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09. Environmental Science

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Abstracts from the 2015 Oklahoma Research Day

Held at Northeastern State University

05. Mathematics and Science

09. Environmental Science

05.09.01 DETERMINING THE EFFECTS OF LAND USE CHANGES AND CLIMATE VARIABILITY ON RESERVOIR SEDIMENTATION FOR THE LITTLE WASHITA RIVER EXPERIMENTATION WATERSHED

Hollie, Skibstead *Redlands Community College*

In the 1930's, the United States experienced a period of severe dust storms known as the Dust Bowl, caused by severe drought and lack of proper farming methods. Lack of vegetation combined with isolated periods of intense rainfall caused increased erosion and flooding. As a result of the Flood Control Act of 1936, the Washita River Basin (WRB) was one of eleven pilot watershed projects chosen to construct flood control reservoirs. These reservoirs were implemented to prevent and manage soil erosion and flooding. A total of 45 reservoirs were installed between 1969 and 1982 in the Little Washita River Experimental Watershed (LWREW) within the WRB. This study sought to determine the impact of land use changes and climate variability on reservoir sedimentation. The main focus was determining the soil physical properties such as bulk density and soil texture. Sediment cores were collected from ten reservoirs using state-of-the-art coring system. The cores were cut, weighed, and dried to determine the bulk density of each sample. After determining the bulk density, samples were tested in the lab using the hydrometer method to determine the soil texture. Results indicated that variability of bulk density were significantly impacted by land use changes and climate variability for the areas contributing to the respective reservoirs, while the soil textural analysis showed results consistent with previous research and analysis performed for the contributing areas within the LWRE.

05.09.02 UV Photoactivation of Titanium Dioxide Nanoparticles: Enhanced Photo-oxidation of Natural Organic Matter in Aqueous Systems

Linzi, Thompson East Central University

Titanium dioxide nanoparticles (TiO₂-NPs) are becoming increasingly abundant in the environment due to their use in commercial products. TiO₂-NPs also accumulate in wastewater treatment plant biosolids, which are then applied to the land as fertilizer. In this study, TiO₂-NP photoactivation and subsequent photo-oxidation of natural organic matter (NOM) in aquatic systems was investigated. Three sources of NOM were used, including NOM present in nearby aquatic systems. 95% of the ultraviolet (UV) radiation that reaches the earth's surface is UV-A, and thus the role of UV light (UV-A and UV-B) was also investigated. Further, the role of naturally occurring minerals that could interact with TiO₂-NPs and how they impact the photocatalysis of TiO₂ was evaluated. Measurements of total organic carbon (TOC) were used as an indirect indicator of the photo-oxidation of NOM in the aqueous samples. Results indicated that NOM photo-degraded faster in the presence of TiO₂-NPs than in systems free of TiO₂-NPs. These results are consistent with UV photoactivation of TiO₂-NPs, enhanced hydroxyl radical formation, and NOM photo-oxidation. The colloidal particles had little effect on the rate of NOM photo-oxidation relative to colloidal-free systems despite (1) the larger relative size of colloids and the potential blockage of UV light on TiO₂-NP inactivation, (2) the scattering or absorbance of the UV light, and (3) the complexation between TiO₂-NPs and mineral surfaces.

05.09.03 Occurrence of typical antibiotics in Huai River and Hongze Lake, eastern China

Linzi, Thompson East Central University

The presence of antibiotics in the aquatic environment, particularly in lakes and rivers, has increased with the rapid development of the world economy. Today, between 100,000 to 200,000 tons of antibiotics are consumed globally per year with China alone consuming 12-25% of this value. Research on antibiotic contamination in many water bodies of China has been conducted. In this study, the economically important Hongze Lake, the Huai River, and the wastewater treatment plant (WWTP) of Laozishan Town in eastern China were examined for background antibiotic concentrations. Water and sediment samples were collected from six locations in this region, including near fish farms and the WWTP outlet waters, influent, and effluent. These samples were analyzed for five common antibiotics: norfloxacin (NOR), oxytetracycline (OTC), enrofloxacin (ENF), ofloxacin (OFL), and ciprofloxacin (CIP). OTC was not detected in any samples, and OFL was only detected in the WWTP influent and effluent, indicating this location as a potential source of OFL contamination into the environment. NOR and ENR were found in all samples, with NOR occurring in the greatest concentrations. The WWTP was over 75% efficient at OFL and ENR removal, but only 4% efficient at NOR removal. Based on these results, NOR appears to be of greatest concern to environmental contamination in this region. These background levels and results should be useful to future study in this region and on this subject.

05.09.04 Exploring the Role of Microbial Alkaline Phosphatase on Soluble Reactive Phosphorus Levels in Stream Water.

Deborah, Hyde Northeastern State University

This study examines the role played by the enzyme, alkaline phosphatase (AP) which is excreted by microbes found in stream water and sediment beds. Since the levels of soluble reactive phosphorus (SRP) are connected with water quality, the ability to quantify the effect of microbial transformations between forms of phosphorus is useful to researchers and environmental managers. This study accesses samples of stream water above, at and below the sediment surface, comparing the levels of SRP and AP activity. Four sites were chosen in the Illinois River watershed in Oklahoma from which to sample at the prescribed depths.

05.09.05 How can Cameron University Made Recycling More Convenient and Accessible to Students and Faculty?

Corrine, Binnings Cameron University

Though academic enrichment is the main focus of most universities and colleges, there should be a focus on molding students into more rounded and responsible citizens. A part of this molding should involve fostering and encouraging an awareness of environmental issues. A simple and effective way to get students actively involved and learning more about their social and environmental responsibility is to start a recycling program on the college. To promote student participation in such an initiative, this study explores how Cameron University can make recycling more accessible to students and faculty and how students and faculty will respond to a more extensive recycling program. Through on-site observation, interviews and surveys done on Cameron University campus, and the assessment of the success of similar programs at other universities, we found that students and faculty had a positive response to the idea and expressed a willingness to support a recycling program that would make recycling more convenient and accessible. Based on research findings, a specific solution for promoting the program was created: With the aid of an annual Recycling Poster Competition, students can become active participants in the program and will learn more about recycling as they work on their posters. These very posters will be displayed on campus to make fellow students and faculty more aware of the program and its impact on environment.

05.09.06 Interpreting Time Series: A Novel Approach to Data Processing

Jeremy, Massengill *University of Central Oklahoma*

Paul, Stone *University of Central Oklahoma*

Sean, Lavery *University of Central Oklahoma*

The ability to discern between information-bearing patterns (signals) and random patterns that distract from the information (noise) is invaluable to ecological and climatological sciences. An important factor in climate change studies is the ability to detect significant changes in the structure or function of the environment. Tracking and interpretation of temperature time series can be used to gauge the severities of climate change. Historically, generalized linear models (GLM) and the autoregressive integrated moving average (ARIMA) model provided a means of forecasting from time series. We have developed a novel computational method for the analysis of temperature time series and prediction of hydroperiod. Using data obtained from temperature data loggers set in temporary aquatic environments we can predict the presence/absence of water using the temperature time series. Our method combines Newton's Law of Cooling with modern statistical processes to detect significant differences between comparable temperature time series. We used mathematical modeling of the temperature tracking exhibited by the data logger with respect to the environment (ambient air or liquid water) to process data and assess statistical significance. The computational method for evaluating time series developed in this study is not limited to aquatic habitat availability but also can be useful in climate change detection, tree ring analysis, animal behavior studies and signal detection/process

05.09.07 The Oklahoma Water Resources Center: Leading Collaborative Efforts on Protecting Water Quality in the Illinois River Watershed

Chad, Penn *Oklahoma State University*

Daniel, Storm *Oklahoma State University*

Garey, Fox *Oklahoma State University*

Leslie, Elmore *Oklahoma State University*

Water quality, especially related to phosphorus concentrations, has been an issue in the Illinois River Watershed in northeastern Oklahoma for decades. Recent improvements in water quality have been reported due to reduction in point source discharges; however, research has also recently highlighted the extent of legacy nutrients stored in streambanks and the magnitude of their contribution to phosphorus loading to streams. The objective is to overview critical water quality research being conducted at Oklahoma State University on understanding phosphorus sources, transport, and storage within the Illinois River Watershed. Research to be discussed includes Water Center sponsored and/or funded grants on watershed modeling identifying the sources and transport of phosphorus, streambanks as sediment and phosphorus sources, and also phosphorus treatment structures to capture dissolved phosphorus in runoff. Also, the Oklahoma Water Resources Center (<http://water.okstate.edu>) and Arkansas Water Resources Center recently hosted a joint symposium, sponsored by the Cherokee Nation Environmental Programs in September 2014. The symposium ended with a facilitated discussion on future research and outreach/education needs. This presentation will provide an overview of the findings regarding future research and outreach priorities. The Center's website (<http://water.okstate.edu/irw>) provides access to symposium presentations, videos, and identified research/outreach needs.

05.09.08 The Formulation, Physical and Chemical Characterization of Dairy Free Lentil Yogurt Compared to Traditional Yogurt

Carissa,Jetto *University of Central Oklahoma*

Kanika,Bhargava *University of Central Oklahoma*

The need for allergen free, non-intolerant and probiotic foods continues to grow around the world. Agar-Agar is used to substitute lactic acid in the lentil yogurt to stimulate growth of the lactic acid bacteria. The goal was to produce a product that would be comparable to traditional dairy yogurt using identical strains of lactic acid bacteria. The lentil yogurt recipe was optimized by testing different ratios of lentils to water and different methods of inoculating the lentil milk and when to mix in the agar-agar. The three batches were tested against the traditional yogurt in acidity at the end point, viscosity, brix or sugar content, and total solids. The traditional yogurt was formulated using dairy milk (2% fat) heated to 165oF and cooled to 110oF and then inoculated with the Danisco yogurt culture. Final pH of lentil yogurt was 4.6 when compared to traditional yogurt (4). The moisture content of optimized lentil yogurt was slightly higher (91.2%) then dairy yogurt (84.2%). The results of the viscosity test showed almost no difference between lentil and traditional yogurt samples. New Dairy Free Lentil Yogurt was formulated and characterized in this study. This new yogurt would be an addition to a growing market and cost effective alternative to soy and coconut based yogurts.

05.09.09 The Effect of Aerobic Exercise on Cue Reactivity in Cases of Alcohol Use Disorder

Dr. Tawni,Holmes Ph. D., R.D., L.D. *University of Central Oklahoma*

Jean,Simo *University of Central Oklahoma*

It is well known that the student population is known for having poor eating habits. The purpose of the research is to better understand the nutrition problems college student's face and the best way to target them for a nutrition intervention. Focus groups will be conducted with UCO students to determine the primary factors that effects food choices (i.e is it lack of food choices at UCO, lack of knowledge about food types, or simply the college lifestyle). This information will be used to develop an intervention and the ability of an educational program to change the behavior and lifestyle of these students. Findings from the focus groups will be presented at Oklahoma Research Day.

05.09.10 Effect of Mining Byproducts on Mammalian Cell Viability: A Study of the Tar Creek Superfund Site

Alejandro, Torres *Tulsa Community College*

Alex, DeLeon *Tulsa Community College*

Dusti, Sloan *Tulsa Community College*

Eric, Bates *Tulsa Community College*

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Nicol, Whinery *Tulsa Community College*

Nnamdi, Ekesi *Tulsa Community College*

Tyler, Noble *Tulsa Community College*

The Tar Creek Superfund site spans Northeastern Oklahoma, Southeastern Kansas, and Southwestern Missouri. Mining began in the 1700s and lasted until 1970. Contaminants from the mining process, primarily lead and zinc, are still present in the soil, surface water, and ground water. The purpose of this study was to evaluate whether contaminants from the Tar Creek Superfund Site were detrimental to mammalian cells grown in vitro. Water samples were collected from different areas of the site and tested for chemical contaminants using a water quality kit. Additionally, the effect of the water samples on mammalian cell viability was evaluated by utilizing the water samples to create growth media for a mammalian cell line (CHOK-1). The cells were seeded in 96-well tissue culture plates and allowed to adhere for 48 hours. Media was made using control water, mine site well water, downstream "mixed" water, and main inlet (from the mine) water and was added to specified wells in the culture plate. The cells were then incubated in their respective media for 5 days. An MTT viability assay was utilized to assess the viability of cells grown in different media types. Water quality testing did not reveal abnormal levels of contaminants in any of the test sites. Results from the MTT assay indicate that there was significant loss of viability in cells grown in media prepared from the NE Inlet and Well Site.

05.09.11 Table Top Exercises as a Tool for University Infectious Disease Planning

Bethany,Ragle *East Central University*

The recent outbreak of the Ebola virus in Western Africa proves that infectious disease emergencies are a serious threat to any part of the world. Universities are especially at risk for disease outbreaks due to students living in close quarters, having large numbers of shared bathrooms, and having large communal dining facilities. Because epidemics are unpredictable in characteristics such as onset, severity, spread, and treatment, universities should practice responding to varying types of outbreaks. With the support of university administration, I planned and facilitated a table top exercise at East Central University to assess infectious disease preparedness, increase awareness of business and education continuity needs, and increase comfort level making decisions in a crisis. During the table top, integral university staff and community stakeholders discussed and responded to scenarios involving increasing cases of seasonal flu, shortages of flu vaccine, staff and faculty absenteeism, an on campus case of Ebola, and a resulting community wide panic. After the scenarios, participants identified gaps in the communicable disease planning process and generated a list of recommendations for the university. These recommendations included developing and practicing an emergency preparedness plan that includes infectious disease, developing an academic contingency plan, furthering communication with community stakeholders, and communicable disease training for university staff.