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CLIMATE RESEARCH

No.	Presenter	University	Scientific Poster Title
1	Rajen Bajgain	University of Oklahoma	Assessing Summer Drought Over Oklahoma Mesonet Sites with the MODIS Land Surface Water Index
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
6	Jason Patton	Oklahoma State University	Towards a High Resolution Soil Moisture Map of Oklahoma
7	Yuanwei Qin	University of Oklahoma	Oklahoma Map of Forest Cover at 30-m Spatial Resolution in 2010
8	Renato Rahal	Oklahoma State University	Streamflow Responses to Sea Surface Temperature Variations Across Oklahoma
9	Michael Stanton	University of Oklahoma	The Kiamichi Watershed
10	Mike Treglia	The University of Tulsa	Does Habitat Stability Promote the Loss of a Complex Life Cycle Stage in a Stream-Associated Salamander?
11	Mike Treglia	The University of Tulsa	Modeling the Current and Future Distributions of Juniper Spp. Across the Continental United States
12	Tony VanWinkle	University of Oklahoma	Ethnographic Research in the Upper Washita Watershed
13	Jie Wang	University of Oklahoma	Mapping Red Cedar in Oklahoma from 1984 to 2010
14	Yuting Zhou	University of Oklahoma	Agriculture Drought In Tallgrass Prairie of the Southern Great Plains and its Impacts on Beef Cattle Production
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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No.	Presenter	University	Scientific Poster Title
16	Brannon Daniels	Oklahoma State University	Declining Water Conditions and Recreation Demand at Oklahoma Reservoirs
17	Holly Enlow	Oklahoma State University	Simulating Reach-Scale Sediment Reduction from Stream Stabilization in the Fort Cobb Reservoir Watershed Using CONCEPTS
18	Xijia Han	Oklahoma State University	Statistical Modeling for Spatio-Temporal Soil Moisture Data in Oklahoma
19	Leon Hounnou	Oklahoma State University	Modeling Least Cost Selection of Best Management Practices to Reduce Soil Erosion in the Fort Cobb Watershed using SWAT
20	Whitney Lisenbee	Oklahoma State University	Evaluation of Field Jet Erosion Tests and WEPP-predicted Erodibility Parameters in Forests and Grasslands
21	Brent Tweedy	University of Oklahoma	The Effects of Freshwater Mussels on Mercury Contamination of Aquatic Foodwebs
22	Yao Zhang	University of Oklahoma	Gross Primary Production in Oklahoma from 2000 to 2014
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
27	Ronald Miller	Oklahoma State University	Drought-Influenced Low-Flow Non-Exceedance Plots for Selected USGS Gauges in Oklahoma
28	Bharat Sharma Acharya	Oklahoma State University	Temporal Variability in Water Level in a Tallgrass Prairie and Juniper Woodland Indicate Vegetation Controls on Deep Drainage
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

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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

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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.