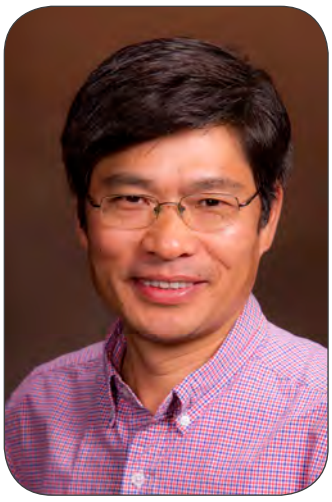
Mrs. Emma Kuster is the Program Coordinator for the current Oklahoma EPSCoR grant, *Adapting Socio-Ecological Systems to Increased Climate Variability*. Her job includes fostering an environment for collaborative work, aiding researchers in communicating with one another, and outreaching the current EPSCoR research at academic and professional conferences. Additionally, she puts out a newsletter twice a month to all participants on the EPSCoR project to help people keep up-to-date on events and deadlines. She has a Bachelor's degree in Meteorology and a Master's degree in Geography, both from the University of Oklahoma. Her primary research interests include the impacts of climate variability and climate extremes on both ecosystems and human societies. Her ultimate goal is to bridge the gap between academic researchers and real-world applications.



DR. CHRIS ZOU

ASSISTANT PROFESSOR
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OKLAHOMA STATE UNIVERSITY
STILLWATER, OK

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Dr. Chris Zou is an associate professor of ecohydrology and wildland hydrology in the Department of Natural Resource Ecology and Management at Oklahoma State University. He received his BA in Biology and M.S. in Ecology from Southwest University, China and Ph.D. in Forestry from University of Canterbury, New Zealand. Dr. Zou's Ecohydrology and Wildland Hydrology Lab focuses on spearheading research and applications at the nexus of climate change, ecology, and water resources. His current research theme is to understand the coupling of ecological and hydrological processes and alteration of ecosystem provisioning services such as water and carbon under land use and vegetation changes both at ecosystem and landscape scales. Dr. Zou's research incorporates both field-based observation and modeling approaches and spans a wide range of settings ranging from deserts, savannas, woodlands, and forests.

Dr. Zou is a co-investigator in the OK NSF EPSCoR Research Infrastructure Improvement Award No. IIA-1301789 (2013-2018), "Adapting Socio-Ecological Systems to Increased Climate Variability." His roles in the NSF EPSCoR project include advancing our understanding of vegetation-induced changes in hydrological mechanisms by expanding experimental approaches of micro-catchment studies, and calibrating hydrological models which can be used by all EPSCoR researchers and broad research communities to understand climate and land use impact on water quality at the regional scale. Dr. Zou will also participate in an integrated study focusing on understanding vulnerability and resiliency of wetlands under changing climate in the Cimarron River basin of Oklahoma using coupled social and ecological approaches.

3:45 SESSION PRESENTATION ABSTRACT

CHRIS ZOU*, NATURAL RESOURCE ECOLOGY & MANAGEMENT
RICHARD T. MELSTROM, AGRICULTURAL ECONOMICS
OKLAHOMA STATE UNIVERSITY

"VULNERABILITY AND RESILIENCY OF WETLANDS UNDER CHANGING CLIMATE IN THE CIMARRON RIVER BASIN OF OKLAHOMA"

Wetlands, among the most valuable ecosystems on the planet, provide important ecosystem services including wildlife habitat and biodiversity, carbon sinks, water regulation and purification, flood abatement and drought buffer, eco-tourism and recreation. Vulnerability of wetlands to changing climatic conditions—particularly protracted drought—and resource management can dramatically impair these services. In this project we will focus on improving our understanding of how physical (climate,-

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-hydrology, land use) and socio-economic (management actions and costs, policies, incentives) systems interact in the lower Cimarron River basin (15,719 km2) of north-central Oklahoma to affect the vulnerability of wetlands and the resiliency of the region to climate change. This project employs ENVISION, a platform that integrates decision-makers, landscapes and policies, to assess alternative future scenarios (Figure 1). We anticipate this project will (1) reveal complex system behaviors and feedbacks associated with wetlands, (2) improve effectiveness of wetland conservation and restoration policies, (3) improve understanding of the role of economic forces in influencing how landowners and managers make decisions under risk and uncertainty, (4) improve understanding of how climate change could affect policy outcomes and ecosystem services, and finally (5) help to develop alternative management strategies, adaptive policies and actions.

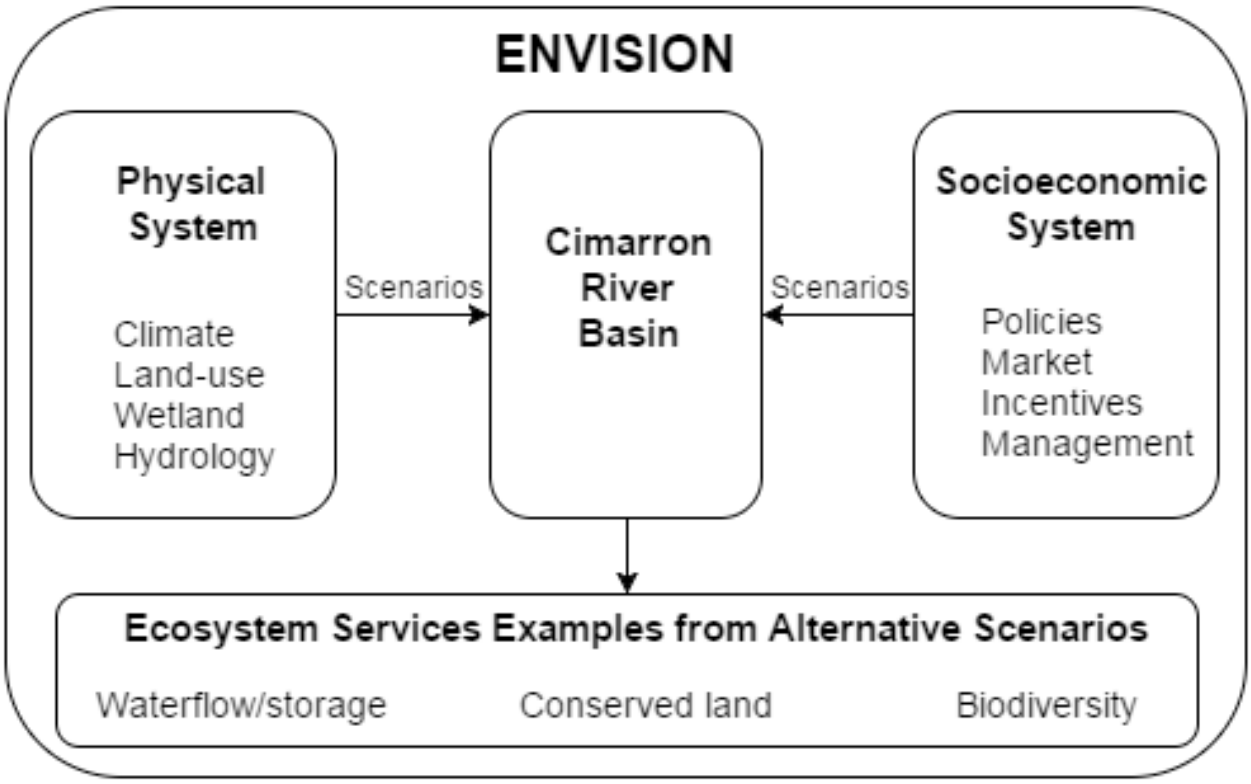

Figure 1. Coupled physical and socioeconomic modelling approach to assess wetland vulnerability and resiliency under changing climate in the Cimarron River Basin of Oklahoma

DR. MIKE TREGLIA

RESEARCH ASSOCIATE
BIOLOGICAL SCIENCE
THE UNIVERSITY OF TULSA
TULSA, OK

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Michael L. Treglia is an EPSCoR Postdoc in the Department of Biological Science at the University of Tulsa, advised by Dr. Ron Bonett. Mike's research involves using GIS and Remote Sensing tools in studies of conservation biology, ecology, and evolutionary biology, with an emphasis on reptiles and amphibians. He completed his Ph.D. at Texas A&M University in 2014 as part of the Applied Biodiversity Science NSF-IGERT Doctoral Program, and his dissertation focused on conservation of the endangered arroyo toad in southern California. He also holds a MS from Texas A&M, and a BS from Cornell University. As part of the Oklahoma EPSCoR program, Mike has been investigating how variability of local climate and fine-scale stream conditions may influence evolution of alternative life history strategies in salamanders, and he is working on development LiDAR-based spatial data products for the state of Oklahoma. In addition to his research, Mike teaches courses at the University of Tulsa, focused on GIS, landscape ecology, and spatial analysis.

3:45 SESSION PRESENTATION ABSTRACT

MICHAEL TREGLIA*, BIOLOGICAL SCIENCE, THE UNIVERSITY OF TULSA
ADAM J. MATHEWS, GEOGRAPHY, OKLAHOMA STATE UNIVERSITY
DUNCAN WILSON, SOUTH-CENTRAL CLIMATE SCIENCE CENTER, UNIVERSITY OF OKLAHOMA

"*DEVELOPMENT OF LIDAR DERIVED PRODUCTS FOR OKLAHOMA RESEARCHERS"*

Light Detection and Ranging (LiDAR) technologies allow for fine-scale, three-dimensional mapping of Earth's surface, and are increasingly being used in research and management of natural resources. LiDAR data collected following standardized protocols are presently available for approximately 40% of Oklahoma, including several EPSCoR focal watersheds, though only in raw form, as point clouds. Point clouds allow for intuitive visualization of the data, but are not immediately useful for further analysis. Thus, we are processing the available LiDAR data for Oklahoma to derive a variety of ecologically-relevant GIS datasets, including high-resolution elevation and canopy height models, wildfire fuel, and metrics of vegetation density. We will make the resulting products freely available for use by others, and anticipate them being employed in various types of research projects on hydrology, wildfire risk, wildlife habitat, and soil moisture monitoring. These data can contribute to coupled human and natural systems research by allowing human behavior to be characterized at fine spatial scale, such as household-level. We will also briefly outline other remote sensing products available that can resolve human behavior in land-use and land-cover dynamics at fine temporal and spatial scales.

DR. HEATHER McCARTHY

ASSISTANT PROFESSOR
MICROBIOLOGY AND PLANT BIOLOGY
UNIVERSITY OF OKLAHOMA
NORMAN, OK

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Dr. Heather McCarthy is an Assistant Professor of Plant Biology, in the Department of Microbiology and Plant Biology at the University of Oklahoma. Her research interests include: plant physiological ecology, global change ecology, urban ecology, ecohydrology and coupled human-natural systems. Her research largely explores how trees and forests respond to environmental changes, and, conversely how can they be managed to moderate environmental changes. This research draws on physiological and ecosystem ecology to explore how plant water and carbon cycle processes respond to global change factors, including changes in water availability, extreme weather events, elevated atmospheric CO2, and urbanization. Dr. McCarthy received her B.S. in Environmental Science at Oregon State University and her Ph.D in Ecology at Duke University, after which she was a postdoctoral fellow in the Department of Earth System Science at the University of California, Irvine.

3:45 SESSION PRESENTATION ABSTRACT

HEATHER MCCARTHY*, MICROBIOLOGY & PLANT BIOLOGY, UNIVERSITY OF OKLAHOMA
BETH CANIGLIA, SOCIOLOGY, OKLAHOMA STATE UNIVERSITY
TRACY BOYER, AGRICULTURAL ECONOMICS, OKLAHOMA STATE UNIVERSITY
GAREY FOX, BIOSYSTEMS & AG ENGINEERING, OWRC, OKLAHOMA STATE UNIVERSITY
JACK FRIEDMAN, CENTER FOR APPLIED SOCIAL RESEARCH, UNIVERSITY OF OKLAHOMA
XIANGMING XIAO, MICROBIOLOGY & PLANT BIOLOGY, UNVIERSITY OF OKLAHOMA
RENEE MCPHERSON, GEOGRAPHY & ENVIRONMENTAL SUSTAINABILITY, SCCSC, UNIVERSITY OF OKLAHOMA

"*LINKING LAND USE AND MANAGEMENT, WATER RESOURCES AND HUMAN WELLBEING IN OKLAHOMA CITY"*

In urban systems, ecosystem function is highly influenced by human decisions (regarding vegetation composition and management), and people benefit directly from many ecosystem services provided by urban ecosystems. Ultimately, the further an urban system is from the "natural" state, the more resources and management are required to maintain it in the altered state. Thus, these systems may be vulnerable to system changes, when climate variability or other events limit resource availability or funding to undertake management activities. We are in the process of using the system dynamics model ENVISION as a framework to bring together remotely sensed land cover and vegetation function (e.g. productivity and water loss), urban hydrology, social and economic understandings of household and municipal water use and decision making, an understanding of ecosystem services provided by urban landscapes, and metrics of-

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-human wellbeing, to answer several overarching questions. 1) how do changes in land use, land management and water resource use feed back to impact human wellbeing? 2) what ecological metrics or indicators do people perceive and respond to? This work will allow us to better understand relationships between urban land use and ecosystem function, how decision making responds to environmental cues, and integrated system dynamics in cities dealing with limited water supplies.

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Duncan Wilson is currently a Research Scientist at the University of Oklahoma with the South-central Climate Science Center. He has been previously affiliated with a number of universities and research centers, including Oklahoma State University, the University of KwaZulu-Natal in South Africa, the University of Florida, and FPInnovations in Canada. His research is focused on natural resource management and how this intersects with human systems.

3:45 SESSION PRESENTATION ABSTRACT

DUNCAN WILSON, SOUTH CENTRAL CLIMATE SCIENCE CENTER, UNIVERSITY OF OKLAHOMA

"*TOPOLOGY OF COUPLED HUMAN AND NATURAL SYSTEMS"*

Coupled human and natural systems appear to have a fundamental topology (structure) that drives many of the dynamics, particularly those reflecting the degree of coupling between the human and natural components. We take the term topology from graph theory to represent the formal graphical structure of the relationship between human and natural systems that remains static despite considerable distortion of system components over time or space. This topology framework is briefly introduced, and ongoing work to examine the dynamics of coupled human and natural systems in the Kiamichi and OKC study areas is presented. New methods in development investigate fire risk perception (OKC peri-urban) and drought risk perception (Kiamichi) under this framework. Opportunities for engagement in this work are outlined.

POSTER SESSION

HIGHLIGHTING STUDENT & POST-DOC RESEARCH

ABSTRACTS

Abstracts can be accessed online after the conference at:
http://www.okepscor.org/research/presentations/2015-epscor-presentations-abstracts

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2	Jingnuo Dong	Oklahoma State University	An Approach to Revealing Meso-scale Spatial Patterns of Soil Moisture
3	Jon Giddens	University of Oklahoma	Urban Forest Health and Mortality in the Oklahoma City Metro Region
4	Chih-Yu Lai	University of Oklahoma	Spatial Interpolation for Temperature and Precipitation in Oklahoma Weather, Society and Government Survey
5	Miriam Laytner	University of Oklahoma	"All That's Left Are Memories": Lake Sardis and the Reconstruction of Memories Regarding Water, Wetlands Recreational Space and Ownership in Southeastern Oklahoma
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15	Justin Alexander	Oklahoma State University	Assessing Reservoir Operations and the Associated Changes in Water Quality on the Persistence of Stream Fishes

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20	Whitney Lisenbee	Oklahoma State University	Evaluation of Field Jet Erosion Tests and WEPP-predicted Erodibility Parameters in Forests and Grasslands
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23	Jesus Zubillaga	University of Oklahoma	Value of Environmental Monitoring Information in Oklahoma Agriculture: A Research Perspective
24	Benjamin Davis	University of Oklahoma	Analyzing Changes in Urban Areas Using Landscape Pattern Metrics
25	Toni Klemm	University of Oklahoma	Improving Seasonal Climate Forecasts for Oklahoma Winter Wheat Farmers
26	Daniel Logue	Oklahoma State University	Detection Estimates and Habitat Occupancy of Two Pelagic Broadcast Spawning Cyprinids
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29	Claude Buerger	University of Oklahoma	The LandSHIFT Model: Use and Applications in Oklahoma

POSTER #1

Assessing Summer Drought over Oklahoma Mesonet Sites with the MODIS Land Surface Water Index

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Agricultural drought, a common phenomenon in most parts of the world, is one of the most challenging natural hazards to monitor effectively. Land surface water index (LSWI), calculated as a normalized ratio between near infra-red (NIR) and short wave infra-red (SWIR), is sensitive to vegetation and soil water content. This study examined the potential of a LSWI- based drought monitoring algorithm to assess summer drought over 113 Oklahoma Mesonet stations comprising various land cover and soil types in Oklahoma. Drought duration in a year was determined by the number of days with LSWI < 0 (DNLSWI) during summer months (Jun-Aug). Summer rainfall anomalies and LSWI anomalies followed a similar seasonal dynamics and showed strong correlations (R2= 0.62 – 0.73) during drought years (2001, 2006, 2011, and 2012). The DNLSWI tracked the East-West gradient of summer rainfall in Oklahoma. Drought intensity increased with increasing duration of DNLSWI, and the intensity increased rapidly when DNLSWI was more than 48 days. The comparison between LSWI and the US Drought Monitor (USDM) showed a strong linear negative relationship across the biomes and soils, i.e, higher drought intensity tends to have lower LSWI values and lower intensity drought tends to have higher LSWI values. However, the agreement between LSWI-based algorithm and USDM indicators for different drought intensity classes varied substantially from 32% (D2 class, moderate drought) to 77 % (0 and D0 class, no drought). Our results demonstrated that by counting DNLSWI (in days), drought intensity thresholds can be established and used as a simple complementary tool in several drought applications which have currently used a relatively complex, resource intensive USDM drought intensity classification for tall grass prairie.

POSTER #2

An Approach to Revealing Meso-Scale Spatial Patterns of Soil Moisture

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Meso-scale spatial patterns of soil moisture with length scales between 0.5 and 50 km are difficult to identify due to the relatively small footprints of in situ measurement devices and the relatively large footprints of soil moisture satellites. Soil moisture observations from large-scale in situ networks, complemented by appropriate spatial interpolation methods, may provide a solution to this scale gap problem. But, how can the interpolated maps be evaluated and refined? A cosmic-ray neutron rover, with a footprint of ~400 m diameter, makes it possible to reveal previously unknown spatial patterns of soil moisture at this scale. A rover was repeatedly transported by vehicle along a 160-km transect in Oklahoma recording fast neutron counts in order to observe meso-scale soil moisture patterns in one-dimension. The spatial patterns perceived by the rover will be presented with a view toward the use of these data to test and improve spatial interpolation methods for large-scale in situ networks.

POSTER #3

Urban Forest Health and Mortality in the Oklahoma City Metro Region

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Many cities wish to increase tree cover and/or improve the quality of the existing forest by promoting large, healthy trees that provide high levels of services. Although urban trees may benefit from reduced competition and increased resource availability, urban trees are generally assumed to face high stress conditions and have reduced lifespans compared to natural trees. However, the role of natural stresses or disturbances, such as droughts and storms, compared to human causes is uncertain. Using ground- and aerial-image-based surveys, we investigated urban tree health and mortality in the Oklahoma City, Oklahoma metro area. Our objectives were to assess patterns in urban forest health and mortality, specifically 1) what factors are associated with poor tree condition (i.e. native status, size)? and 2) how much can poor tree condition can be attributed to natural factors versus human causes? Assessments of recently planted trees reveal an average mortality rate (within 2 years of planting) of 40%. Although there is great spatial variability in condition, a majority (83%) of surveyed trees were in good to fair condition. Notably, human-induced damage – such as root girdling, trunk wounds, and improper pruning – were much more commonly observed than storm damage or canopy dieback. The smallest and largest trees were most likely to be in poor condition, and trees native to central Oklahoma were not in better condition than those native to other regions. These results suggest that human stressors, rather than inappropriate species selection, is the biggest factor in poor tree health. High mortality rates and poor tree health result in diminished return on financial investments, the lack of realization of the full extent of services that can be provided by urban forests, and challenges to human management efforts to mitigate urban heat island effects, CO2 emissions, and other climate change-related stressors impacting cities.

POSTER #4

Spatial Interpolation for Temperature and Precipitation in Oklahoma Weather, Society and Government Survey

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Spatial interpolation is the procedure of generating the continuous surface from the sampled point values. To predict the unknown values of temperature and precipitation at our respondents' locations in Oklahoma Weather, Society and Government Survey, we took the observations from the Mesonet stations to create the estimates by using the deterministic and geostatistical interpolation methods in ArcGIS Desktop 10.2. Deterministic methods include inverse distance weighting (IDW), global polynomial interpolation (GPI) and local polynomial interpolation (LPI). In geostatistical methods, we use Universal Kriging and Ordinary Kriging with 3 different kernel functions. To evaluate the interpolated results, Cross Validation is applied by using a dataset that was not involved in creating the prediction model. The fewer the error mean is, the less the difference between the predicted value and the observed value. After examining these interpolation methods with cross validation, "Universal Kriging with Polynomial5 Kernel Function" has the lowest "Mean Error", "Root-Mean-Square Error" and "Mean Standardized Error" values. Also, "Ordinary Kriging with Gaussian Kernel Function" has the lowest "Root-Mean-Square Standardized Error" value. Because "Universal Kriging with Polynomial5 Kernel Function" has better results in cross validated estimation, we chose it as our spatial interpolation method for temperature and precipitation in Oklahoma Weather, Society and Government Survey.

POSTER #5

“All That’s Left Are Memories”: Lake Sardis and the Reconstruction of Memories Regarding Water, Wetlands Recreational Space and Ownership

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In 1977, construction commenced on Lake Sardis in southeastern Oklahoma. Only a few years after its completion, Sardis became a contested space at the center of not only two important legal battles, but also regional and national debates over the meaning of wilderness, recreational space, wetlands and the rightful owners and users of water. This poster examines the ways in which residents of Sardis (which was intentionally flooded for the construction of the lake) and nearby towns perceived of and discussed these issues through the use of data gathered from archived newspapers and other materials found in the Oklahoma History Center. It will discuss the methodology used by the research team, which has logged over 70 hours in the archives to date. The poster will also discuss the team’s findings so far and provide specific examples of headlines and editorials from local papers that demonstrate the fluctuating attitudes of locals towards the aforementioned issues over time. Finally, the poster will describe the potential significance of our findings to current and future ethnographic researchers in the region.

POSTER #6

Towards a High Resolution Soil Moisture Map of Oklahoma

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Large scale (> 1 km2) estimates of soil moisture have been validated by using data from single points of long-term networks with sparse soil moisture measurements and/or by using data from short-term experiments with dense soil moisture measurements. Long-term soil moisture data that match or can be scaled to match the spatial resolutions of large scale (e.g. satellite and model) estimates are needed. Our goal is to produce daily soil moisture maps of Oklahoma at quarter-section (~800 m) resolution that are suitable for not only scientific purposes — validation of modeled and remotely sensed soil moisture, for example — but also for operational purposes — weather forecasting, land management, etc. Initial results towards this goal have been developed by combining Oklahoma Mesonet soil moisture data with spatiostatistical models (e.g. ordinary kriging). These maps have been developed further by adding other relevant data (soil texture, radar precipitation estimates) to our models. The next step includes incorporating findings from a roving cosmic-ray soil moisture sensor ("COSMOS rover") to validate and improve our soil moisture maps. Mesonet soil moisture measurements are only taken under grassland conditions, so a second priority is accounting for other land cover conditions.

POSTER #7

Oklahoma Map of Forest Cover at 30-m Spatial Resolution in 2010

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Forest and their changes are important to carbon cycle, biodiversity and ecosystem services. Great uncertainties about forest cover in sparsely forested regions calls for an accurate forest cover map. In this study, we developed a decision tree method to map forest distribution at the spatial resolution of 30-m in Oklahoma in 2010, using ALOS PASLAR orthorectified mosaic images and time series Landsat TM/ETM+ images. Our result shows that the total forest area is about 39,518 km2 in Oklahoma, about 22% of entire state, which is quite close to the forest area from Oklahoma Forest Resource Assessment 2010 (40,468 km2). This study could help to reduce the uncertainties about forest cover and facilitate the policy makers to modify forest management.

POSTER #8

Streamflow Responses to Sea Surface Temperature Variations Across Oklahoma

R.M. Renato*[,1,4], Chris B. Zou[1,4], Garey A. Fox[2,4], and Tyson E. Ochsner[3,4]
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BACKGROUND/QUESTION/METHODS

Precipitation in Oklahoma is dominated by decadal-scale cycles of relatively wet and dry periods primarily controlled by large-scale climatic phenomena such as PDO and AMO. It is not well known how streamflow responds to these decadal-scale cycles of wet and dry periods and how this response varies along a precipitation gradient. In this study, we analyzed precipitation and streamflow data and calculated annual streamflow coefficient (ratio between annual streamflow/ annual precipitation) from 1952 to 2015 for 14 meso-scale watersheds across the State of Oklahoma. The wet phases includes: 1957-62 and 1980-2000 and the dry phases includes: 1952-1956,1965-1979, and 2007-2014.

RESULTS/CONCLUSIONS

In the arid and semiarid panhandle regions, precipitation is a poor indicator for long-term streamflow in general,with a relatively stronger correlation between annual streamflow and precipitation during PDO wet phases. In other regions of the state, precipitation accounts for 30-40% variability of streamflow, with a stronger correlation during the PDO dry phase, especially for the central part of the state. The streamflow coefficient decreases curvilinearly from southeast (up to 53%) towards the panhandle (less than 1%) along the precipitation gradient. Streamflow coefficient for a given watershed remains relatively constant for both dry and wet PDO phases.

POSTER #9

The Kiamichi Watershed

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This poster summarizes the preliminary findings of ethnographic fieldwork in the Kiamichi Region of southeastern Oklahoma. The geographical focus of this ethnographic research has so far been primarily in LeFlore, Latimer, and Pushmataha Counties within the Choctaw Nation due to proximity to Lake Sardis and several small towns along the Kiamichi River. Lake Sardis, located near Clayton in the upper watershed impounds Jackfork Creek and is of particular interest to the study because of ongoing controversies over water rights, availability, allocation, and water quality. Water plays a key role in the timber, farming, and tourism industries of the region. The Kiamichi basin is covered by 65.5% forested lands while 25% is pastureland. Although annual precipitation ranges between 48 and 56 inches annually, the steep topography of the Ouachita and Kiamichi mountains results in the Kiamichi Watershed having very high runoff per square mile and therefore highly susceptible to drought conditions. This research focuses on the socio-ecological impacts of changing land and resource use patterns over time and how those changes have shaped perceptions of risk and subsistence strategies within the watershed.

POSTER #10

Does Habitat Stability Promote the Loss of a Complex Life Cycle in a Stream-Associated Salamander?

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Local and regional conditions influence species' distributions, and for amphibians, these tend to be associated with different life-history strategies. Most salamanders undergo metamorphosis, developing into terrestrial adults from aquatic larvae, but some lineages exhibit paedomorphosis, retaining larval traits and remaining aquatic throughout maturity. The theory of complex life cycles suggests that stable aquatic conditions and variable terrestrial conditions are conducive to the evolution of paedomorphosis, though most studies have considered only terrestrial or aquatic conditions, and focused on intra-population variation of pond-associated species. The Oklahoma Salamander (*Eurycea tynerensis*) is found in small streams of the Ozark Plateau in the south-central United States and exhibits both paedomorphosis and metamorphosis among populations. We tested hypotheses that paedomorphosis is associated with more stable stream conditions and more variable climates, using stream temperature data from 23 sites and climate data from the Worldclim dataset. We found sites containing paedomorphs had significantly more stable stream temperatures and more variable climates than sites with metamorphic *E. tynerensis*. This system is an example of how habitat variability influences the dynamics of complex life cycle evolution.

POSTER #11

Modeling the Current and Future Distributions of *Juniper SPP.* Across the Continental United States

Rashmi Prava Mohanty and Michael L. Treglia*
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Multiple Juniper species (Juniperus spp.) are native to North America, though some are widely recognized as encroaching on grassland ecosystems, threatening associated biodiversity and degrading grazing lands. Furthermore, pollen from these trees is a potent allergen, and expanding ranges may contribute to human health concerns. We developed models of the current and future distributions for multiple species of Juniperus across the continental United States, to ultimately inform long-term management and monitoring efforts. We developed the distribution models using a machine-learning algorithm, random forests, with available locality data from multiple biodiversity databases, pseudo-absence data, and environmental datasets characterizing climate and soil conditions. We projected the model into the future climate, for 2050, based on the CNRM-CM5 Global Climate Model. Our results suggest the amount of area suitable for Juniperus spp. will generally increase under future climate conditions, and recent locality data indicates that the ranges are already expanding. Final outputs from this work will help identify areas most susceptible to woody encroachment of Juniperus, allowing for early detection of and response to continued range expansions.

POSTER #12

Ethnographic Research in the Upper Washita Watershed

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While still in very early stages of execution, this poster highlights research strategies and preliminary findings from in-situ ethnographic fieldwork in the Upper Washita River watershed. The context for this particular socio-ecological observatory corresponds more precisely to the political boundary of Caddo County and the overlapping tribal jurisdictions of the former Kiowa-Comanche-Apache and Wichita-Caddo-Delaware reservations. Situated amid a semi-arid mixed cropland/ prairie mosaic landscape, this observatory displays a staggering diversity of water, land, and community/cultural resources. Historic and contemporary land tenure relations and land use patterns continue to shape perceptions of local resources and climate conditions in significant ways. While land and resource relations both within and between variously differentiated communities has been shaped by a host of federal, state, and local agencies and interventions, research in the Upper Washita is exploring the influence of internal community dynamics and individual agency on the reception and implementation of resource conservation strategies.

POSTER #13

Mapping Woody Plant Encroachment in Grassland Using Multiple Sources Remote Sensing Images: Case Study in Oklahoma

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Woody plant encroachment (mainly *Eastern Red cedar*) in the native grassland has been rapidly increasing in the Southern Great Plains. Increasing woody plants significantly influence the local grassland ecosystem, such as carbon storage, soil nutrient availability, herbaceous forage production, livestock, watershed hydrology and wildlife habitats. However, very limited data are available to monitor the spatio-temporal dynamics of woody plant encroachment to the native grassland at regional scale. Data from remotes sensing could potentially provide relevant information and improve the conversion of native grassland to woody plant encroachment. This study examined the potential of medium resolution images to detect the woody encroachment in tallgrass prairie. We selected Landsat images with Path 28 Row 35 (covering more than 20 counties in Oklahoma) as case study area. Phased Array Type L-band Synthetic Aperture Radar (PALSAR) images and time-series Landsat images were used to identify the invaded woody species (*Juniperus virginiana*). The resulting woody plant encroachment map was compared with the Oklahoma ecological system mapping. These results showed that integrating PALSAR and Landsat had good performance to identify the woody encroachment in the study area.

POSTER #14

Agricultural Drought in Tallgrass Prairie of the Southern Great Plains and its Impacts on Beef Cattle Production

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Tallgrass prairie is an important ecosystem type and a major feed for beef cattle in the Southern Great Plains (SGP: Kansas, Oklahoma, and Texas). Frequent drought in the SGP affects the production of tallgrass prairie and ultimately the beef cattle production. It is, therefore, necessary to map drought vulnerable areas to help ranchers adapt cattle industry to drought conditions. In this study, we analyzed Land Surface Water Index (LSWI) calculated from near infrared and shortwave infrared bands of Moderate Resolution Imaging Spectroradiometer (MODIS) and quantified the spatial-temporal dynamics of agricultural drought in the tallgrass prairie region of the SGP during 2000-2013. The number of days with LSWI < 0 during the thermal growing season (start and end dates as well as duration of land surface temperature > 5 °C) was defined as the duration of drought to generate drought duration maps for each year. Following the decreasing rainfall gradient from east to west in the SGP, counties in the west experienced whole growing season drought (WGSZ) more (three or more out of 14 years with WGSD), middle counties had one to two months summer drought, and eastern counties experienced less drought (mainly one year with WGSD and less than one month of summer drought). The LSWI-based drought duration map showed similar patterns with Evaporative Stress Index (ESI) and U.S. Drought Monitor (USDM) in wet, summer drought, and whole growing season drought years. Our drought map has identified the vulnerability of counties to different droughts (summer drought and whole growing season drought) in the SGP. This fine resolution (500 m) drought map has the potential to show the drought condition for individual ranch, which can be used to guide drought mitigation activities and livestock production.

POSTER #15

Assessing Reservoir Operations and the Associated Changes in Water Quality on the Persistence of Stream Fishes

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The persistence of riverine fish populations likely to be affected by human-induced changes relates directly to environmental conditions that are controlled by the interaction between ground and surface waters. We have a limited understanding of the temperature tolerances of stream fishes and how groundwater-surface water interactions via hyporheic flow mediate stream temperatures at multiple spatial scales. This is particularly significant to populations that reside below dams and are subject to both flow and temperature modifications, coupled with a significant loss of stream habitat. The long-term objectives of this research are: 1) Determine how reservoir releases influence the downstream temperature and dissolved oxygen regime, with an emphasis on the summer, baseflow period, 2) Assess interactions between changes in baseflow levels in the Kiamichi River and hyporheic exchange, which correspondingly influences temperature at the reach scale, 3) Determine changes in fish assemblage use of thermal patches at the reach scale, and 4) Examine acute thermal tolerances and delayed mortality associated with duration of exposure to elevated water temperatures by stream fishes. Preliminary temperature model calibrations were performed using both the regression model proposed by Spooner et al. (2005) and the Water Quality Analysis Simulation Program (WASP). Results were in good agreement with observation data, with deviations supporting incorporation of groundwater in the model to more accurately model stream temperatures. Dissolved oxygen data are currently being collected to support model calibration for DO predictions. Initial comparisons of critical thermal maximums of fishes occupying adjacent basins at similar latitudes suggest these values can be used as a basis for comparisons with delayed mortality studies that will begin this year.

KEY WORDS Hyporheic, Temperature Regime, Critical Thermal Maximum, Dissolved Oxygen, Reservoir Releases, Delayed Mortality.

POSTER #16

Declining Water Conditions and Recreation Demand at Oklahoma Reservoirs

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This poster presents research on the impact of climate and water conditions on the demand for reservoir recreation in Oklahoma. Increased temperatures are known to impact recreation demand while declining water conditions and algae bloom events at lakes and reservoirs are a growing concern in the United States. Recreational users are often directly impacted by declining water conditions, which can result in reduced tourism traffic and the loss of an important source of local income. We relate state park visitation at public reservoirs to water levels, water quality and swim warning events. Our demand model is estimated using panel data on park visitation in Oklahoma with a monthly time series that runs from 1998 to 2015. Over this time visitation has declined by as much as 50 percent at Oklahoma parks. The results of this research allows us to determine the extent of the economic impact, in terms of tourism traffic, that poor water conditions will have on the rural economies that surround these state parks.

POSTER #17

Simulating Reach-Scale Sediment Reduction from Stream Stabilization in the Fort Cobb Reservoir Watershed Using CONCEPTS

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Excess sediment from unstable streambanks and beds continues to impair surface waters. Many techniques are used to stabilize unstable bed and banks to reduce sediment erosion, including in-stream structures, grade control, vegetative plantings, and streambank armoring. These techniques can be cost prohibitive and therefore stabilization often focus on one site within an unstable stream system. While stabilizing a single site may reduce sediment leaving that site, it may be insignificant at a reach scale. Therefore, the objective of this research is to determine the effectiveness of various streambank and bed stabilization practices on reducing total sediment yield from an entire stream reach. Bank erosion, channel aggradation/degradation, and sediment transport processes can be simulated on the reach-scale scale using the CONservational Channel Evolution and Pollutant Transport System (CONCEPTS). CONCEPTS simulates unsteady, one-dimensional flow to predict the response of stream corridors to flow and sediment transport using soil erodibility and shear strength parameters, channel geometry, and flow hydrographs as input. A CONCEPTS model has been developed and calibrated for two tributaries to the Fort Cobb Reservoir which is located in southwest Oklahoma. The reservoir fails to meet water quality standards based on sediment, with unstable and incised channels being the primary source of sediment. Using CONCEPTS, total reduction in sediment from the entire stream system for various stabilization practices, including bed and bank armoring, toe protection, sloped banks, and vegetative plantings will be simulated and compared. Also, the length of stream that needs to be stabilized to provide a significant reduction in total sediment yield on the reach scale will be determined.

POSTER #18

Statistical Modeling for Spatio-Temporal Soil Moisture Data in Oklahoma

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We focus on the state-level soil moisture data from Mesonet. There are two aims in our analyses: (1). Understanding temporal patterns of soil moisture in both a short term period and a long term period. We expect to establish a descriptive statistical model for changes over time; (2). Understanding spatial variations of soil moisture at the state-level. We expect to use other variables, such as weather and land, which may also vary in space and time, to explain the variation of soil moisture. The goal is to predict soil moisture at those locations where data are not available in the entire state, i.e. a statistical mapping. Combining the knowledge of (1) and (2) will help us to establish a predictive model for mappings over time.

POSTER #19

Modeling Least Cost Selection of Best Management Practices to Reduce Soil Erosion in the Fort Cobb Watershed using SWAT

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The main cause of water quality impairment in the Unites Stated is due to Non-Point Source (NPS) pollution caused by human activities like agriculture and urbanization. An example is the Fort Cobb Watershed which has limited capability due to soil erosion and phosphorus load. Soil and water conservation practices can be used to mitigate soil erosion, nitrogen and phosphorus inflow from agricultural lands. Some conservation practices have been implemented in the Fort Cobb Reservoir watershed but their cost effectiveness had not yet been assessed.

The objective of this study is to determine the most cost effective selection and location of Best Management Practices (BMPs) on farmland to reduce soil erosion and the delivery of sediment and phosphorus to the reservoir. Detailed conservation practices were simulated with the SWAT (Soil and Water Assessment Tool) to determine yields, erosion, and phosphorus loss for each practice by each HRU (a soil type-land use unit) and location in the watershed. Linear Programming was used to determine the cost minimizing choice of BMP(s) for each HRU (hydrologic response unit) that meets sediment and phosphorus targets for the watershed.

Of the conservation practices simulated, conservation tillage plus contour farming (66%), conservation tillage plus strip cropping (83%) and conservation tillage plus parallel terracing (95%) are the most effective in reducing sediment loads as compared to the baseline (conservation tillage only). The results of the linear programming maximization of net profit indicate that a combination of management practices is the best option for reducing soil erosion while maintaining a substantial income for the farmers.

Key words: Watershed, management practices, optimal choice, SWAT, linear programming.

POSTER #20

Evaluation of Field Jet Erosion Tests and WEPP-Predicted Erodibility Parameters in Forests and Grasslands

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Vegetation has been shown to reduce erosion through many studies. Individual species of vegetation have been studied to determine their effect on erosion but has focused mostly on agricultural settings. This study evaluated erodibility parameters under two distinct land covers: tallgrass prairie grassland and an encroaching Eastern Redcedar forest. The erodibility parameters from each watershed were estimated by the hydrologic model, the Water Erosion Prediction Project (WEPP). WEPP is often used to determine the runoff and sediment yield of a given field site using input data such as the slope, climate, soil and land management characteristics. Currently, WEPP uses empirical equations to determine two major erodibility parameters within in the soil input file: the critical shear stress (τc) and the erodibility coefficient (kd). It also uses adjustment coefficients to account for seasonal variations and vegetation. In addition to modeling, field testing was completed to determine these two parameters mechanistically using the Jet Erosion Test (JET). The JET data was compared to WEPP-predicted values of τc and kd. The adjusted kd predicted by WEPP for all watersheds was under predicted compared to JET-measured data. The WEPP results were directly correlated with the soil texture since that is the basis of its empirical equations. However, JET results showed erodibility parameters of the two vegetation types to be more similar. The grassland sites had kd values that were two to four times smaller than the forested sites. The importance of these results is to demonstrate that erodibility parameters based on soil texture may not best represent the true susceptibility of an area to erosion.

POSTER #21

The Effects of Freshwater Mussels on Mercury Contamination of Aquatic Foodwebs

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Freshwater mussels are an important part of many freshwater ecosystems throughout North America, including Oklahoma. Mussels drive many significant ecosystem processes in lakes and rivers that link the water column and sediments, such as the conversion of mercury (Hg) found in sediments into highly toxic methylmercury (MeHg) that is released into the water column and subsequently aquatic food webs. Because of mussels' important role in driving ecosystem function, we hypothesized that they regulate the production and/or release of MeHg. We tested this hypothesis with a field survey and a mesocosm study. We sampled fish and habitat parameters at sites with and without mussels and measured Hg contamination. We found no difference in Hg contamination of fish between mussel positive and negative sites. The follow-up mesocosm study used eight replicates of none, low (4), medium (10), and high (16) mussel density treatments. We collected emergent insects and snails for Hg analysis as well as abiotic parameters. We found significantly higher concentrations of Hg in snails in tanks with high densities of mussels relative to tanks with a low density or no mussels. Our results suggest that our already threatened mussel-driven ecosystems may be more sensitive to Hg contamination than previously thought.

POSTER #22

Gross Primary Production in Oklahoma from 2000 to 2014

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Carbon dioxide, one of the most important greenhouse gases (GHG), has continuously rise in atmosphere concentration ever since the beginning industrial revolution. Recent studies suggest the increasing CO2 concentration has caused the global warming, increasing frequency of extreme climate events, and increasing plant growth. Gross primary production (GPP)--the carbon fixed by plant through photosynthesis--is one of the most important process and the major driver of the global carbon cycle. During the past decades, numerous approaches has been made to improve the predictability of the GPP through ground, atmospheric and space observations, but there still remains a large range of GPP estimates among different method. In this study, we present the most recent GPP estimates from the VPM model for Oklahoma, this GPP product has 500m spatial resolution and 8-day temporal resolution. It will be beneficial to understand the climate change impact on terrestrial carbon cycling and provide valuable information for decision makers.

POSTER #23

Value of Environmental Monitoring Information in Oklahoma Agriculture: A Research Perspective

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Extreme weather events in Oklahoma have considerably been impacting agricultural production that covers around 78% of the total state area. Due to constant weather variability in Oklahoma, accurate, updated and timely environmental monitoring information is indispensable for farmers to include in their agricultural production decisions.

The statewide weather monitoring network - Oklahoma Mesonet has been used by farmers (and other communities) to obtain accurate and comprehensive environmental monitoring information that has significantly helped them improve their planting, growing, and harvesting decisions, thus generating input savings and preventing production losses. Farmers have repeatedly acknowledged the value of Mesonet information, which has also been substantiated by several qualitative studies. However, the value and extent of the application of Mesonet information have not been measured and evaluated quantitatively with scientific methods yet.

This research aims at filling this gap by quantifying the economic value and environmental savings (and prevented losses) of improved farmer decision making influenced by Mesonet information. Contingent valuation has been applied to determine the economic impacts of Mesonet information on large scale, medium scale and small scale farmers in the time span 2005-2015. A time series analysis allowed us to address changes in production patterns and farming outputs before and after the application of information provided by Oklahoma Mesonet. The analysis has been conducted for several scenarios including, among others, producers of traditional crops and specialty crops, which demonstrates varying needs for specific environmental monitoring information variables in the production of different crops in different regions in the state.

POSTER #24

Analyzing Changes in Urban Areas Using Landscape Pattern Metrics

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Determining how landscape patterns are changing in urban areas is important to modeling future changes in cities. We performed a literature review to determine some of the most commonly used pattern metrics. These metrics were then applied to the 1992, 2001, 2006, and 2011 National Land Cover Dataset for the state of Oklahoma using Fragstats, a computer program for calculating landscape metrics. The results were compared to determine if there is evidence for the value of these metrics changing over time. Patterns in any observed changes could be incorporated into urban landscape models.

POSTER #25

Improving Seasonal Climate Forecasts for Oklahoma Winter Wheat Farmers

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Agriculture is one of the most weather- and climate-dependent industries. Unseasonal wet or dry climate, such as the recent droughts and rainfall in the south-central US, can lead to crop damage with severe consequences for regional and national economies. Seasonal climate forecasts, tailored for the agricultural community, could help reduce crop losses by providing skillful forecasts for the coming seasons. My proposed research uses online surveys and spatial statistics to explore ways in which tailored seasonal climate forecasts can help winter wheat producers in Oklahoma make better long-term decisions and assess whether climate model output is skillful enough to create such tailored forecast products. I see my research as a stepping stone in applied climate research towards creating operational seasonal climate forecasts and reducing crop losses for winter wheat farmers and agricultural producers in general.

POSTER #26

Detection Estimates and Habitat Occupancy of Two Pelagic Broadcast Spawning Cyprinids

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Non-native species introductions are a primary threat to the biodiversity of southwestern rivers. Historically, the federally-threatened Arkansas River Shiner Notropis girardi occurred throughout the Arkansas River basin. Major anthropogenic changes throughout the basin have altered the natural flow regime and reduced the Arkansas River Shiner's range to only the South Canadian river. It has been speculated that the establishment of the non-native Red River Shiner Notropis bairdi reduces the chance of Arkansas River Shiner recovery but little evidence exists of ecological relationships between the species that may promote interspecific competition. However, detection error is rarely accounted for when sampling riverine fish assemblages which may lead to false conclusions. This study examined the habitat occupancy of both Arkansas River Shiner and Red River Shiner in the Arkansas River basin, Oklahoma to determine if there was an ecological-niche overlap and if population estimates may be biased due to detection error. We sampled reaches throughout the Cimarron and South Canadian rivers to collect abundance estimates and microhabitat information. Single-species occupancy modeling was used to assess the probability of detection, presence, and abundance of each species at the microhabitat scale. We also used multi-season occupancy models to estimate seasonal colonization and extinction rates (i.e., patch turnover). Our results indicated that Arkansas River Shiner typically occupied main channel habitats, whereas Red River Shiner tended to occupy backwater habitats. Habitat use infers that if these species were to co-occur, habitat overlap would unlikely be the cause for competitive exclusion. Results also indicated that when detection is not accounted for populations may be underestimated. Understanding habitat use, particularly in relation to potential competitors, is crucial for both future management of Arkansas River Shiner and non-native species control in southwestern rivers. Furthermore, failure to assess sampling error may be detrimental to detecting the spread of non-native species.

KEY WORDS Detection, Arkansas River Shiner, Threatened, Occupancy, Non-native.

POSTER #27

Drought-Influenced Low-Flow Non-Exceedance Plots for Selected USGS Gauges in Oklahoma

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Periods of low flow in streams have implications for available water, habitat suitability, and permitted discharges. An important standard in planning for low stream flows is the seven-day average of flows with a 50% probability of occurrence in a year. A 50% probability in a year is equivalent to occurring once in a 2-year period, thus this flow is often labeled the "7Q2" low flow. This project will explore differences between the standard calculation of 7Q2, and estimates that included only flows occurring in low-precipitation years. Understanding the influence of drought on those low flows is important for maintaining Oklahoma's water quality and security in the face of increased climate variability. Exceedance probability plots are useful statistical tools which are used to estimate the annual probability or return interval of a given stream flow. Non-exceedance plots describe the probability that a flow lower than a given magnitude will occur, and are most commonly based on 7-day or 30-day averages from the flow record. When considering climate variability and specifically the likelihood of more frequent droughts, it may be more useful to examine low-flow probabilities based exclusively on flows deemed to have occurred in years with below-average precipitation. The below-average years from the Oklahoma Climatological Survey (OCS) precipitation history for each of the nine climate regions in Oklahoma were used to select only daily average flow records from below average precipitation years, which represent drought-influenced flows. Low-flow plots for 7-day averaged flow for those records were prepared, and the 50% probability flow was compared to the 7Q2 for the full record. The differences between standard and drought-influenced 7Q2 are discussed in the context of Oklahoma climate region and the distribution of normal annual precipitation across the state.

POSTER #28

Temporal Variability in Water Level in a Tallgrass Prairie and Juniper Woodland Indicate Vegetation Controls on Deep Drainage

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Vegetation and vegetation transition such as woody plant encroachment in a tallgrass prairie is reported to alter recharge processes. However, there is limited understanding on the effect of woody plant encroachment on deep drainage in mesic prairie catchments. Two monitoring wells of 3 m depth were drilled in a hydraulically conductive location as indicated by electrical resistivity imaging (ERI) in both a tallgrass prairie site and a juniper-encroached catchment site using a solid-stem auger mounted in Geoprobe 6300 TMP and the piezometers were instrumented with CTD-10 sensors for monitoring. The sensor was connected to the EM50 data logger (Decagon, Pullman, WA, USA) to measure water level (accuracy + 0.05%), electrical conductivity (accuracy + 0.01 dS/m) and temperature (accuracy + 1°C) at 15-minutes intervals. Water level was higher under the grassland than under the juniper woodland. Peak water level was recorded during 16-May 2015 in the grassland, but the water level in woodland peaked during 20-May 2015. Results indicate that vegetation can modulate recharge processes, and woody plants can decrease the water table in a perched aquifer by a significant amount. Thus, spatio-temporal variability in groundwater level can be used as an important tool in land-use and groundwater management.

POSTER #29

The LandSHIFT Model: Use and Applications in Oklahoma

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The relationship between human land-use activities and the environment is often described as a coupled human-natural system. Land-use and land-cover change is an important outcome of that relationship with competition between differing human uses and management styles for land parcels. One of the few large scale approaches that integrates functional components to represent both human and environmental aspects of land-use change, is the LandSHIFT model. The LandSHIFT model is a highly modularized large scale land use model that can be adapted to various study regions and several spatial scales. LandSHIFT's main field of application is the simulation of spatially explicit, mid- to long-term scenarios of land-use change involving multiple biophysical (e.g. climate) and socioeconomic (e.g. population growth) factors. LandSHIFT output consists of time series of grid maps with projected land-use/land-cover information that can serve as basis for further impact analysis of research questions related to climate change. These analyses can help to identify where conflict might occur over limited resources, such as water in Oklahoma, due to demands from irrigated agriculture, animal husbandry, and urban growth or demands for cropland and urban land. Here we present the LandSHIFT modeling system and first steps of an implementation of LandSHIFT for Oklahoma for the purpose of modeling potential future changes in land use under various climate scenarios.

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CLIMATE RESEARCH

The Oklahoma NSF EPSCoR Research Infrastructure Improvement Award No. IIA-1301789 (2013-2018), "Adapting Socio-Ecological Systems to Increased Climate Variability," is a multi-institutional collaborative project that includes researchers from Oklahoma State University, Samuel Roberts Noble Foundation, University of Oklahoma and University of Tulsa.

The knowledge gained from this project will be used to empower managers to effectively adapt social and ecological systems to climate variability, to educate Oklahomans about the expected consequences of regional environmental change, and as a foundation for future climate researchers' work.

ADAPTING SOCIO-ECOLOGICAL SYSTEMS TO INCREASED CLIMATE VARIABILITY

Oklahoma's unpredictable weather and large precipitation gradient work together to create a vulnerable and diverse landscape that is exceptionally well-suited for the climate-based research that Oklahoma NSF EPSCoR scientists are performing. Five study areas have been identified: North Canadian River watershed, Cimarron River watershed, Washita River watershed, Kiamichi River watershed, and the Oklahoma City metropolitan area.

The research team, representing more than a dozen disciplines and four institutions from across the state, is working to advance understanding of how socio-ecological systems can adapt sustainably to increased climate variability, especially as it relates to drought and water resource management.

An Integrated Approach

EPSCoR scientists are examining complex human, climate and natural resource systems while addressing three interlinked research focus areas: an observatory network, a modeling and prediction system, and a decision support system. The innovative project addresses each of the research objectives in tandem, as well as their collaborative interactions.

EPSCoR SCIENTISTS ARE FORGING NEW PATHS IN SOCIO-ECOLOGICAL RESEARCH.

DEFINING THE PROJECT

Oklahoma NSF EPSCoR's socio-ecological system research studies how humans and the environment interact with one another and how those relationships can adapt to changes in climate. As an example, drought conditions are expected to increase with climate variability. How will farmers' use of water resources change during times of drought compared to current use patterns? This and other important questions are being addressed through the EPSCoR RII award's research.

Photos courtesy of Oklahoma State University

RESEARCH OBJECTIVES

The Oklahoma NSF EPSCoR project is innovative in addressing each of the research objectives in tandem, as well as their interactions.

ADAPTING SOCIO-ECOLOGICAL SYSTEMS TO INCREASED CLIMATE VARIABILITY

Socio-Ecological Observatory

Establish a first-of-its-kind, statewide, socio-ecological observatory network designed to provide a systems-level understanding of the coupled human and natural system under a variable climate.

In addition to existing data that are being used in the Observatory, EPSCoR researchers are currently developing the following new datasets:

- Societal perceptions of climate and weather events from a first-of-its-kind longitudinal survey
- Streamflow diagrams
- Runoff and groundwater recharge from new micro-catchments
- High-resolution soil moisture maps from the new cosmic-ray neutron rover

Pictured left: Installing micro-catchments to aid in understanding runoff and groundwater recharge patterns

DECISION-SUPPORT SYSTEM

Create a decision-support system that provides researchers, educators and practitioners with data, models, tools and scenarios that are needed to explore and understand the social and ecological impacts of management and policy decisions.

Some cyber tools being developed:

- Water Data Portal www.oklahomawatersurvey.org
- Watershed-specific websites
- CyberCommons online access of research data
- New decision tools for water planning

Pictured above: Cosmic-ray neutron rover, currently in the testing stage, will be used to map soil moisture. Photo credit: Yohannes Tadesse Yimam

Pictured right: A surface flux tower is deployed to measure water and carbon exchanges between the atmosphere and land surface.

Photo credit: Jeff Basara, University of Oklahoma

Socio-Ecological Modeling and Prediction System

Develop a fully integrated modeling and prediction system based on Observatory data to predict future socio-ecological scenarios. Qualitative and quantitative approaches will be used to systematically examine insights from disciplinary and integrated perspectives.

FOR MORE PROJECT INFORMATION

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