

ABSTRACTS

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Agriculture Oral Presentations

*Navarrete-Tindall, Nadia, Weber, P., Bartelette, S., Alvarez, I. Lincoln University of Missouri. PROTECTING AND GROWING NATIVE WILD LEEKS IN MISSOURI. Wild leeks (*Allium tricoccum*) are shade tolerant edible plants native to deciduous forests in the United States and Canada. Conservation measures are underway in states like West Virginia, North Carolina, Virginia and New York because of the threat of overharvest. In Missouri, wild leeks are documented in 19 counties. To avoid this imminent risk in Missouri and protect natural populations, the main goal of this study is to offer training through outreach and education based on research conducted in these states. We are also evaluating them as specialty crops in Missouri to discourage digging in the wild. Plant growth and seed germination will be measured for 3 or more years at LU campus in raised beds, pots and field plots. Preliminary results on numbers of bulbs per plant and bulb size showed no differences for wild leeks grown in pots with three different soil media. Survival was close to 98% and animal disturbance and diseases were not observed. Five small farmers in Boone, Callaway, Cole and Scott Counties are collaborating with this study. Wild leeks' acceptability as an edible was tested in 2015 during food tasting sessions, in which volunteers rated flavor, aroma, texture, appearance and acceptability of recipes with wild leeks. Average rates for flavor, texture, aroma, presentation and overall acceptability of five recipes containing wild leeks was 4.2 to 4.5, with 5.0 being excellent. Evaluations will continue in 2016. This study receives funding from the Missouri Department of Agriculture and the USDA.

*Panday, Dinesh and Nkongolo, N. Lincoln University of Missouri. EFFECT OF SOIL AND CROP MANAGEMENT

PRACTICES ON SOIL PORE SPACE TORTUOSITY AND GAS DIFFUSION COEFFICIENT. Soil and crop management practices affect soil properties, but the assessment of the effects of these practices on soil is mostly restricted to properties such as soil moisture or bulk density. Soil pore space indices can better detect changes due crop and soil management, but they are not often investigated. We studied the effect of tillage (no-till vs conventional tillage), cover crop (no-rye vs rye) and crop rotation (continuous corn, continuous soybean, corn-soybean and soybean-corn) treatments on soil pore space indices: the relative gas diffusion coefficient (D_s/D_o) and the pore tortuosity factor (τ). The study was conducted on a silt loam soil planted to corn and soybean at Freeman farm of Lincoln University in 2011-2015 growing seasons. The experimental design was a randomized complete block with 16 treatments and 3 replications. Soil samples were collected at two depths: 0-10 and 10-20 cm, and their fresh weights recorded. Samples were later oven dried at 105°C for 72 h. After drying, air-filled porosity (AFP) and total pore space (TPS) were calculated and later used in Marshall, Buckingham, Sallam et al, Millington, and Jin and Jury models for predicting D_s/D_o and τ . Results showed that there were significant ($p < 0.05$) tillage*cover crop and tillage*crop rotation interactions for both pore space indices for all models and years (except in 2011). D_s/D_o increased in tilled plots with cover crop, however, τ decreased in tilled plot planted to rye. D_s/D_o also increased in tilled corn-soybean rotation and continuous corn plots and τ followed an opposite trend to that of D_s/D_o . D_s/D_o and τ can be used to assess the impact of soil management practices on soil physical properties.

*Panday, Dinesh and Nkongolo, N. Lincoln University of Missouri. EFFECT OF SOIL AND CROP MANAGEMENT

PRACTICES ON SOIL PORE SPACE TORTUOSITY AND RELATIVE GAS DIFFUSION COEFFICIENT. Soil and crop management practices affect soil properties, but the assessment of the effects of these practices on soil is mostly restricted to properties such as soil moisture or bulk density. Soil pore space indices can better detect changes due crop and soil management, but they are not often investigated. We studied the effect of tillage (no-till vs conventional tillage), cover crop (no-rye vs rye) and crop rotation (continuous corn, continuous soybean, corn-soybean and soybean-corn) treatments on soil pore space indices: the relative gas diffusion coefficient (D_s/D_o) and the pore tortuosity factor (τ). The study was conducted on a silt loam soil planted to corn and soybean at Freeman farm of Lincoln University in 2011-2015 growing seasons. The experimental design was a randomized complete block with 16 treatments and 3 replications. Soil samples were collected at two depths: 0-10 and 10-20 cm, and their fresh weights recorded. Samples were later oven dried at 105°C for 72 h. After drying, air-filled porosity (AFP) and total pore space (TPS) were calculated and later used in Marshall, Buckingham, Sallam et al, Millington, and Jin and Jury models for predicting D_s/D_o and τ . Results showed that there were significant ($p < 0.05$) tillage*cover crop and tillage*crop rotation interactions for both pore space indices for all models and years (except in 2011). D_s/D_o increased in tilled plots with cover crop, however, τ decreased in tilled plot planted to rye. D_s/D_o also increased in tilled corn-soybean rotation and continuous corn plots and τ followed an opposite trend to that of D_s/D_o . D_s/D_o and τ can be used to assess the impact of soil management practices on soil physical properties.

*Rai, Dipti and Nkongolo, N. Lincoln University. MEASUREMENT OF CARBON DIOXIDE EMISSIONS FROM CORN/SOYBEAN FIELD USING PHOTOACOUSTIC INFRARED SPECTROSCOPY AND GAS CHROMATOGRAPHY. Greenhouse gas emissions have gained a special interest mainly due to their relation with global warming. Accurate measurements of these emissions are necessary to devise climate change's mitigation strategies. Photoacoustic Infrared Spectroscopy (PAS) and Gas Chromatography (GC) methods were evaluated for measuring CO_2 emissions in a silt loam soil at Freeman Farm of Lincoln University. Sixteen PVC static and closed chambers measuring 30 cm in height and 20 cm in diameter were permanently inserted into the soil to a depth of approximately 5 cm. Soil air samples for gas analysis were collected from each chamber with 60 ml syringes and put into storage bags. Air samples analyses for determination of CO_2 concentrations was conducted at Dickinson Research Lab using a GC. CO_2 was also directly measured at these 16 locations using PAS. The accuracy of PAS and GC measurements were

found comparable in different years 2012, 2013 and 2015. PAS measurements for CO_2 showed a strong correlation ($r = 0.84$; $p < 0.05$) with GC in 2012. Similar significant results between PAS and GC measurements were also found in the year 2013 ($r = 0.98$; $p < 0.05$) and 2015 ($r = 0.99$; $p < 0.05$), respectively. Apart from the good agreement between methods, portability and ease of operation makes PAS an alternative option for conventional gas chromatography.

*Higgins, Todd R. Lincoln University. CANOLA FOR MISSOURI: HOW TO FIT INTO OUR CROPPING SYSTEMS. Canola is one of the major oilseed crops globally. Typically, North American canola growing locations have been in western Canada, and the northern tier of US states. Recent developments in canola breeding have provided an opportunity for canola to become a potential third crop for Midwestern and upper Mid South states. Research in Missouri is focusing on both winter and spring canola production. For Missouri, the challenge for growing winter canola is largely related to the timing of the removal of the preceding crop (typically corn) to allow for winter canola to be sown in a timely manner. An alternative method of sowing canola is to frost seed spring canola in February and harvest it in late June or early July to allow a short season soybean crop to be produced in the same year. The paper presented here focuses on the challenges of canola production and how innovative strategies may open up the Midwest as a significant canola producing region.

*Sharma, A. Lincoln University. ALTERNATIVE MANAGEMENT OPTIONS FOR MISSOURI FORESTS: AN EVALUATION USING USDA-FVS MODEL. The state of Missouri has rich forest resources with one-third of its geographical area under forests- primarily privately owned- providing diverse ecological and economic benefits. In 2013, Missouri forest products industry contributed approximately 8 billion dollars to Missouri's economy, supported 42,500 jobs, and generated 78.5 million dollars in state sales tax revenue. Ecologically, estimated 18% of native vascular plants, 14% of nonvascular plants, and 28% of the vertebrate animals in Missouri are the species of conservation concern. However, most of the private forest landowners of Missouri have limited knowledge or experience regarding forest management. Only about 10% of Missouri's family forest owners utilize assistance from a professional forester, leaving 90% of Missouri's family forest land being managed without any professional guidance. To ensure long-term sustainability and to realize full ecological and economic benefits, it is imperative that we evaluate and develop alternative forest management options for Missouri forests. In this study, we used USDA Forest Vegetation Simulator (FVS) model to evaluate individual tree selection

(q-factor based), clearcut (even-aged) method, and no management options for managing Missouri's major forest type (Oak-Hickory) for structural diversity, and production benefits. Over a period of 100 years, we found that uneven-aged management led to higher annual merchantable timber production ($69.91\text{ft}^3/\text{ac}/\text{yr}$) and stand structural diversity (Shannon Index: 2.27) than either clearcut-regenerate method or no action option, given the assumptions of the simulation modeling. Uneven-aged management also led to sustained yield of sawtimber (1159 to 1280ft^3) every 20-year cutting cycle.

*Bailey, Charles, Brock, A., Giri, A. University of Central Missouri. PURINA MILLS. Missouri consistently ranks among the top ten states in the nation in animal production. Majority of the animal producers use products of Purina Mills, a subsidiary of Land O' Lakes, in their livestock operation. This study focuses on company analysis of Purina Mills. More specifically- types of products, product differentiation, market structure, SWOT analysis and advertisement strategies. Poster presentation of this company will be very beneficial to university students of Missouri as many intend to return to their family livestock operations and/or start one of their own after school. Preliminary findings based on product research suggests that the products offered by the company are both horizontally (at same price all products enjoy positive market share) and vertically (at same price level only few products enjoy positive market share) product differentiated. Moreover, after analyzing regional and national markets we identified that the company has any limited market power (mostly oligopoly) based on licensing, patent, geographic location and some other unique attributes. In addition to analyzing advertisement methods, we also talked with company personnel, carefully studied the mission and vision statement of the company to do an extensive Strength, Weakness, Opportunity and Threat (SWOT) analysis. From SWOT analysis we found that the strength (S) of the company was high quality products, extensive research, reputation, variety of products offered; Weakness (W) were high price products, domestic market; Opportunities (O) were technology leader, producer specific product to reach new markets and the potential threats (T) were- declining market share, and competition from other firms.

Agriculture Poster Presentations

*Takhachhe, Parameshwor, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF

SOIL THERMAL PROPERTIES AT GRIFFITH FARM. Thermal properties of soil, in addition to crop vegetation, influence directly or indirectly, the processes of mass and energy flow in the boundary layer of the atmosphere. Assessment of the distribution of these properties is therefore important in understanding their changing nature at field scale. Thus, this study was conducted to explore the status and spatial variability of soil thermal conductivity (K), thermal resistivity (R), thermal diffusivity (D), volumetric heat capacity (C) and soil temperature (T) across the Griffith farm. Soil samples were collected in 2014 in a farmer field and sent to a commercial laboratory for analysis. Soil thermal properties were directly measured using a KD2 Thermal Properties meter. Results showed that the average values for K, R, D, C and T were 0.34 ± 0.01 , 302.42 ± 54.72 , 0.29 ± 0.04 , 0.04 ± 0.17 and 33.43 ± 1.83 , respectively. The variogram analysis showed that the measured properties correlated spatially, however the coefficients of determination (R^2) were low. Interpolated maps showed that soil thermal conductivity (K) was evenly distributed with range between 0.31 and 0.37. Since, the R^2 value were not highly supportive the geostatistical map for the soil thermal properties could be done only using inverse distance weighing method instead of kriging.

*Nelson, Lancelot, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF SOIL PROPERTIES BUSBY FARM IN MISSOURI. In recent years the, the study of agriculture has revolutionized dramatically. Information about weather, climate, and climate change are now used in calculating and estimating crop viability and efficiency. Soil properties are also studied as an important crop evaluation technique. Thus, Geographic Information System is being use to pin point and log these soil properties data spatially so that farmers are more aware, and changes, overtime are analyzed. In 2014 Lincoln University conducted a soil sampling at Busby farm to assess and map the status of micronutrients Fe, Cu, Mn, Zn, B, and Al .Based on the data, Iron (Fe) was fitted to a linear variogram model $R^2 = 0.29$. This data was plotted into a map which showed two zones. The area of higher intensity was northerly and lower concentration was southerly. Copper (Cu) varied with no area of high or low intensity. (Mn) showed that a southeastern zone having a lower value than the northwesterly zone. Zinc (Zn) recorded lower area of intensity in the northern zone followed by area of highest intensity then a diminishing in intensity towards the southern zone. There was also a high area of intensity in the middle of the field for Al micronutrient.

*Al-awwal, Nasruddeen, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University.

MAPPING SOIL NUTRIENT CONTENT USING STATISTICAL AND GEOSTATISTICAL TECHNIQUE IN OSAGE COUNTY MISSOURI. Understanding of the status and distribution of soil properties is vital in any farming operation. Statistical and Geostatistical analysis can help in improving our understanding such status and distribution. The objective of this study was to determine and map soil nutrients content using statistical and geostatistical technique. The study was conducted in a farmer field in Osage County in Missouri. Soil samples are collected in the farm and sent to a commercial laboratory of soil chemical properties and nutrients. Soil nutrients of interests were nitrate (NO_3), ammonium (NH_3), potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg) and sulfur (S). Results showed that the coefficients of variability (CV) for NH_4 , NO_3 , K, Mg, P, S, and Ca were 17.46%, 36.96, 12.65, 16.75, 5.31, 10.52, 21.57 and 14.84%, respectively. The mean and median values for these properties were close enough to assume normal distribution of the data. Geostatistical analysis showed that NH_4 , NO_3 , Mg, P and S were fitted to a Gaussian variogram model with the R^2 values of 0.49, 0.66, 0.90, 0.81 and 0.11 respectively. However, K and Ca had isotropic variogram that fitted a spherical model with R^2 values equal to 0.29 and 0.50. This study revealed the potential and ability of geostatistical in determining and mapping soil nutrients.

*Mzeru, Christopher, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. GEOSTATISTICAL ANALYSIS OF MICRONUTRIENTS AT FREEMAN FARM. Information on soil nutrients status is of great importance in agricultural production and management of the environment. We studied the spatial distribution of soil micronutrients: Iron (Fe), Manganese (Mn), Copper (Cu), Zinc (Zn) and Aluminum (Al) in a silt loam soil at Freeman farm of Lincoln University. Forty eight samples were collected in 2015 at 0-10 cm depth and sent to commercial for analysis. The spatial distribution of micronutrients was studied using both classical statistics and geostatistics. Results showed that average values of micronutrients were 194.80, 191.42, 477.80, 2.45 and 3.45 mg/kg for Fe, Mn, Cu, Zn and Al, respectively. Their coefficient of variation ranged from 7.70 for Al and 15.80% for Mn. Geostatistical analysis showed that Fe responded to an exponential variogram model with $R^2 = 0.12$. The corresponding map showed the highest concentrations of Fe in the eastern part of the field, near the Missouri river bank. Cu and Mn, on the other hand, responded to a Gaussian model with $R^2 = 0.45$ and $R^2 = 0.45$, respectively, with high concentrations in the middle of the field. Al and Zn fitted to a spherical model with $R^2 = 0.12$ and $R^2 = 0.77$ respectively.

Geostatistical analysis was useful in portraying the distribution of micronutrients across the farm.

*Prater, Brandi, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF SOIL PROPERTIES IN A FARMER FIELD OSAGE COUNTY. Mapping soil properties is important in determining the overall quality and health status of a soil. We studied the distribution of soil bulk density (BD), volumetric water content (VWC), temperature (T), thermal conductivity (K), and thermal resistivity (R) in a farmer field in Osage County, Missouri. The farm is located at 38.701052 latitude and 91.709377 longitude. Data on soil thermal properties (T, K and R) was collected in 2013 using a KD-2 Thermal Properties meter. Soil samples were also collected at a depth of 0-30 cm for the determination of soil volumetric water content (VWC), bulk density (BD) as well as other soil physical properties. Statistix 10 statistical software and GS+ 7.0 Geostatistical software were used for data analysis. Results for statistical analysis showed that BD ranged from 0.92 to 1.63 g/cm³ with an average value of 1.29 g/cm³. Soil thermal resistivity (R) showed the highest variability with a minimum value of 74.00 and maximum of 389.00, therefore a range of 315.00 W/mK. Interpolation map of BD showed a much higher BD on the left side of the field than on the right. The interpolated map R however, showed values higher on the right than the left side of the field though there was only slightly significant correlation between the two thermal properties. Interpolated maps of other properties showed a more even distribution across the field.

*Morgan, Anthony, Nkongolo, N. Department of Agriculture and Environmental Sciences, Lincoln University. MAPPING SOIL MICRONUTRIENTS AT GRIFFITH FARMS MILLER COUNTY, MISSOURI. Management of soil properties is crucial in maintaining plant nutrition and crop production. Geospatial technologies can help to identify farm areas where nutrients are deficient for their subsequent correction. We mapped the distribution of soil micronutrients at Griffith farm. The farm is located in Miller County (Missouri) and its coordinates are Latitude 38.355079 and Longitude -92.533460. Soil samples were collected at 30 cm depth and sent to a commercial laboratory for analysis. The micronutrients of interests were B, Al, Mn, Fe, Cu, and Zn. Results showed that the mean values for B, Cu and Al were closer to their medians, implying that data for these micronutrients approached normality. The coefficients of variation (CV) ranged from 15.29 for Al to 58.90% for Mn. In fact, Mn concentration varied from 22.00 to 284 mg/kg, therefore a range of 262 mg/kg. Interpolated maps showed that

the concentration of micronutrients were higher in the southern portion of the field. With this information, we can make better manage the fertility of our field.

*Almuhanna, Abdulhadi, Mkongolo, N. Department of Environmental Sciences, Lincoln University. STATISTICAL AND GEOSTATISTICAL ANALYSIS OF SOIL PROPERTIES AT CARVER FARM. Knowledge of the distribution soil properties is important in farm management and productivity. We conducted a statistical and geostatistical analysis of soil chemical properties and nutrients at Carver farm of Lincoln University. The chemical properties studied were soil pH, cation exchange capacity (CEC), total carbon (TC), total nitrogen (TN) and organic matter (OM). Macronutrients investigated were soil phosphorus (P) and calcium (Ca). Soil samples were taken in 2014 and were sent to commercial laboratory for the analyses of these properties and nutrients. The results of statistical analysis showed that the average pH was 5.98 and ranged from 5.60 to 6.60, suggesting that the soil of the study site was acidic. The coefficient of variation (CV) ranged from 5.03 for pH to 45.52 for TC, suggesting that TC had the highest variability. All mean values for soil chemical properties were closer to their median, suggesting that these properties were normally distributed. Geostatistical analysis showed that soil chemical properties fitted to a range of variogram models with R^2 ranging from 0.49 to 0.99. Interpolated maps also showed that soil chemical properties were evenly distributed along E-W zones with pockets of high and low concentrations across the field. These maps showing the distribution of chemical properties can be crucial for farm management and productivity.

*Johnson, Hwei-Yiing. Lincoln University. ORGANIC LETTUCE PRODUCTION USING A DYI VERTICAL HYDROPONIC SYSTEM. A forty-foot long four-tiered vertical hydroponic system was assembled to grow lettuce in front of a farm building. The system was made of PVC pipes (4 inches in diameter) and plumbing fittings to form a closed circulation system. Two hundred lettuces were planted with two red cultivars of Ruby Sky and Skyphos and two green cultivars of Adriana and Tropicana. Compost tea was made by brewing worm castings and food waste compost mixed at a ratio of 2 to 1 (v/v) under an actively aerated condition with dissolved oxygen above 8 ppm. The compost tea was used as primary sources of nutrients and beneficial microbes to support plant growth. Fish hydrolysate and liquid kelp, were added at below recommended doses to supplement nutrients. The nutrient solution was maintained in the ranges of pH 5-6. EC (1-1.5 mmho/cm), NO_3^- (60-100 ppm), Ca_2^+ (90-130), and K^+ (50-100 ppm). Lettuce plants developed large size and healthy

appearance with bright pigmentation during the 8-week growing period. This trial proved that organic lettuce can be produced using an economic DYI system with the support of compost tea and reduced doses of organic fertilizers to minimize operational cost. This system demonstrates the feasibility of maximizing organic food production at urban homes and small producers' farms in a limited space without soil. The operator's knowledge and experience on composting, compost tea brewing, monitoring nutrients and investment of test kits are crucial to sustain the success of growing hydroponic crops.

*Braden, Indi, Bollinger, D., Craft, C., Klueppel, M., Vonder Haar, J., Galeski, M. Southeast Missouri State University. LEARNING THROUGH APPLICATION: SPATIAL ANALYSIS. For many years, producers have based management decisions on final yield averages for row crop acres. Precision agriculture technology allows producers an opportunity to evaluate inputs and outputs on a site-specific scale. Yield data was collected for corn and soybean harvest at the David M. Barton Agricultural Research Center, Gordonville, MO. Students enrolled in AG444 Spatial Analysis were challenged with evaluating yield data. By using real-world data, students are able to ask questions and consider relationships between yield and other variables, such as soil test results. Students applying course material to real-world data are able to gain hands-on experience and critical thinking skills that can be applied in future geographic information system (GIS) applications.

*Takhachhe, Parameshwor, Liu, F., Yang, J., Marianne, D. Department of Environmental Sciences and Cooperative Research Programs, Lincoln University, Jefferson City. VARIABILITY OF WATER QUALITY ACROSS HEADWATER CATCHMENTS WITH DISTINCT SOILS AND HYDROLOGIC SYSTEMS IN MID-MISSOURI. Surface water and groundwater contamination by non-point pollutants such as soil applied herbicides and fertilizers continue to be a major water quality problem in Mid-Missouri. Variation in watershed characteristics due to the presence of distinct soils and hydrologic systems has added the complexity in understanding the controls of contaminants. The purpose of this study is to examine spatial variability of water quality among three different headwater catchments-Goodwater Creek Experimental Watershed (GCEW) with claypan soil, Sulphur Creek Watershed (SCW) with deep loess soil, and Wet Glaize Creek Watershed (WGCW) with karst system. Samples were collected from February 2015 to February 2016 from streams, springs and groundwater and analyzed for major nutrients and herbicides. Mean NO_3^- concentrations in the stream water

were 0.78 (± 0.76) ppm, 0.35 (± 0.32) ppm and 0.77 (± 0.04) ppm in GCEW, SCW and WGCW, respectively. Nitrate-N concentrations in groundwater were higher than those in stream water, with 16.32(± 3.7) ppm, 8.02(± 15.5) ppm and 3.20(± 1.30) ppm on average at GCEW, SCW and WGCW, respectively. Atrazine concentrations in stream water were higher than in groundwater at both GCEW and SCW. The mean atrazine concentrations were 3.16(± 6.52) ppb and 0.063 (± 0.14) ppb in stream water and groundwater at GCEW, respectively, while the values were 1.47(± 2.04) ppb and 0.0067(± 0.012) ppb in stream water and ground water at SCW. This study provides a holistic overview of the spatial variability in water quality among headwater catchments in Mid-Missouri.

*Svenson, Sven. Charles Nemanick Alternative Agriculture Garden, Department of Agriculture, Southeast Missouri State University. NATIVE PERENNIALS FOR BUTTERFLY AND POLLINATOR GARDENS: FIRST YEAR PERFORMANCE IN SOUTHEAST MISSOURI. Perennials native to Missouri were evaluated for survival, growth, and flowering during the first 15 months after planting into a compost-amended urban soil in Cape Girardeau, MO. Twenty eight container-grown plants of each species were planted in late August 2014 in a butterfly-shaped garden under full sun growing conditions. Two plots per species were planted in each wing of the garden, providing 4 replicated plots of 7 plants of each species for analysis. During the first full year after establishment, the following species had 100% survival, excellent growth, and 100% flowering: *Coreopsis lanceolata*, *Echinacea pallida*, *Eutrochium purpureum*, *Penstemon digitalis*, *Rudbeckia fulgida* var. *umbrosa*, *Rudbeckia missouriensis*, *Symphotrichum oblongifolium*, and *Veronicastrum virginicum*. Species having 75% to 86% survival, good growth, and 100% flowering during the first growing season included: *Echinacea paradoxa*, *Echinacea purpurea*, *Eryngium yuccifolium*, and *Zizia aurea*. *Amorpha canescens*, *Asclepias tuberosa*, and *Glandularia canadensis* had less than 50% survival, poor growth, and 100% flowering of surviving plants. Secondary plots of additional species were studied, but were not part of the butterfly-shaped garden plot. Species in the secondary plots had 100% survival, excellent growth, 100% flowering, including: *Asclepias incarnata*, *Callirhoe involucrata*, and *Liatris spicata*. The data will help guide the selection of plant species used for urban or suburban butterfly and pollinator gardens in southeast Missouri.

*Timpe, Tricia, Bayan, R., Wetzel, J., Edwards, J. Lincoln University. DIETARY INCLUSION OF BIOCHAR AND KAOLIN FOR NORTHERN BLUEGILL SUNFISH. Biochar as a soil amendment reduces subsequent need for fertilizers,

although adding biochar directly does not provide benefits until the cation exchange capacity is charged with nutrients. Nutrient charging of biochar could be coupled with solving a problem where fish producers under new EPA restrictions must lower the same nutrients in their effluent waters. Nutrient leachates from feces may be reduced by dietary biochar and kaolin by adsorption or by promoting fecal integrity, reducing fragmentation. Nothing is known about nutritional benefits of biochar in fish feed. Palatability of feed mixed with biochar and kaolin are of particular concern and must be explored before more is invested in studies with volumes required for soil amendment use. We report preliminary findings with fingerling Bluegill Sunfish *Lepomis macrochirus* where we investigate consumption of feeds containing biochar and/or kaolin and impact on growth. Age-0 fish (n = 10) were stocked into nine 200-gal tanks of an indoor recirculating aquaculture system. Groups of three randomly assigned replicates were fed one of three diets: control (Bio Vita), 5% biochar base, and 5% each of biochar and kaolin mixed with Bio Vita. Three daily apparent satiation feedings were applied five days a week with weight determinations following two days of food withdrawal. Feed consumption, feed conversion ratio, and specific growth rate showed no differences as a function of inclusion. We conclude biochar and kaolin does not adversely affect feed palatability or growth. Further research is needed to investigate long-term consumption, impacts on leaching and soil amendment value.

*Haruna, Samuel, Nkongolo, N., Anderson, S. Lincoln University/University of Missouri. WATER INFILTRATION AS AFFECTED BY COVER CROP AND TILLAGE MANAGEMENT PRACTICES. Various agricultural management practices such as cover crops and tillage have the potential to influence water infiltration into soil. This study was conducted on an alluvial soil at Lincoln University's Freeman Farm to evaluate the influence of cover crop and tillage management on in situ field infiltration. The field site included three replicate blocks in a randomized block design with each plot measuring 21.3 m length and 12.2 m width. The two treatment factors included cover crop at two levels [cereal rye (*Secale cereale*) cover crop vs. no cover crop] and tillage at two levels (moldboard plow tillage vs. no till). Crop management included continuous corn (*Zea mays*). Infiltration rates were measured using ponded infiltration during the 2014 and 2015 growing seasons. Water infiltration parameters were estimated using the Green-Ampt and Parlange infiltration equations. Cover crop management significantly increased various infiltration parameters compared with no cover crop. Tillage management improved some infiltration parameters compared with no-till but this effect was not consistent probably due to reduced transmission pores caused by tillage. Cover crop

management can improve soil quality which enhances the sustainability of crop production systems.

*Acharya, Shanta, Nkongolo, N. Lincoln University, Missouri. ASSESSING THE EFFECT OF FOUR YEARS OF TILLAGE, ROTATION AND COVER CROPPING ON THE YIELD OF SOYBEAN. The practices of tillage, rotation and cover cropping affect the biological, chemical and physical properties of soil and thus may affect the yield of crops. They also improve soil quality by increasing soil carbon, soil aggregation, and soil water infiltration, thus reducing year-to-year variability in yield. The objective of this research was to assess the effect of four years of tillage, rotation and cover cropping on the yield of soybean. Twenty four plots of soybean were laid out in a randomized complete block design with 8 treatments and 3 replications. Treatments were-tillage at two levels- conventional and no tillage; cover crop at two levels- no cover crop and cover crop; rotation at four levels- continuous maize, continuous soybean, maize soybean and soybean maize. Rye grass was used as a cover crop. Yield was estimated by harvesting 1 m² from 4 different areas in each plot. In 2014, the interaction effect of tillage and crop rotation was significant over soybean yield ($p = 0.0383$). Across the years, tillage was significant for the year ($p = 0.0350$). Similarly, interaction of Tillage*Cover*Rotation was significant for the yield ($p = 0.0426$). Although soybean yield responded to the various treatments combination, the response was not consistent across years of study. It is, thus, suggested that more experiments should be done, over a longer period of time to better understand the effects of tillage, cover crop and crop rotation on soybean yield.

*Shivers, Traron, Johnson, H., Piñero, J. Lincoln University. JAPANESE BEETLE COMPOSTING: CONVERTING PESTS TO SOIL FERTILIZER USING COMMON FARM MATERIALS. In an attempt to use large amounts of Japanese beetles (JB) that have been captured using mass trapping, we developed a composting method and explored potential applications of the JB-based compost that was produced. Our carbon sources were shredded paper, wood chips, and leaves while our sole nitrogen source was JB. Four compost bins were prepared using the layer method and we monitored temperature during the composting process daily. Once composting was complete, pilot studies that involved oyster mushroom production, vermicompost, and small-scale hydroponic lettuce production using compost teas and compost / vermicompost were conducted. Chemical analyses of the compost produced indicated that JB-based compost is a good quality soil amendment and can be used to augment fertilization in support of organic production. The vermicompost produced offers

additional benefits such as uniform and fine product size, more nutrients readily available for plant absorption, and hormone-like chemicals to stimulate plant growth.

*Khanal, Manzeal, Reed, M., Mersha, Z., Wuliji, T., Zheng, G. Lincoln University. POTENTIAL OF USING ENDOPHYTIC STRAINS OF ENDOSPORE-FORMING BACTERIA TO SAFEGUARD FRESH VEGETABLES AGAINST IMPORTANT FOOD-BORNE PATHOGENS. Fresh vegetables are increasingly associated with food-borne disease outbreaks in the U.S. as a result of the increasing consumption of these fresh products as part of a healthy diet. Though chemical sanitizing agents are widely used, they are not always effective and have safety concerns. Therefore, biological control using the native microbiota can be a better alternative to reduce and prevent contamination of fresh produce by pathogens. The objectives of this study were to isolate and use endophytic strains of endospore-forming bacteria as the biocontrol agents to reduce and prevent certain pathogen contamination of fresh vegetables. This study was first conducted to isolate endospore-forming bacteria from inner tissues of lettuce, then to screen their anti-pathogen activities in vitro, and finally to test their effects in planta. In total, 50 isolates were obtained and their inhibitory activities were tested against the important food-borne pathogens, including *Escherichia coli* 0104:H4, *Escherichia coli* 0157:H7 and *Salmonella enterica* Pullorum ATCC 13036. In the agar spot tests, 19 isolates showed inhibition toward at least one of the pathogens. Based on the results of 16S rDNA sequencing analyses and biochemical tests, these anti-pathogen isolates were taxonomically identified to be either *Bacillus* spp. or *Paenibacillus* spp. In addition, our study demonstrated that certain strains of these isolates could be taken up by the roots of the lettuce. The preliminary data thus showed a potential of using the endophytic strains of endospore-forming bacteria isolated from vegetables to control the food-borne pathogen contamination of the vegetables.

*Lark, Justin, Navarrete-Tindall, N., Perez-Hernandez, O. University of Central Missouri. CHARACTERIZATION OF SEED FREQUENCY IN WILD AND CULTIVATED PERSIMMON FRUITS IN CENTRAL MISSOURI. Common persimmon (*Diospyros virginiana*) is a deciduous tree native to North America. In Missouri, wild persimmon trees are relatively abundant and typically found in prairies, abandoned fields, and along roads. The tree bears edible fruits that mature in the fall and may persist on the tree into winter. Recently, interest in the persimmon fruit has emerged in the U.S. due to the fruit nutritional value and consumer's preference for organic food and exotic plants. In particular, seedless persimmon fruit with thicker skin and consistent maturation

is desired amongst persimmon enthusiasts and it is a characteristic sought by breeders. The presence of varying seed number in persimmon fruit is often mentioned among consumers and taken as a trivial characteristic of the tree. However, such variation has not been quantified. Determining such a frequency could allow a better understanding of the persimmon fruit seed development and provide insights into the ecology of the persimmon fruit. The objective of this research is to characterize the frequency of developed seeds in wild and cultivated persimmon fruit in Central Missouri. Available wild and cultivated persimmon trees were surveyed in central Missouri. From each tree, about 100 hundred fruits were collected and the seed in each fruit was manually extracted and counted. The frequency distribution of the seed number in the examined trees will be presented as well as a discussion of the morphology and genetic of the flower.

*Aide, Michael. Southeast Missouri State University. RESPONSE OF DENITRIFICATION BIOREACTORS TO TILE DRAINAGE EFFLUENT. The Departments of Agriculture and Chemistry, at Southeast Missouri State University, with assistance from USDA-NRCS/ARS has developed a controlled subsurface irrigation/drainage technology coupled with denitrification bioreactors. The purpose of this project was to limit nutrient migration, particularly nitrate-N. Water from Williams Creek (Cape Girardeau County, Missouri) was impounded with the assistance of levees and the water permitted to infiltrate the soil resource. Water capture by the drainage system was transported to the denitrification bioreactor. Water chemical analysis demonstrated that nitrate-N was effectively diminished by the soil resource and the denitrification bioreactor. It was estimate the system could produce 1/9 million gallons of water having less than 10 mg NO₃-N/acre-year.

*Aide, Michael, Beighley, D. Southeast Missouri State University. ARSENIC UPTAKE IN RICE. The purpose of the 2015 rice research was to assess agronomic and arsenic uptake differences in rice production involving furrow and delayed flood irrigation. Individual rice varieties involving furrow and delayed flood irrigation regimes showed rough rice yield differences; however, the mean of all rice variety yields were not significantly different between the irrigation treatments. Nitrogen, phosphorus, potassium, magnesium, calcium, sulfur, iron, boron, copper and zinc rough rice concentrations were not significantly different because of irrigation treatment; however, arsenic concentrations were significantly smaller in rough rice from the furrow irrigation system. Manganese rough rice concentrations were greater in rough rice from the delayed flood regime.

Biochemistry Oral Presentations

Mottaleb, Musavvir, Stowe, Carly, Johnson, Daniel, and *Mottaleb, M. Abdul. Northwest Missouri State University. OCCURRENCE OF DIPHENHYDRAMINE, DIAZEPAM, CARBAMAZEPINE AND METABOLITES DRUGS IN FISH OF GROCERY STORES BY GC-SIM-MS. Occurrences of pharmaceuticals are evident in aquatic organisms. A reproducible gas chromatography - mass spectrometry (GC-MS) method using selected ion monitoring (SIM) has been used to determine the anti-histamine diphenhydramine (DPH), anti-anxiety diazepam (DZP), anti-seizure carbamazepine (CZP) drugs and their metabolites in grocery stores fish that were homogenized, extracted, pre-concentrated, cleaned up, and examined. Identifications of the compounds in extracts were obtained by comparing similar mass spectral features and retention properties with standards. Among nine frequently detected drugs, only DPH and DZP were observed and ranged from 0.61 - 6.21 and 1.99 - 16.57 ng/g, respectively, in fourteen fish species. These concentration values were lower than the environmental fish. Mean spike recoveries of analytes exceeded 75% with relative standard deviations (RSD) < 10%. The statistically-derived method detection limits (MDLs) for nine compounds ranged from 0.13 - 5.56 ng/g. Average surrogate recoveries were 80 to 85% with 4 to 9% RSD.

Biochemistry Poster Presentations

*Hicks, Maci, Ruggiero, Melissa J., Willever, Katherine, Hamilton-Brehm, Scott, Moser, Duane and Campbell, James H. Department of Natural Sciences, Northwest Missouri State University. CHARACTERIZATION OF POTENTIALLY NOVEL ALPHAPROTEOBACTERIA FROM WALKER LAKE, NEVADA. Walker Lake, NV, is a terminal lake which has been rapidly drying in recent years. Next-generation sequencing has revealed a dynamic microbiota as the lake has receded. We have isolated six cultures of potentially novel *Alphaproteobacteria* from samples collected in 2008. The isolates are most closely related to rare (<1%) OTUs from the lake biosphere. These isolates we collected from this area have been characterized using pH, sodium, phosphate and temperature gradients. Molecular cloning and sequencing of 16S rRNA genes have been used for genetic comparisons of closely related species. Our isolates have notable genetic and physiological differences from named relatives that indicate potentially novel species. Ongoing physiological and biochemical research will determine if new species can be named.

*Qi, Mengyuan, Jung, Gi Ahn, Campbell, James H., Campbell, Alisha G. Northwest Missouri State University. CHARACTERIZATION OF BACTERIAL COMMUNITIES ASSOCIATED WITH CALCIUM CARBONATE-RICH SOILS. Caliche, or soil that contains mostly hardened calcium carbonate, is a material found in arid or semiarid regions such as West Texas. The material is often used in road construction. Environments rich in calcium carbonate often show little signs of vegetative growth, and there is little information about the microbial communities associated with this environment. Therefore, we set out to determine the composition of bacterial communities within calcium carbonate-rich soils and to determine if any of these community members are producing novel antibiotics. Samples were collected along a transect of a caliche pit in Concho County, Texas. Culture-based studies were performed using oligotrophic media on two samples with the highest amounts of calcium-carbonate and lowest amounts of organic material. Sequencing of 16S rRNA genes indicated that most isolates fell within the Class *Actinobacteria*. We have also tested isolates for antibiotic production by assessing the inhibitive properties of the isolates on other microbes. Crowded plates were made from selected samples, and isolates that were able to form zones of inhibition were identified. These isolates are being tested for their ability to inhibit several laboratory strains.

Biological Sciences Oral Presentations

*Bowlin, Kelsey, Schaffer, K. Northwest Missouri State University. THE EFFECT OF β -ESTRADIOL ON THE GERMINATION OF ZEA MAYS. Water is one of the most important resources for an ecosystem. Pollution of major water sources has become a serious problem across much of the world. One example of water pollution caused by humans is the dumping of waste products as effluent into major rivers and waterways. While documentation for the effects of water contaminants on a variety of animals has been widely researched and documented, studies on the effects of these same contaminants on plants are relatively new. Current research has focused on the effects of these contaminants either on plant germination or on vegetative plant growth. Previous studies have found germination was reduced by 57% in *L. sativa*, 6% in *D. carota*, and 18% in *L. esculentum* when compared to the controls (D'Abrosca et al. 2008). The purpose of this research was to investigate the effects of a major pollutant, β -estradiol, on the germination of corn (*Zea mays* L.). The concentrations used in these experiments were .05 mg/L, 0.1 mg/L, 1.0 mg/L and 10 mg/L. The parameters explored were total percent germination, mean hour of germination,

primary root length, coleoptile length, and number of adventitious roots. Corn kernel germination and corn seedling growth were consistently inhibited by the 10 mg concentration. The 0.1 mg treatment augmented germination and seedling growth. Future experiments could be carried out to follow the development of the corn seedlings through maturation and the production of kernels to determine if the high doses of β -estradiol affect the later stages of development as well.

*Colbeck, Gabriel, Chambers-Colbeck, C. Maryville University. CHARACTERIZING SECONDARY CONTACT IN STUDIES OF SPECIATION: USING DATA FROM A SINGLE SAMPLE TO TEST PREDICTIONS ABOUT GENE FLOW. Understanding the nature of introgression upon secondary contact is central our understanding of the process of speciation, but our ability to make pertinent inferences in natural populations remains limited. Information about the strength of selection against hybrids and asymmetries in gene flow has traditionally come from studies involving phenotypic and/or genetic gradients across both space and time. Such studies, while incredibly valuable, can be logistically challenging. Here, we develop a model that permits inferences about the genetic nature of secondary contact to be drawn from a single sample collected at a single point in time. Our ultimate goal is to apply the model to the Black-capped/Carolina chickadee hybrid zone in St. Louis, MO. By simulating populations under models of varying degrees hybrid viability and asymmetries in fitness, we show that a reduction in heterozygosity and skewness are reliable predictors of the strength of a hybrid zone and asymmetries in fitness, respectively. We apply our model to two published data sets and show that we can draw the same conclusions based on only a single sample. We have thus far been unable to apply the model to St. Louis chickadees because the population around the Maryville University campus is genetically nearly 100% Carolina chickadee. This model should have broad applicability for any study examining barriers to gene flow among populations or species in which the investigators wish to make inferences from single samples.

*Bailey, Rachele, McAliley, L. R., Campbell, J.H. Northwest Missouri State University. SOIL CHEMISTRY OF A HEAVY-METAL CONTAMINATED ZONE IN THE TRI-STATE MINING DISTRICT. The Tri-State Mining District of Missouri, Kansas and Oklahoma was the site of large-scale mining operations for lead, zinc, and other heavy-metals until the mid-1950s. Although mining across the area has ceased, high concentrations of lead, zinc, and cadmium continue to be found in the region's soil and water systems. Picher was included in the Tar Creek Superfund Site by the US Environmental Protection Agency in 1980. In order to

elucidate the extent of heavy-metal contamination, a soil chemistry survey of the town of Picher in Ottawa County, Oklahoma was conducted. Samples ($n=111$) were collected along a cardinal-direction transect within an 8.05-km radius of Picher in August 2015 and analyzed for soil metal content, pH, and moisture content. Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) analyses of 20 metals showed high concentrations of lead (>1000 ppm), cadmium (>40 ppm), zinc (>4000 ppm), and aluminum (>5000 ppm) throughout the sampled region. Soil moisture content ranged from 0.30-35.9%, and pH values ranged from 5.14-7.42. MANOVA analysis of metal profiles determined that soils collected from the north transect were significantly different ($p<0.05$) than other sampled directions. Phospholipid Fatty Acid (PLFA) analyses and Next-Generation Sequencing (NGS) of prokaryotic 16S rRNA genes are underway. A systems biology approach will be used to compare soil-chemistry to the microbial community data of the same sampled sites.

Alhusayni, S., *Nikaido, Selene. University of Central Missouri. EXPRESSION OF FHT AND IVS GENES IN EGGPLANT (*SOLANUM MELONGENA*). Anthocyanin pigments are formed abundantly in some, but not all flowers and fruit. The reasons for these differences in concentration are not well understood. In 2012, Thill et al. reported an increase in anthocyanins in black dahlia (*Dahlia variabilis* hort.) over the lighter white and yellow dahlia flowers due to differential expression of FHT, IVS and FNSII genes. FHT and FNSII genes code for the biosynthetic enzymes, flavanone 3 β -hydroxylase and flavone synthase, respectively. The IVS gene is a transcription factor that activates FHT expression. Flavanone 3 β -hydroxylase and flavone synthase compete for a common precursor to divert biosynthesis toward anthocyanin formation (flavanone 3 β -hydroxylase) or flavone formation (flavone synthase). Our investigation of the FHT gene expression in eggplant (*Solanum melongena* L.) suggests that the up-regulation of FHT expression correlates with an increase in anthocyanin production as it does in dahlia. Significant differences in the mean FHT and IVS expression between purple versus white eggplant were measured through quantitative PCR. Mean expression of FHT in the epidermis of purple eggplant (10.43 ± 7.434 , $N=3$) was different from the expression in the epidermis white eggplant (0.62 ± 1.010 , $N=3$), but not different in the predominantly green leaves of purple eggplant (2.06 , $N=2$) versus the leaves of white eggplant (1.91 ± 0.558 , $N=3$). A similar pattern was seen with IVS gene expression. Further experiments with the FNSII gene expression in eggplant are planned. This work was funded by the University of Central Missouri Willard-North grant to S.A.

*Gomez, Jessica, Lankford, S. University of Central Missouri. IMPACTS OF SEX STEROIDS ON CORTISOL SYNTHESIS IN RAINBOW TROUT HEAD KIDNEY TISSUE. The concept of stress is inevitable, as homeostatic systems are constantly met by intrinsic and extrinsic stressors that can lead to multiple physiological problems (Bonga 1977). Fish, like all vertebrates, are known to be impacted by an active stress response. Potential stressors range from water temperature, water quality, season, physiological conditions, or social factors (Bonga 1977), and most result in the release of a hormone called cortisol.

Unlike mammals, which have an adrenal gland, fish synthesize cortisol with specialized interrenal cells located in the head kidney tissue. The interrenal cells release cortisol when stimulated by high levels of adrenocorticotropic hormone (ACTH), which is produced from the anterior pituitary when an animal perceives a stressor. Past research indicates that stress, via cortisol, results in reduced reproductive performance (Tort 2011). This impact is caused by an alteration of reproductive hormones, but different researchers report varying levels of impact. It is possible that differences between reproductive status impacts the sensitivity of the animal to stressors; however, few studies have examined that possibility.

The objective of this study is to investigate the impact that estradiol and progestins (i.e., reproductive hormones) have on cortisol synthesis and the potential local regulators that orchestrate those changes. Changes in interrenal cell cortisol production and expression of TGF- β superfamily mRNA transcripts were measured in vitro as evidence of altered sensitivity and potential molecular regulators of the stress response, respectively. Our preliminary data suggest an alteration of both the sensitivity to stress and TGF- β expression.

*Foley, Leanne, McAliley, L.R. Northwest Missouri State University. MAMMAL SURVEY OF NODAWAY COUNTY, MISSOURI. A mammal survey of Nodaway County, Missouri is currently being conducted in order to provide an updated index of mammals occurring within the county. This is important to document when we consider the agricultural growth, global warming and trends in land stewardship of the county. Mammals are key indicators of ecosystem health, many of them being flag ship species, we must examine how they are affected from external stimuli. We surveyed 25 locations for mammal trapping and 27 locations for camera traps encompassing numerous diverse habitats throughout Nodaway County during fall 2015 and have continued this work into spring 2016. Survey methods include Sherman traps, Tomahawk traps, predatory distress caller, game cameras for terrestrial mammals, AnaBat SD2s and mist nets for bat

species. Our survey to date yields a 15% success rate of small mammals and a total of 19 species in 694 trap nights. Species richness of mixed grasslands yields higher than all habitats surveyed. A value of 0.82 was calculated for Simpson's Diversity of Index, while a value of 0.92 was calculated for Shannon Weiner Index, this allows us to examine mammalian species diversity and evenness within Nodaway County.

*Barton, Samantha, Adam, P.J. Northwest Missouri State University. CRANIODENTAL ADAPTATIONS AND THEIR RELATIONSHIP TO RESOURCE PARTITIONING IN OTTERS. Otters are semi-aquatic mammals that can be found all over the world and are grouped within Subfamily Lutrinae. Lutrinae is composed of 13 species that show a large variation in diet. Some species have become specialized to feeding on snails, clams, and other molluscs (i.e., *Enhydra lutra*), others eat mostly fish (i.e., *Pteronura brasiliensis*), and still others eat a combination of vertebrates and invertebrates (i.e., *Aonyx capensis*). Diets should have an effect on skull and tooth morphologies that should correlate to the diet of each species. To explore these adaptations, thirty-two cranial and tooth measurements were taken from adult specimens and analyzed. These measurements have been found to be indicative of diet in previous studies conducted in carnivoran families such as Felidae, Canidae, Ursidae, and Hyaenidae. Measurements were taken using digital calipers to the nearest 0.01mm. Digital pictures of the skull and dentary were taken in different views to allow additional measurements to be taken using the software program ImageJ. Species were separated into diet groups that were determined by the prey composition of their diet. Principal component analysis and discriminant function analyses were used to validate groupings and their correlations to skull and tooth morphology.

*Harrelson, James T. Maple Woods Community College. THE ROLE OF GAMETOPHYTIC FRAGMENTS IN THE PASSIVE DISPERSAL AND ESTABLISHMENT OF ARBOREAL MOSS MICROCOMMUNITIES. The current literature has only lightly addressed the subject of the passive dispersal of arboreal bryophyte microcommunities. Tardigrades, a member of this community, have been demonstrated to disperse strongly attached to gametophytic fragments of mosses. While the scope of these studies have been limited to the tardigrades; nematodes, rotifers, and ciliates have been noted as being observed as well. In order to better understand how this community disperses in nature it is critical to understand the role of gametophytic fragments in the establishment of new arboreal moss colonies. To gauge the role of fragments in the establishment of new arboreal moss colonies twenty trees were chosen and samples of the soil, moss colonies, bark, and other

bryophyte communities where examined and the microcommunities documented. Communities were then compared as a means of gauging the possible sources of the microcommunities found on moss samples present. Given the more limited substrate compatibility of many species of tardigrades, more attention was paid to them in this study. The data collected suggests that moss colonies containing tardigrades are likely the result of the establishment by gametophytic fragments. This understanding is an essential part of a more complete picture of the dispersal and establishment of new arboreal moss colonies. The next logical question comes from noting the radial positioning of the moss colonies on the host tree. Comparing those positions to the historical seasonal wind data, it suggests that these fragments may have the most success during the winter months.

Biological Sciences Poster Presentations

*Al-Warid, Harith S., Beringer, J., Hiller, T.L., Belant, J.L., Gompper, M.E. Department of Fisheries and Wildlife Sciences, 302 ABNR, University of Missouri, Columbia, MO 65211. TICKS (ACARI: IXODIDAE) ON AMERICAN BLACK BEARS (URSUS AMERICANUS) FROM SOUTHERN MISSOURI, USA. Ticks were collected from 17 free-ranging, live-trapped or road-killed American black bears, *Ursus americanus*, in southern Missouri. All bears were infected with ticks, with a mean intensity of $n = 411.4$ engorged and non-engorged ticks per bear. Engorged ticks ($n=967$) were identified to species so as to discern hard tick species that are capable of successfully feeding on black bears. Five species were identified: *Amblyomma americanum*, *A. maculatum*, *Dermacentor variabilis*, *D. albipictus* and *Ixodes scupularis*. *Amblyomma americanum* was the most common tick species, collected on all surveyed bears and represented 58.7% of the total engorged ticks, while *A. maculatum* was the least common tick species, collected from only four bears and representing 2.4% of the total engorged ticks.

*Graves, Megan Elizabeth. Maryville University. CAPSAICIN ACCELERATES GROWTH RATE IN SERVOMYCES CERVISIAE. Capsaicin is a secondary compound produced by Capsicum peppers that may play a role in deterring mammalian herbivores and/or may deter microbial pathogens. We investigated the potential for capsaicin to inhibit the growth of fungi by measuring its effects on the growth rate of brewer's yeast (*Servomyces cerevisiae*) at various temperatures. I extracted capsaicin from dried Ghost pepper (*Capsicum chinense*) powder using Soxhlet extraction and 100% ethanol as the solvent. Experimental beakers consisted of 200 ml pasteurized apple

cider in a 250 ml Erlenmeyer flask. I ran trials with three groups: an ethanol control (2 ml ethanol), a capsaicin treatment (2 ml capsaicin extract), and an additional control (no ethanol, no capsaicin). Each treatment was run at 10° C and 25° C. I collected 1 ml samples every hour and analyzed growth (turbidity) with a UV-VIS spectrophotometer. To our surprise, capsaicin elevated the growth rate of the yeast in the capsaicin treatment relative to the controls. This effect was much stronger in the 10° treatment. Instead of inhibiting yeast growth, capsaicin appears to accelerate it. I hypothesize that this could be because capsaicin acts as metabolic precursor, because it affects cellular physiology, and/or it affects gene expression in the metabolic pathway. Future work will focus on elucidating the mechanism(s) of capsaicin's effects on *Servomyces cerevisiae*.

*Payne, Spencer, Goad, D. University of Central Missouri. EFFECT OF VARIOUS PLANT EXTRACTS ON THE RATE OF NEURON FIRING IN ACHETA DOMESTICS. Many companies produce dietary supplements with various plant based materials which are claimed by them to have effects on health and the nervous system. Unlike pharmaceuticals, if a substance is classified as a dietary supplement they are not required to be rigorously tested by the Food and Drug Administration (FDA). I hypothesized that examining the changes in neuronal firing rates in common crickets (*Acheta domestics*) could function as an ideal model system for determining the effect of specific plant extracts on nervous tissues. I decided to test extracts made from Ginseng (*Panax quinquefolius*), Valerian (*Valerinana officinalis*), Chamomile (*Matricaria chamomilla*), Tobacco (*Nicotiana tabacum*) and Valerian (*Valerinana officinalis*) for there effects on neuronal firing rates. All of the plant species I chose contain alkaloid compounds that have been shown to affect neuronal signaling. Crickets were anesthetized, attached to a recording contraption, then injected with either 0.1mL of plant extract or 0.1mL of saline solution. Frequency of Spikes mean (Hz) was examined pre-injection and at 30 seconds post-injection. There were no significant results to report for the assays. I hope this experiment can be used to encourage the advancement of research on the supplement industry.

Kiso, A., Hubbard, M., *Moyer, Taylor, Holliday, D. K. Westminster College. IN WAR NO ONE FIGHTS ALONE, G-FUEL™ HAS YOUR BACK THE EFFECTS OF G-FUEL ON GAMING PERFORMANCE. G-Fuel™ is an energy supplement marketed for increased e-sports performance. G-Fuel™ contains several active ingredients such as caffeine, taurine, L-Tyrosine, and ATP, and is aimed at improving focus and concentration, providing energy, and decreasing reaction time.

We will test the effectiveness of this supplement using 20 male participants aged 18-20 who play the first-person shooter game Call of Duty® at least once a week. We will use a randomized, double-blind placebo crossover design. Upon arrival on testing day 1, participants will complete a questionnaire asking about perceived fatigue, alertness, focus, and energy levels. The participants will then be administered 16 oz. of G-Fuel™, or Crystal Light Peach-Mango Green Tea (a flavor-matched placebo). Twenty minutes after drinking the beverage, the participants will complete the questionnaire again. The participants will then play one round of "death match" on Call of Duty® Black Ops III. After the round is completed, game statistics will be recorded and participants will complete an X-box choice reaction time game. We will compare the change in performance as a function of treatment to determine if G-Fuel™ produces the advertised effects.

*Henke, Wyatt, Bailey, R., Davis, C., McAliley, R., Campbell, J. Department of Natural Resources, Northwest Missouri State University. EFFECTS OF HEAVY-METAL SOIL CONTAMINANTS ON TOTAL NUMBERS OF BACTERIA AND ARCHAEA AT THE PICHER, OKLAHOMA MINING SITE. The Tri-State Mining District in Picher, Oklahoma was site to over 100 years of lead, zinc and other heavy-metal mining. Although mining ceased in 1967, the toxic by-products can still be found within the soil. Water contamination has been a known issue for many years, but no work has been done to observe the contamination within the soil. Soil samples (n=111) were collected from an 8.05-km radius around the town of Picher. Whole-community-genomic DNA (gDNA) was obtained from the samples. Quantitative PCR (qPCR) is being used to enumerate 16S rRNA genes with domain-specific primers targeting Archaea and Bacteria. Results of qPCR assays will be analyzed and compared to the levels of soil contaminants as part of a larger project to characterize mining effects on soil chemistry and microbial ecology in the Picher region.

*Gomes, Grace M., Rios, C.M., Escudero, J.M. St. Louis College of Pharmacy. METHICILLIN-RESISTANT ISOLATES OF STAPHYLOCOCCUS IN DOMESTIC CATS OF THE COASTAL BEND REGION. *Staphylococcus aureus* is a common constituent of the skin and mucosal membrane microbiota of humans. The evolution of methicillin-resistant *S. aureus*(MRSA) is a growing cause for concern in clinical and community settings. The mechanism for methicillin resistance is conferred by the *mecA* cassette, which encodes the penicillin binding protein 2a (PBP2a). Due to weak affinity of PBP2a for penicillin, methicillin-resistant isolates of *Staphylococcus* (MRS) are able to survive and reproduce in

the presence of b-lactam. Interspecies transmission of MRSA is suspected between humans and domestic animals due to the close interactions between people and their pets. *The focus of this study was to determine the prevalence of MRSA among cats housed at three shelters in the South Texas Coastal Bend area and to identify them at the species level.* Ninety-eight samples were collected by swabbing the pharyngeal and perianal areas of 49 cats resulting in 67 isolates from 44 of the 49 cats. Through biochemical testing, isolates were identified as members of the *Staphylococcus* genus, but they were not identified as *S. aureus*. Sixteen of the 44 *Staphylococcus*-positive cats tested positive for methicillin-resistance *Staphylococcus*. MRS was prevalent among cats housed in the shelter in the South Texas Coastal Bend area where 32.7% of felines tested positive. Although the focus of this study was to identify MRSA in these companion animals, the results indicate that *S. aureus* is not common on these cats, but other species of methicillin-resistant *Staphylococcus* are present and are being identified.

*Moreno, Marco, Cawly, J. Lindenwood University. GENOMIC ANALYSIS OF CHITINASE AND CHITINASE-RELATED SEQUENCES IN CUCUMIS SATIVUS. Chitinases are hydrolases that cleave the linkages between N-acetylglucosamine units in chitin. They are present in bacteria, plants, and certain invertebrates. In plants, chitinases are thought to have evolved as a means of defense against infection by fungal pathogens. In this study, chitinase and chitinase-like sequences were searched throughout the genome of *Cucumis sativus* (cucumber) to determine the plausible number of such genes and sequences related to them. A total of 40 chitinase and chitinase-like sequences were found. Most sequences were found in chromosomes 3, 5, and 6, while no reliable sequences were found in chromosome 7. The NCBI's genome database was used to retrieve the cucumber's genome, and all E-values for the resulting matches were $\leq 4.0 \times 10^{-6}$ (most were far less than 1.0×10^{-10}). The query sequences used for alignment with *C. sativus* genome were: a known endochitinase precursor of *C. sativus* and a known chitinase of *Cucumis melo* (muskmelon). These known proteins were analyzed with the program SMART for domain architecture. The endochitinase precursor was found to contain a glycol-18 domain, while a glycol-hydro-19 domain was found in the muskmelon chitinase. Both are O-glycosyl hydrolase domains. Future research steps are targeted toward the alignment of the individual chitinase and chitinase-like sequences found in the *C. sativus* genome with known proteins in the NCBI database, as well as a phylogenetic analysis of chitinase sequences in *C. sativus* and related species. This will help build a better understanding of chitinase genes evolution in the cucurbitaceae family.

*Hartnett, Samantha. Maryville University. GENETIC ASSESSMENT OF A MOVING HYBRID ZONE. Observations of the chickadees living in the Town and Country area show a larger number of Carolina over Black-capped chickadees. While this may be evidence that the hybrid zone is migrating northward, it might also indicate the Town and Country area is located south of the hybrid zone. The aim of this project is to use simple genetic tests to distinguish between these two alternatives. Morphological differences in wing/tail ratios between Carolina and Black-capped chickadees can provide a rough estimate of the ratio of chickadees living in the area. Therefore, wing and tail measurements were obtained from all of the birds banded. This revealed a larger number of Carolina chickadees in the area. Next, blood samples were collected and genetic analysis was performed on the mitochondrial DNA (mtDNA), which involved extracting, amplifying, and sequencing the mtDNA from each chickadee. The sequenced DNA was then compared to sequences stored in the GenBank database, which revealed, once again, that a majority of the chickadees captured were of the Carolina species. Only one of the fifty successfully sequenced DNA samples was characterized as Black-cap. Most recently the nuclear DNA of each individual was characterized through analysis of single nucleotide polymorphisms (SNPs). This involved the amplification and sequencing of 4 different SNP regions. These results showed evidence of 2 species, Carolina and hybrid, existing in the Town and Country area.

*Lounsberry, Nicole, Wills, C. Rockhurst University. INSECT DIVERSITY IN AN URBAN ENVIRONMENT. To estimate insect diversity in a variable urban environment, sweep netting was used to collect insects along a 23 mile transect across Kansas City, MO from Jerry Smith Park in Southern Kansas City to Richard L. Berkley Riverfront Park at the Missouri River during daylight hours between June and October 2015. Collections were made within 0-25 meters of Holmes Road. Holmes Road runs North/South, approximately crosses the center of the Kansas City metro area, and transects a variety of urban environments including wooded park to urban downtown. We estimated land cover (type and approximate area along this transect) using Google Earth. Insects were frozen at -18° C until they could be classified. Approximately 31 different families were identified along the transect. As expected, we found a greater number of individuals and families in areas with more vegetation. The suburban areas were found to be the most vegetated and therefore inhabited the greatest number of families. The rural and urban areas with less vegetation demonstrated less diversity in family groups overall. Additionally, the time of collection demonstrated a correlation in which evening hours yielded greater sample sizes. This

suggests that more individuals thrive during twilight hours while greater diversities reside in suburban areas.

*Jack, Brittany, *Gonzalez, Maria, Haskins, M. Rockhurst University. PREVALENCE OF PARASITE EGGS IN METROPOLITAN PARKS. Fecal contamination of soils in metropolitan parks may present health risks to humans and other animals which frequent those parks. Among those health hazards is the potential for exposure to parasite eggs. Soil samples were collected in metropolitan Kansas City, MO from five off-leash dog parks and five green recreational areas in which people exercise their dogs. A total of six samples were collected from each location and dried for approximately 12 hours. Following published protocols, soil was then sifted through a series of mesh screens and 2 g of each individual sample transferred into separate 15 ml centrifuge tubes. In preparation for a floating sucrose assay each soil sample was "washed" with eight ml of Tween 80 and centrifuged. Supernatant was gently removed from the soil pellets and thrown away. Approximately 10 ml of saturated sucrose solution was then added to each tube, the pellet re-suspended, and tubes centrifuged for an additional 10 min at 190 g. Finally, each tube was "topped off" with a saturated sucrose solution and a coverslip added to collect eggs that floated during the final centrifuge cycle lasting 5 minutes at 80 g. After centrifugation each coverslip was removed and carefully placed onto a clean slide. Each of the six slides representing one collection site were inspected for parasite eggs using a compound microscope. Approximately 30% of the soil samples examined to date tested positive for one or more parasite eggs.

*Phillips, Shannel, *Templeton, Samantha, Adam, P.J. Department of Natural Sciences, Northwest Missouri State University. CARNIVORES HAVE SPINE: FORM AND FUNCTION OF VERTEBRAE IN RELATION TO LOCOMOTION AND BEHAVIOR IN CARNIVORES. Studies of morphological correlates with terrestrial locomotor strategies have concentrated predominantly on the appendicular skeleton. However, specialization of locomotor strategies has resulted in adaptive variation in vertebrae morphology. Using measurements of select landmarks on vertebrae, the predictability of terrestrial locomotor strategies was assessed. Forty specimens representing 32 carnivore species were subjected to four landmark measurements: transverse process width (TW), total vertebral height (TW), centrum height (CH), and centrum length (CL). All available vertebrae were taken into account with the cervical #7 (C7) used to standardize measurements to account for size disparity. Missing vertebrae were estimated using mean values from present, articulating vertebrae. Specimens were categorized into five different locomotor strategies: arboreal,

scansorial, cursorial, non-cursorial, and semi-fossorial. Measurements were subjected to Principal Components Analysis (PCA) to examine patterns in overall variance. Discriminant Function Analyses (DFA) were then conducted to reveal patterns in vertebral variation and presage reclassification of locomotor group classifications. Results demonstrated locomotor classification can be predicted with a high degree of accuracy (>95%) regardless of taxonomic alliances, with similar results for all measurements.

*McCann, Cammie L., Adam, P.J. Department of Natural Sciences, Northwest Missouri State University. NOT ALL CLAWS ARE THE SAME: FORM AND FUNCTION OF CAT CLAW MORPHOLOGY. Morphological differences between claws of the fore- and hind limbs are due to differences in their functions. Forelimb claws tend to be highly curved and allow a cat to hang onto a struggling prey item. Hind-claws tend to be more sickle-shaped and are used to help disassemble prey as well as for climbing trees in arboreal species. They also help a cat to push against the ground when jumping. The cheetah (*Acinonyx jubatus*) has much straighter claws than other representatives of Felidae due to its unique hunting behavior and lack of sheaths of skin to cover the claws when retracted. My research focuses on anatomical differences between the claws of the fore limb and the hind limb to better understand how they are used. This research will be further investigated by looking at the claw curvature and how it relates to hunting habits in a survey of felid species. Measurements of claws from all cat species will be taken using calibrated digital calipers and digital photographs at the Field Museum in Chicago. Pictures will be taken of the lateral view of claws to measure curvature of claws from all of the digits on the anterior and posterior claws. After collecting data, a principal components analysis (PCA), a discriminant function analysis (DFA), and other multivariate analyses (MANOVA) will be used to determine how hunting habits in cat species can be predicted from characteristics of claw curvature.

*Legaria, Alex, Cawly, J. Lindenwood University. ANALYSIS OF THE ALLELOPATHIC PROPERTIES OF THE EXUDATE OF THE ACER GINNALA SEED. In previous studies the *Acer ginnala* seed showed an allelopathic properties in its exudate. This research project has the objective of supporting and analyzing this properties. In order to perform such analysis, we removed the testa layer of the seed, we disinfected the seed coat by rinsing it with 1% for one minute, and two rinses with DI water, one more minute each. Seven seeds were cultured per plate with phytoblend for 7 to 10 days. The exudate was then collected. The plates with the exudate spots were used to culture *Lolium perenne* seeds. The *Lolium*

perenne seeds were previously disinfected by rinsing each seed with 70% ethanol and 1% sodium hypochlorite for one minute, followed by two rinses of water of one minute each. The seeds were then cultured in the phytoblend plates where the spots of the *Acer ginnala* exudate was diffused. The seeds were rinsed with 7 μ L of the exudate, and then observed for a week. A control group was set up by culturing 7 disinfected *Lolium perenne* seeds per phytoblend plate with no presence of exudate. After a week, ~80% of the experimental seeds showed an abnormal behavior of its root. The root did not penetrate the media until it had avoided the exudate. None of the control groups showed this behavior in any of its seeds. Also, 74% of the seeds in the experimental groups presented fungal presence while 0% of the control groups showed this presence. An HPLC will be performed during the following weeks to determine the possible composition of the exudate.

Biomedicine / Biotechnology Oral Presentations

*Mobley, G., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Rapid detection of *Staphylococcus* Enterotoxin A (SEA) from food samples. *Staphylococcus aureus* is an enterotoxin-producing bacteria responsible for a minimum of 241,000 cases of foodborne illness in the United States every year. The economic impact of these bacteria on the food industry and society as a whole is immense, with an estimated cost of \$167,697,860 per year. There are a variety of methods of *Staphylococcus aureus* detection. The faster that the presence of these bacteria can be determined, the sooner the distribution of the contaminated food can be halted. For this reason, the efficiency of detection is directly tied to a reduction in affected populations. The objective of this study was to develop a novel detection method for the *Staphylococcus* Enterotoxin A (SEA). The pure toxin was labeled with fluorescent dyes (FITC and TRITC); then the labeled toxin was captured by a magnetic bead immobilized with the anti-SEA antibody. The bead used had a dual purpose: toxin purification and toxin detection. This process allowed the immuno-complex to be observed with use of a fluorescent microscope and fluorescent spectrophotometer.

*Balakrishnan, B., Barizuddin, S., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Novel Immuno-MUG Assay for the Rapid Detection of *E. coli* O104:H4. Immunomagnetic separation hybridized with MUG assay for the rapid detection of *Escherichia coli* (*E.coli*) O104:H4 pathogen from meat samples. Monoclonal antibody specific to *E. coli* O104:H4 were immobilized on

protein A-coated magnetic beads. This Protein-A-anti *E. coli* O104:H4 antibody complex was used to capture the *E. coli* O104:H4 antigen (whole cell) from enriched meat sample. The goal of using this technique was to achieve a fluorescent Protein-A-anti *E. coli* O104:H4 - *E. coli* O104:H4 complex. The eluted contents of this complex were added to the LST-MUG (Lauryl Sulfate Tryptose-4-methylumbelliferyl- β -D-glucuronide) broth, a signalling reporter. When the *E. coli* bacterium comes into contact with LST-MUG, it cleaves the substrate via the enzymatic activity of β -glucuronidase. The resulting cleavage produces 4-methylumbelliferone, a highly fluorescent species. This fluorescence was detected using a fluoro spectrophotometer. The lower and upper detection range for this LST-MUG sensing regimen was found to be between 2.05×10^5 - 4.09×10^8 CFU/ml. If qualitative detection is the primary goal, the results can be ascertained in 8 hrs. *The advantages of this technique include*, the highly specific detection of bacteria and versatility in terms of acting like a platform for detection of “any” bacteria that produces β -galactosidase enzyme should be detected.

Biomedicine / Biotechnology Poster Presentations

*Balakrishnan, B., Barizuddin, S., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Novel Immuno-MUG Assay for the Rapid Detection of *E. coli* O104:H4. Immunomagnetic separation hybridized with MUG assay for the rapid detection of *Escherichia coli* (*E.coli*) O104:H4 pathogen from meat samples. Monoclonal antibody specific to *E. coli* O104:H4 were immobilized on protein A-coated magnetic beads. This Protein-A-anti *E. coli* O104:H4 antibody complex was used to capture the *E. coli* O104:H4 antigen (whole cell) from enriched meat sample. The goal of using this technique was to achieve a fluorescent Protein-A-anti *E. coli* O104:H4 - *E. coli* O104:H4 complex. The eluted contents of this complex were added to the LST-MUG (Lauryl Sulfate Tryptose-4-methylumbelliferyl- β -D-glucuronide) broth, a signalling reporter. When the *E. coli* bacterium comes into contact with LST-MUG, it cleaves the substrate via the enzymatic activity of β -glucuronidase. The resulting cleavage produces 4-methylumbelliferone, a highly fluorescent species. This fluorescence was detected using a fluoro spectrophotometer. The lower and upper detection range for this LST-MUG sensing regimen was found to be between 2.05×10^5 - 4.09×10^8 CFU/ml. If qualitative detection is the primary goal, the results can be ascertained in 8 hrs. *The advantages of this technique include*, the highly specific detection of bacteria and versatility in terms of acting like a

platform for detection of “any” bacteria that produces β -galactosidase enzyme should be detected.

*Turner, K., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Highly specific immuno-detection method for foodborne *Shigella* spp. *Shigella* is Gram-negative and facultative anaerobic bacteria closely related to the genus *Salmonella*. *Shigella* is a major foodborne bacterial pathogen, which is the cause of shigellosis. Some serotypes can produce an enterotoxin called the Shiga toxin, which is responsible for Hemolytic Uremic Syndrome. The source of contamination is through humans, especially in cases of poor hygiene. Detection process of this bacteria remain a concern due to lack of specific culture methods of this bacteria, which leads to a high level of cross contamination with *Salmonella* species. In the present study, the bacteria were purified from the food samples using highly specific immunomagnetic beads and a specific antibody. The purified bacteria were then subjected to an immunofluorescent detection method using a spectrofluorometric assay and fluorescent microscopy. This method proved to be highly specific to *Shigella*.

*Pollard, A., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Immunomagnetic purification and fluorescent detection method for foodborne *Salmonella* – A hybrid system of immunofluorescent detection. *Salmonella* are Gram-negative enteric bacteria, known to be commensal microorganisms present in gastrointestinal tracts of humans and animals. *Salmonella* has remained the primary cause of foodborne illness over a period of 100 years, throughout the world. To avoid foodborne illness caused by salmonella, a reliable and rapid detection method is needed for monitoring in various stages of food processing. The goal of this study was rapid purification of *Salmonella* from food samples. Thus, the purified bacteria can be detected quickly. In order to achieve this, a new kind of immunomagnetic beads were used. The beads used were coated with a specific antibody capable of capturing *Salmonella*. The purified bacteria were then taken into the immunofluorescence detection process. At this point the bacteria were labeled with a Fluorescent Dye (TRITC) and detected using spectrofluorometric assays.

*Taylor, A., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Rapid and reliable detection method for *Listeria monocytogenes* from infected food samples. *Listeria monocytogenes* is a Gram-positive facultative anaerobic pathogenic foodborne bacteria, causes listeriosis. This bacteria is typically found in

both raw and processed foods. *L. monocytogenes* are capable of growing in a wide range of pH, temperature, oxygenic, and osmolarity conditions. This adaptable characteristic means that the detection process of this bacterium must be a continuous practice along with the entire process of food preparation and supply stages. The present study involved in developing a rapid and reliable detection method for this bacterium that can be used at any point in food processing and supply stages. The method includes a quick purification of bacteria from the food sample using an immunomagnetic separation technique. The purified bacteria were inoculated into Brain Heart Infusion broth for a short-term enrichment (10 Hrs) to achieve a detectable quantity. After enrichment the bacteria was labeled with a Fluorescent dye (FITC). The labeled bacteria were then captured with immunomagnetic beads that were immobilized with a specific antibody. This immune complex was visualized under a fluorescent microscope and also evaluated using a spectrofluorometer. The entire detection process including enrichment procedure was completed in just 12 Hrs, while the traditional culture-based methods require five to seven days for detection.

* Shen, A., Deng, F., Liu, F., Wuliji, T., Reed, M., Dolan-Timpe, M., and Zheng, G. Department of Agriculture and Environmental Sciences, Lincoln University. The association of DNA fragment IT3E with environmental *E. coli* population. Differentiation of enteric *E. coli* from environmental *E. coli* is critical for accurate identification of fecal pollution in water. The objective of this study was to determine if the DNA fragment IT3E of *E. coli* could be used as a genetic marker to distinguish the two groups of *E. coli*. One hundred and sixteen strains of *E. coli* were isolated from surface water and groundwater at 8 different locations within the Goodwater Creek Experimental Watershed in northern central Missouri. Presence or absence of IT3E for each *E. coli* isolate was determined by the polymerase chain reaction (PCR) assay. The PCR assays indicated that the rate of IT3E-positive *E. coli* was relatively steady and high in the deep groundwater samples, ranging from 66.7 to 100%, while those in surface water from 0 to 23.1% and in shallow groundwater from 0 to 100%. The results also showed that the rates in the samples taken from surface water and shallow groundwater were subject to the influence of precipitation and temperature. This preliminary data suggest that the DNA fragment IT3E of *E. coli* is associated with deep groundwater and therefore with environmental *E. coli* population. However, more research will be needed to include more water samples from different watersheds, under different precipitation conditions, and over different seasons, in order to understand the complete value of

IT3E in the differentiation of environmental and enteric *E. coli* populations.

*Mobley, G., Balakrishnan, B., and El-Dweik, M. Department of Agriculture and Environmental Sciences, Lincoln University. Rapid detection of *Staphylococcus* Enterotoxin A (SEA) from food samples. *Staphylococcus aureus* is an enterotoxin-producing bacteria responsible for a minimum of 241,000 cases of foodborne illness in the United States every year. The economic impact of these bacteria on the food industry and society as a whole is immense, with an estimated cost of \$167,697,860 per year. There are a variety of methods of *Staphylococcus aureus* detection. The faster that the presence of these bacteria can be determined, the sooner the distribution of the contaminated food can be halted. For this reason, the efficiency of detection is directly tied to a reduction in affected populations. The objective of this study was to develop a novel detection method for the *Staphylococcus* Enterotoxin A (SEA). The pure toxin was labeled with fluorescent dyes (FITC and TRITC); then the labeled toxin was captured by a magnetic bead immobilized with the anti-SEA antibody. The bead used had a dual purpose: toxin purification and toxin detection. This process allowed the immuno-complex to be observed with use of a fluorescent microscope and fluorescent spectrophotometer.

*Al-awwal, Nasruddeen, Balakrishnan, B., El-Dweik, M. Department of Life and Physical Sciences. Lincoln University. ONE-POT SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF α -AMINOPHOSPHONATES. The great demand in life science for new molecules of biological and medicinal importance has led to an increased interest in the development of synthetic methodologies. The synthesis of α -aminophosphonates using aldehydes or ketones, amines and alkyl phosphites in dry organic solvents at room temperature or by heating via a Kabachnik-Fields reaction is a most promising and convenient route. α -Aminophosphonates were synthesized in a one-pot simultaneous reaction of aniline, diethylphosphite, and different aromatic aldehydes by the Kabachnik-Fields reaction in ethanol at room temperature to afford the corresponding α -aminophosphonates in good yields. All these compounds were found to exhibit moderate to good antimicrobial activity. Compounds were characterized using FT-IR and NMR analyses.

*Khopang, Jesse, Murphy, M., Starkey, B., Gilbert, L., Marsh, D. Chemical and Physical Science Department. Missouri Southern State University. SYNTHESIS CONDITIONS OF QUANTUM DOTS. Quantum dots (QDs) are quasi-spherical semiconducting nanoparticles which contain electrons that are

bound in discrete quantum energy states and have a particle diameter less than that of its exciton Bohr radius. Particle size distribution can be fine-tuned through chemical processing including choices in atmospheric conditions, temperature, initial reactants, stabilizers, and solvent matrix. These synthesis settings aid in tailoring the production of quantum dots with light absorbing and emitting properties in specific frequencies. As a result, QDs have a variety of practical applications. A wet chemical process, similar to the Hines and Scholes method, was utilized to attempt the production of lead sulfide (PbS) and zinc sulfide (ZnS) quantum dots. Focus was placed on the purity of initial reactants and synthesis conditions such as temperature and atmosphere.

Conservation Oral Presentations

*Cople, L. and T. Boman., Missouri Southern State University. TESTING OF CHEMICAL, BIOLOGICAL AND PHYSICAL PARAMETERS PRIOR TO THE ADDITION OF NATIVE PLANTS IN AN EFFORT TO AID IN FLOOD CONTROL, HEAVY METAL DEPLETION, AND SOIL EROSION. Improving habitat quality is a growing need across the state of Missouri, for a range of native birds, insects, and other animals. Periods of heavy rainfall, drought, and constantly changing temperatures make land management a challenge and restoration of disturbed land a prerequisite of quality ecosystems. Planting native, Missouri Eco-type, wetland and grassland plants in an area that constantly loses soil from flooding, and that possibly contains heavy metals from previous mine work could change and improve the overall habitat of the area. Over 250 acres of land in Webb City, Missouri are currently restoration sites, with the goal of decreasing heavy metal contamination and erosion, while increasing flood control. It is anticipated that these areas will be transitioned back to the native wetlands and grasslands that once thrived in the area. Overall this study will determine the current chemical, biological and physical conditions of one such restoration site prior to restoration. Determining these conditions prior to the implementation of native plants will allow for a comparison to post-implementation and with the goal of determining the impact of such restoration projects on the site itself and surrounding areas. The methods incorporated will include water, soil, and biodiversity sampling. This study has the potential to be expand throughout Southwest Missouri, to improve riparian zones, habitat, and the overall conservation of Missouri.

Fernando, G., U. Das, and *M. Sicay Lux, Cottey College. COMPARING LEVELS OF PHOSPHATES IN WATER

BODIES IN NEVADA, MISSOURI WITH LAKE ATITLAN, GUATEMALA. The main focus of this study is to analyze the amount of eutrophication in water bodies in farms in Nevada, MO area, based on total phosphates content. Eutrophication is the accumulation of nutrients such as phosphates and nitrates, which promotes the excessive growth of algae. In recent years, these algae; mainly Cyanobacteria, have known to produce cyanotoxins that are harmful to humans as well as livestock. Lake Atitlan in Guatemala is highly polluted by these nutrients and is affected by eutrophication. The researcher conducted a three-month summer internship in 2015 studying the phosphate levels in Lake Atitlan and continues to obtain data from the facility to compare with her results from water bodies in Nevada farms. It is found that the pollution in Lake Atitlan is mainly caused by excessive use of fertilizers in rural communities surrounding the lake. Nevada, MO is a rural farming community as well, and is vulnerable for eutrophication. Regular monitoring of phosphate levels is highly important to ensure sustainable agriculture and safe water supplies for humans and livestock. Although continuous monitoring of eutrophication is done in Lake Atitlan, no regulations exist unlike in United States on safe levels of phosphates. In this study, lake water samples collected were analyzed for phosphate content, pH, DO and other water quality parameters. Hannah water meter and UV/Vis absorption of ascorbic acid complex method were used. Data were collected from Nevada area farmers about the use of fertilizers in their farms and correlated to the total phosphate content.

*Irwin, K. and L. R. McAliley, Northwest Missouri State University. HABITAT USAGE IN PROXIMITY TO WIND FARMS BY LOCAL BAT SPECIES IN NORTHWEST MISSOURI. Wind farms are becoming increasingly abundant as development of green energy in the United States becomes a priority. This rapid expansion has come a cost to local bat populations. Wind farms have been credited for hundreds thousands of bat kills nationwide and as such has become a priority of research in mitigation measures and understanding bat behavior. This loss, in conjunction with white nose syndrome, has some species in drastic decline (i.e., *Myotis lucifugus*, *Myotis sodalis*, and *Myotis grisescens*). This is of increasing concern as bats are key predators for insects and a prey item for raptors. The purpose of this study is to examine bat utilization of similar habitats located within windfarms and outside of windfarms. This data will allow us to examine bat use of habitat that may impact our development of mitigation strategies to decrease bat fatalities at this alternative energy sources. A comprehensive understanding of habitat usage in bats will allow the expanding wind farms to have a reduced impact and help conserve the bat population.

*Slagle, A. and J. McGhee, Northwest Missouri State University. AN ASSESSMENT OF LEECH PARASITISM ON TWO SPECIES OF FRESHWATER TURTLES (*CHELYDRA SERPENTINA* AND *CHRYSEMYS PICTA*). Leeches are one of the most commonly found ectoparasites of freshwater turtles, but are relatively unstudied in the northwest Missouri area. In the summer of 2015 we studied leech prevalence on populations of two species of semi-aquatic turtle (*Chelydra serpentina* and *Chrysemys picta*) at ponds near Mazingo Lake in Nodaway County, Missouri. Hoop net traps baited with cat food were used to trap 41 turtles to determine leech prevalence. We focused on 4 aspects of study in our research: (1) leech prevalence between species, (2) leech prevalence between sexes, (3) leech location, and (4) leech prevalence due to turtle size. The bottom dwelling species, *Chelydra serpentina* had the highest prevalence of leech parasitism (*Chelydra serpentina* 87.3%, *Chrysemys picta* 12.7%; $P = 0.032$) while there was no statistical difference in leech parasitism of males versus females of either turtle species ($P = 0.706$ and $P = 0.453$ for *Chelydra serpentina* and *Chrysemys picta* respectively). Leeches were found to parasitize the posterior end of the turtle significantly more than the anterior, while no correlation was found between size of turtle and leech prevalence. Our results suggest that sex and size of the turtle does not affect leech parasitism, but species of turtle plays a vital role in leech prevalence which could be due to ecology and habit differences between these two species.

*Baepler, J., Lincoln University. OF NICHES AND FISHES: HOW THE NATURAL HISTORY OF *HYPOPTHALMICHTHYS MOLITRIX* AND *HYPOPTHALMICHTHYS NOBILIS* ALLOWED FOR COLONIZATION OF NORTH AMERICAN WATERWAYS. This paper attempts to summarize the origins of invasive *Hypophthalmichthys molitrix* (silver carp) and *Hypophthalmichthys nobilis* (bighead carp) in North American waterways and outline the factors that have contributed to their highly successful colonization within riverine systems. In addition the known impacts on some native fishes will be discussed as will measures and controls that could limit current population size and distribution. The further spread of these Asian carp into the Great Lakes is also addressed.

*Balogun, A., N. Nkongolo, Lincoln University of Missouri, and A. Alarape, University of Ibadan. LEVEL OF AWARENESS OF HIGH SCHOOL STUDENTS ABOUT WILDLIFE CONSERVATION IN NIGERIA. For an efficient implementation of the sustainability of wildlife resources, the level of awareness of the public should be considered especially that of the high school students as they are the leaders of our tomorrow's natural resources conservation strategies. Hence, it

is an urgency to emphasize the need for them to be aware of the importance of wildlife conservation and the problems associated with wildlife survival. This study was conducted in Ibadan north local government area, Oyo state in Nigeria with the aim of assessing the student's level of awareness with regards to wildlife conservation, the medium through which they got informed and the influence of their educational level. The study was carried out using questionnaires. Three hundred questionnaires were distributed to 10 public and private schools within Ibadan north local government area, Oyo state and the data were analyzed using descriptive statistics and chi-square. The results of the analysis revealed that most respondent were between ages 11- 15yrs, with more females than male. The results also indicated that students were aware of wildlife conservation both from their schools and visual media (internet, television). This simply means that wildlife extension method, governmental and non-governmental means were poor approaches to student's awareness of wildlife conservation. Results also showed that the level of wildlife conservation awareness of students was not dependent on their level of educational level. It is suggested that the schools incorporate wildlife studies in their curriculum. In addition, governmental and non-governmental organizations should organize wildlife programs for high schools.

*Messick, J. P., Missouri Southern State University. PRELIMINARY COMPARISON OF POPULATION DISPERSION PATTERNS MEASURED USING AN UNMANNED AERIAL VEHICLE (UAV OR DRONE) AND TRADITIONAL METHODS. Colored paper 5 × 5 centimeter squares were arranged in random, clumped and regular dispersion patters within a 10 × 10 meter grid. The grid was photographed from a drone and the locations of the colored squares transferred to raster files in Geographic Information Systems (GIS) software. The GIS software was used to analyze the dispersion patterns and the results compared with results obtained using traditional plot and plotless methods for analyzing dispersion. Agreement between the results from the images captured with the drone and the traditional methods was generally poor. Imaging and technical limitations of the drone, operator skill, weather, and lighting conditions may have affected the results. This study supports the potential of using drones for data collection, but also indicates that we need to develop specific guidelines and methods for using this new technology.

Conservation Poster Presentations

*Athen, A. and J. McGhee, Northwest Missouri State University. THE EFFECTS OF HABITAT FEATURES ON

CAPTURE RATES OF THE COMMON SNAPPING TURTLE AND THE WESTERN PAINTED TURTLE. The Common Snapping Turtle (*Chelydra serpentina*) and the Western Painted Turtle (*Chrysemys picta*) have very different ecologies but are often found in the same bodies of water. Trapping and monitoring programs may study both under particular trapping conditions. The habitat features throughout a pond vary from the shoreline to pond cover to the outside conditions. We are interested in the habitat features that turtles are frequently being trapped in. At four different ponds in Northwest Missouri, we used hoop nets baited with cat food to trap both Snapping and Painted Turtles. At each trap site, data was taken on the humidity, water temperature and conductivity, shoreline cover and pond vegetation. We compared capture rates of both species to these variables using correlation analysis. We found statistical correlations between submerged logs in the pond and Snapping Turtle captures, as well as water temperature and duckweed pond cover and Painted Turtle captures. We suggest that trapping success of Snapping Turtles will improve if hoop nets are placed near submerged logs, and for Painted Turtles in warmer conditions with high duckweed cover.

Baepler, J. and *J. Johnston, Lincoln University Missouri. A SURVEY FOR TROGLOBITIC FLATWORMS IN NORTHERN MONITEAU COUNTY, MISSOURI. Devil's Icebox Cave (Boone County, Missouri) is home to *Macrocotyla glandulosa*, a troglobitic turbellarian (Wicks et al. 2010). This is the only documented location for this species. Slay (2006) notes that there is a probability that more flatworm species are present in Missouri, but difficulties in collection and identification result in lack of documentation. A portion of northern Moniteau County is adjacent to the region in Boone County containing Devil's Icebox and the two regions share a similar karst geography. A field survey for the presence of troglobitic flatworms was conducted in several caves in northern Moniteau County. No flatworms were found inside any of the surveyed caves. However, unidentified flatworms were found within twelve meters of emergence of the cave springs at three locations. Of the flatworms found, none could be conclusively identified as having troglobitic characteristics.

*Balogun, A., N. Nkongolo, Lincoln University of Missouri, and O. Oluwagbemiga, University of Ibadan. PROMINENCE AND SPACE ALLOCATION OF BIODIVERSITY NEWS PUBLICATIONS BY SOME NIGERIAN NEWSPAPERS. The continuous loss of biodiversity and people's lack of concern in many areas of important environmental issues remains a problem for discussion in Nigeria. The newspaper has been identified has one of the daily means of disseminating news to a large audience

hence, we investigated the prominence and space allotted to biodiversity news in three selected Nigerian dailies. The Punch, the Guardian and Nigerian Tribune were the three dailies purposively selected and where the content was analyzed for a period of 5 years. The prominence was based on three factors; the type of headings, the page position and the position of newspaper. The space allotted was based on the measurement of the length X breadth of individual news space. The results showed that out of a total of 1360 biodiversity related news published by the selected dailies; the Guardian had a total of 50.07% biodiversity news followed by Nigerian Tribune with 25.59% and the punch with 24.33% of biodiversity articles. We found 646 news articles in the upper position; Guardian had 280 news (43.3%), Tribune had 234 news (36.2%) and Punch had 132 news (20.4%). Although 1360 news articles were low for the total news of publication for three dailies, in terms of position in newspaper, a higher percentage of biodiversity articles were published in the other page with 868 news articles. The Tribune allotted more space to biodiversity news amongst the selected dailies. Biodiversity news should be given more prominence in the front and back position of the newspapers

*Olsen, S and J. McGhee, Northwest Missouri State University. EFFECT OF TEMPERATURE AND COVERAGE ON COPE'S GRAY TREE FROG CAPTURE RATES. Cope's Gray Tree Frogs are an important frog species in the state of Missouri, and PVC pipe traps can be used to capture these frogs for research. This study examined the effects of foliage cover and temperature on their activity as part of a larger analysis observing the effectiveness of PVC pipe traps as a population monitoring tool for this species. A total of 65 PVC pipes were placed at various locations in and around four ponds at MOERA. Pipes placed on the ground were 1 meter long, and pipes placed on trees were 60 cm long. Tube temperature was recorded in tubes where a frog was captured, as well as a random tube in the area, using a simple mercury thermometer. A student's t-test was used to compare capture vs. random tubes. Canopy coverage was measured above PVC pipe traps each week, and pipe use by tree frogs was analyzed graphically. While no significant relationship was found between frog use of pipes and pipe temperature, there did appear to be a relationship between canopy cover and pipe usage. However, this relationship was non-normal and highly varied. Data suggests that canopy coverage may be of greater importance in habitat selection criteria than perch temperature and warrants greater study.

Geography Oral Presentations

*Richards, E. University of Central Missouri. HOW CAN COMPACT LIVING BE SUCCESSFUL IN THE UNITED

STATES? Compact living entails occupying a smaller space and using more resourceful construction methods. Living a frugal lifestyle is a big change, but it is one that holds promise for creating a more sustainable society. The intended purpose of compact living is to help deal with unsustainable urbanization fueled by the American dream of achieving a higher standard of living. This project examines how likely compact living is to succeed in the United States. It argues that compact living must become desirable to Americans, in order for it to work in America. There are at least three key aspects to making compact living work in U.S. cities: the idea must be worth investing long term; designs must be sustainable to investors' financial resources; and developers must be able to identify and sell to the right populations. The main hurdles will be the time it takes for the idea to become attractive and how much capital people have to spend. This project proposes that we must first build examples in major cities, in order to demonstrate that the concept works and for the idea to gain favor over the next generation.

Geology Oral Presentations

*Hu, W., Liu, F., Dolan-Timpe, M., and Yang, J., Lincoln University. A DIFFUSIVE HYDROGRAPH MODEL IN GOODWATER CREEK EXPERIMENTAL WATERSHED: THE TIME CONSTANT AND CONTROLLING FACTORS. Low percolation rate and high runoff potential of claypan soils cause rapid stream flow rises following intense storms and increase the risk of great loss of property and life. A hydrograph model based on Darcy's law and diffusion allows for easy determination of discharge responding to storms with only a single free parameter, basin time constant b . The objectives of this study were to determine b values and to understand the factors controlling b values in Goodwater Creek Experimental Watershed (GCEW, 73 km²), located in north central Missouri. Daily flow measured since 1971 was used and 468 single storm events were selected. Results indicated the mean b values were 0.46 and 0.40 using volume and fitting methods, respectively, with a range of 0.05-1.18 and 0.06-1.5. The b values were primarily controlled by antecedent rainfall, rainfall on the day and peak flow. The b values were correlated with peak flow by a power law with a R^2 of 0.49 for fitting method and 0.54 for volume method. The range of b values varied from 0.2-1.5 in the low peak flow condition (< the 25th percentile or 62,680 m³ day⁻¹) to 0.09-0.9 in the medium peak flow condition (between the 25th and 75th percentile or 62,680-763,904 m³ day⁻¹) and 0.06-0.6 in the high peak flow condition (> the 75th percentile or 763,904 m³ day⁻¹) based on the b values from the fitting method. This study helps

improve the quality of hydrograph simulation and thus water resources management in this watershed.

*Joshi, A. and Appold, M., University of Missouri. METHANE TRANSPORT POTENTIAL OF POROSITY WAVES IN ELASTIC SEDIMENTS OF THE EUGENE ISLAND FIELD IN THE GULF OF MEXICO BASIN. Geophysical and geochemical observations of the Eugene Island field in the Gulf of Mexico basin show overpressured hydrocarbons to have migrated through the Red fault at rates on the order of millimeter- to kilometer per year despite the fault's very low permeability. High pore fluid pressures can reduce effective stress and dilate porosity to form porosity waves capable of traveling at rates much greater than predicted by Darcy's law. Previous study show porosity waves were not likely to have transported oil at the Eugene Island because of restricted geological conditions for its formation. The purpose of the present study was to evaluate porosity wave behavior for methane transport at the Eugene Island using a one-dimensional numerical solution to equations of pore fluid mass conservation and Darcy's law for elastic, methane-saturated sediment. Results show that rates of gradual fluid pressure generation in a source rock caused by basin diagenesis are too slow for porosity waves to transport methane at kilometer per year rates. However, provided instantaneous fluid pressure generation, porosity waves can transport methane at rates on the order of at least 10's of meter per year over a vertical distance of 1-2 kilometers, but may also fracture the rock through which they travel. Although, earthquakes can increase fluid pressures instantaneously, it is unlikely that they produced porosity waves in seismically quiet Eugene Island. Nevertheless, porosity waves could play a major role in transporting methane from source rocks to reservoirs within 1-2 kilometer distances in seismically active regions.

Math and Computer Science Oral Presentations

*Gohil, P., S. Joshi, S. Singh. University of Central Missouri. RELEVANCE MAPPING AND IMPACT COMPUTATION OF WIKIPEDIA EDITS. *Wikipedia* is 'internet's largest' as well as the 'most popular general reference source'. It boasts over 38 million articles and is constantly growing. The open collaborative nature of *Wikipedia* results in 170,000 edits per day on its articles. Most revisions are minor, like spelling and grammar checks. The edits related to information alteration, addition or deletion of facts are generally classified as major edits. Edits can further be categorized as relevant and impactful or otherwise. Due to volume of edits, it is critical to

automatically and instantaneously analyze the nature of these changes. We have created a repository of links to *Wikipedia* edits that is being automatically updated with each edits, minor or major. This real time database is used to calculate the relevance and impact of a major edit on a *Wikipedia* article. Ontological hierarchy, cognitive synonyms or synsets and concept based ranking is used in the calculation of relevance and impact of edits. Statistics on relevance and impact of an edit is used to predict the nature of edits and thwart any attempts to vandalize *Wikipedia* articles. We aim to help maintain the integrity of *Wikipedia* articles by making them more accurate and reliable.

*McKeever, J. Truman State University. A GRAPH THEORY-BASED APPROACH TO PRODUCT RECOMMENDATION USING FUNCTIONAL PROGRAMMING. User-to-user connections are an increasingly important tool quickly becoming standard practice for product recommendations of all types, but particularly when it comes to book recommendations. By warehousing large amounts of book data and comparing the preferences of readers, we can write sophisticated computer algorithms to generate accurate book recommendations for a given individual. In this investigation, our approach is implemented using the functional programming paradigm in which functions are evaluated mathematically and are equivalent in treatment to their returned values. The algorithm developed for this project involves a breadth-first search on a graph of reader nodes connected to book nodes. Reader nodes have connections to book nodes which represent the reader's opinion of a particular book: readers who are connected to the same book create a path by which books may be recommended to both of them in turn. Functional programming is particularly well-suited for this task, as it allows for high levels of parallelism at run-time, which enables the system to scale as the database of readers and books grows larger. Results thus far have indicated that the algorithm returns appropriate recommendations based on the reader's expressed preferences.

*Free, V., J. Seiffert. Truman State University. LINK STATE ROUTING WITH SIMULATED ANNEALING. Computer networks are a valuable way to facilitate communication in businesses, home applications, and more, with the Internet being a prime example. It is worth exploring how communication happens in a computer network. At the network layer, a computer network consists of routers and links between the routers. To communicate, the routers send packets to each other. Routing algorithms are used by computer networks to find the best path to send packets from one router to another. The network layer must choose appropriate paths to minimize

the time and distance each packet travels while also evenly distributing the network traffic and accounting for changes in the network topology. One type of routing algorithm is link state routing. In this algorithm, each router discovers the costs to its neighbors, shares this knowledge with every other router, and computes the shortest path to each router using Dijkstra's algorithm. In this research, we investigate both a straightforward implementation of link state routing as well as one in which we use the machine learning technique of simulated annealing to attempt to improve the process of finding best paths. This is especially valuable in a situation where the network topology can change.

Physics & Engineering Oral Presentations

*Howard, Tyler. Department of Physics and Engineering Physics, Southeast Missouri State University. SIMULATION OF SPACE CRAFT REENTERING THE EARTH'S ATMOSPHERE. Objects reentering the Earth's atmosphere experience a myriad of forces acting upon them. Scientists have a hard time modeling the motion of the craft by hand because they must use an iterative method to continuously update distance, forces, air density, momentum and finally position. By using the computer language VPython, the trajectory of the space shuttle can be tracked as it reenters the Earth's atmosphere from a stable orbit that is 500 kilometers above the Earth's surface, or about the altitude of the International Space Station. This program will begin by asking the user to input a speed by which to slow the craft down, and as the craft loses altitude, taking into account the forces of gravity and air resistance the program will display the acceleration, velocity, altitude and/or the potential and kinetic energy of the craft as a function of time. From this program we can compare the amount of energy lost and acceleration when the craft is slowed down gradually or in large increments. We can also demonstrate the effect of increasing the speed of the craft, which will result in an elliptical orbit. With this program we can accurately model the path of an object as it reenters the Earth's atmosphere and simulate the forces and energy transfer that the object will experience.

*Bucklein, Brian K.¹, Moody, J. W.², Hintz, E. G.² ¹Missouri Western State University. ²Brigham Young University. THE EFFECT OF NEARBY VOIDS ON GALAXY NUMBER COUNTS. The size, shape and degree of emptiness of void interiors sheds light on the details of galaxy formation. A particularly interesting question is whether void interiors are completely empty or contain a dwarf population. However, the nearby voids that are most conducive for dwarf searches have

large angular diameters, on the order of a steradian, making it difficult to redshift-map a statistically significant portion of their volume to the magnitude limit of dwarf galaxies. As part of addressing this problem, we investigate here the usefulness of number counts in establishing the best locations to search inside nearby ($d < 300$ Mpc) galaxy voids, utilizing Wolf plots of $\log(n < m)$ vs. m as the basic diagnostic. We examine the signatures of three void profiles, "cut out", "built up", and "universal profile" carved into Monte-Carlo Schechter function models. We investigate the signatures of voids in the Millennium Run dark matter simulation and the Sloan Digital Sky Survey. We find that evidence for cut-out and built-up voids is most discernible when the void diameter is 40% of the distance to its center or more. However, the density distribution of the universal profile that is characteristic of actual voids is essentially undetectable at any distance. A useful corollary of this fact is that galaxy counts are a reliable measure of survey completeness and stellar contamination even when sampling through significant voids.

*Sundararajan, Jency. Missouri Southern State University. Golam Rabbani, M. University of Washington, Anant Anantram, M.P. University of Washington. SIMULATION STUDIES ON SCHOTTKY MODULATED SILICON NANOWIRE FET SENSOR FOR SPECIFIC DETECTION OF BIOLOGICAL AND CHEMICAL SPECIES. Direct detection of biological and chemical species is one of the greatest potentials of nanotechnology which can deliver highly sensitive, label-free, cost-effective, portable, low-power and reliable sensing devices. In this project, simulation studies on the electrical properties of p-type Silicon nano-Field Effect Transistor (p-Si nano-FET) devices were investigated for specific detection of biological and chemical ions. Schottky modulation in p-Si nano-FET devices were achieved by making two specific changes to the device structure. One set of nanodevices were given a Schottky-Ohmic contact and the variations in transport properties were compared with the conventional Ohmic-Ohmic contacts in order to understand the influence of barrier properties in affecting device sensitivity and selectivity. In the second set of devices the surface of p-Si nanoFET was modified by creating localized Schottky barriers via metal nanoparticle functionalization leading to an inhomogeneous / homogeneous depletion within the FET device depending upon nanoparticle density. The influence of positive and negative charges were studied for both device types. From the simulation results, it can be observed that the Ohmic-Ohmic device displayed a minimal response to the influence of charges ($< 1\%$), whereas, a gigantic response of $\sim 70-90\%$ was observed with Schottky-Ohmic contacted device. The doping concentration of the conducting channel, work function of the

metal electrical contacts, concentration of interface charges and the doping concentration of Schottky contact are influential in modifying the charge transport in silicon nanowire devices for detection of specific biological and chemical species.

*Shaw, John, Zhang, Y., Monismith, D., Chakraborty, H. Department of Natural Sciences, Northwest Missouri State University. COMPUTATIONAL SIMULATIONS OF CHARGE TRANSFER FOR A HYDROGEN ION SCATTERING FROM NANOSTRUCTURED SURFACES. Nanostructured surfaces can be broadly defined as substrates in which the typical features have dimensions in the range of one to several nanometers. The recent surge of interest in these systems originates from the remarkable quantum effects that may arrive from critical size reduction. We studied the electron dynamics in mono-crystalline metal surfaces with stepped vicinal surfaces. The unoccupied bands of the surface are resonantly excited via the charge transfer interaction of the surface with a moving hydrogen ion. The interaction dynamics are simulated via a quantum mechanical wave packet propagation approach in which the survival probability of the interacting ionic species was calculated. Results clearly show resonant states in the ion survivability. The velocities at which peaks in survival probability occur do not depend on where the ion approaches the vicinal steps on the surface nor do they depend on the height or width of the vicinal steps. The velocities at which peaks in survival probability occur do depend on the ion trajectory as well as the distance of closest approach, which indicates a strong dependence on the time of interaction.

Physics & Engineering Poster Presentations

*Hibbeler, Leah, *McCarthy, M., Myers, H., *Storer, M. Rockhurst University. TYMPANOGRAM MODELING TO OBSERVE THE EFFECTS OF FLUID BEHIND THE TYMPANIC MEMBRANE. The purpose of this Physics of Medicine project was to design and build a tympanic membrane model to investigate the physics principles that are involved in the functioning of the middle ear under standard and adjusted pressure values. Research was done to understand how a tympanogram can be used to measure hearing impairments in the ear due to increased fluid pressure. Through trial and error, a simplified model of a tympanogram was constructed. In the model, a frequency generator emitted sound through a latex covering, representative of the tympanic membrane, and into a plastic container that represented the middle ear. The sound was then received on the opposite side of the container by a microphone. To change the pressure

behind the membrane, water was added to the container to represent fluid behind the eardrum. The sound was emitted from a speaker at a frequency of 516 Hz, and the amount of sound transmitted through the system was collected by the microphone, and measured using Logger Pro. Results from the experiment indicated that when fluid is present behind the membrane, the amount of the sound wave transmitted is decreased because more sound is reflected due to a difference in impedance. The model of the tympanic membrane will be used in the Rockhurst University Physics of Medicine program to study the effect of fluid pressure on the ear. Future experimentation plans are to use the model to integrate physics principles of hearing and sound when investigating other hearing impairments.

Science Education Oral Presentations

*Haskins, Mary, Rockhurst University, GEOSPATIAL ANALYSIS USING SMARTPHONES. Geospatial analysis is becoming an integral component of many careers and is increasingly used in businesses. Therefore, incorporating geospatial labs into science courses may be useful for all students including non- majors, e.g., recent trends in business applications will be explored. Historically, learning these skills required expensive equipment and software. However, relatively new software, available free of charge, makes it easier to incorporate geospatial problems into a lecture and/or laboratory. Data collection pages can be developed by instructors in less than ten minutes and then accessed by students using a variety of electronic platforms, e.g., smartphones, iPads and tablets. After data collection is complete, the class can then seamlessly move the data onto maps for geospatial analysis. In this session participants will collect data, observe the processing of transferring the data onto a map, and create their own geospatial questionnaire ready for data collection. A brief discussion will also explore the possibility of “mining” public data for geospatial analysis in the event electronic devices are not available for student use. Because instructors can adjust question complexity as well as the method of data collection projects can be geared to any subject and/or age group.

*Ward, Katherine, Lincoln University, THE EVOLUTION OF CONSERVATION EDUCATION IN POST-COLONIAL MALAWI. Malawi is a very poor African nation with a natural resource-based economy. Those natural resources have come under increasing pressure due to expanding human populations and their activities. The country faces serious food insecurity, pollution, overfishing, soil degradation, deforestation, and

global climate change concerns. The future wellbeing of Malawians depends on whether the protection of their natural environment can be secured before recovery becomes unachievable. In response to these numerous challenges, important educational advancements are being made in agriculture, nutrition, post-harvest management, adult literacy, cooking practices, climate change adaptation strategies, natural resource conservation, pollution reduction, legal rights awareness, disease management and prevention, and the communication of innovative ideas. This presentation will examine the evolution of conservation education in Malawi from the end of the colonial period in 1964 to the present day with a focus on areas in which education has achieved notable results. The role of dire poverty as the greatest threat to progress will also be discussed.

Social and Behavioral Sciences Oral Presentations

*Smith, P.S., Independent Scholar. AN INCLINATION TOWARD THE ABOVE AND THE ARCHITECTURE OF THE ANCIENTS. The focus of this presentation will be to explore the existential anthropological basis to the ceremonial structures of ancient primary people. Given the extreme conditions of survival and physical vulnerability, with heightened levels of awareness and memory, combined with the need to make an assumption about knowing, helps the researcher to better understand the notions primary people made about themselves and their environment. In fact, the ingeniousness and complexity to their thought processes, as they created and invented social reality is indicated at the start of social development. That so many beliefs, practices and architectural features in primary cultures had remarkably common characteristics over a wide range of time, region and culture indicates a universal dynamic of physical condition and behavior in reaction to environment. But it was the factor of not-knowing, combined with the development of associative reasoning that drove assumptions and beliefs about self and environment, finding expression in ceremonial practice and architectural form. Thus, primary architecture with the inclination toward the above, extends from the like-equals-like association and is consequent of the existential condition of vulnerability and the elements of reason and the need to know in relation to what is not known that leads to a desire for and belief in continuation. At this juncture inclination toward the above and the role of assumptive reality and exertion play an important part in the design and intended purpose of ancient ceremonial structures, namely celestial connection.

*Jaehn, A., *Knoche, K., & *Johnson, A., Park University. CREATIVITY EXPERTS RATE THE CREATIVITY OF PICTURES. Assessing creativity has been a challenging prospect historically due to its multidimensionality. There are a range of creativity tests from subjective ones, e.g., Picture Completion Task, to objective ones, e.g., Remote Associates Test (RAT). In this presentation we report the results of a follow up study using experts to assess the creativity of pictures. More specifically, three members of the Park University faculty body were invited to participate in our creativity study through a peer-nomination process. We gathered demographic information for each of the experts and each completed a self-report creativity trait instrument (http://ipip.ori.org/newHEXACO_PI_key.htm#Creativity). Following this the experts completed a two-minute Remote Associates Test (RAT) – an objective creativity test. Then, the experts rated their own set of 15 Picture Completion Task artifacts on: target difficulty, creativity, originality, and artistry. Finally, the experts were asked to rank order their 15 pictures from most to least creative. We will present the ratings and rankings of the experts in context to comparisons groups. Our results suggest that creativity judgments of experts map closely to comparison samples on some of the measurements.

*Knoche, K., Jaehn, A., Johnson, A. & Griffith, R., Park University. USING CROWDSOURCING TO RATE THE CREATIVITY OF PICTURES. Assessing creativity has been a challenging prospect historically. There are a range of creativity tests from subjective ones, e.g., Picture Completion Task, to objective ones, e.g., Remote Associates Test (RAT). The study reported here presents the judgments of creativity for three sets of 15 Picture Completion Task artifacts. We used a crowdsourcing solution (Amazon Mechanical Turk – Mturk) to gather ratings from a sample of 453 participants. Our presentation will focus on the descriptive analysis of the overall sample and their ratings of Picture Completion artifacts across measures of: target difficulty, creativity, originality, and artistry. The results indicate that ratings of creativity, originality, and artistry are separate and independent judgments. These results clarify prior research that suggests creativity and originality are synonymous.

Social and Behavioral Sciences Poster Presentations

*Gall, L.B., Marsh, P.A., & Sá, M., Park University. SELF-REGULATION OF ACADEMIC ACHIEVEMENT. Past studies have proposed a variety of self-regulated learning strategies in both academic and occupational setting. However,

few have narrowed in on the interplay between personality and metacognitive regulation of learning processes that occur in academic settings. Cognitive learning regulation was measured with the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994) and the Core Self-Evaluation Scale (CSES; Judge, Bono & Thoresen, 2003) assessed the personality trait of self-regulation. Correlations were examined among the independent variables of CSES and the six MAI subscales to see if they were related to academic achievement. Regression analyses were used to identify which variables predicted students' ($N = 45$) exam grades and course grades. Results show that course grades were predicted by two of the MAI subscales, declarative knowledge and planning. The equation containing these two predictors accounted for a statistically significant proportion of the variance in *exam grade*, $F(2,43) = 8.92$, $p = .001$, Adjusted $R^2 = .26$. The equation containing declarative knowledge (MAI subscale) predictor accounted for a statistically significant proportion of the variance in *course grade*, $F(1,43) = 6.58$, $p = .014$, Adjusted $R^2 = .11$. Results did not find CSES to be related to or predictive of academic achievement. This was partially unexpected, because past studies found a relationship between CSE and academic outcomes (Lian, 2014) while others found the measure to be a poor predictor of objective outcomes (Judge et al., 2003). Implications of these findings will be discussed.

*Rudd, L. & Livengood, J., Missouri Valley College. EFFECTS OF DANCE ON BODY IMAGE. Previous studies have indicated that dance, as well as Dance and Movement Therapy (DMT), have influenced aspects of psychology such as body image, confidence, depression, PTSD, etc. in a positive way. For example, Muller-Pinget, Carrard, Ybarra, and Golay showed that the participants in a DMT session showed more positive body perception than those who had not participated (2012). Another previous study showed that dance sessions not only improved body image, but also made the participants feel more in control of their bodies in which they called "connectedness" (Grogan, Williams, Kilgariff, Bunce, Heyland, Padilla, et al., 2014, pg. 270). Overall, many studies show the positive influence of dance on many aspects of the human body, mind, and psyche. The current set of studies sought to examine 1) student's perceptions of DMT and 2) the impact of dance/movement sessions on those perceptions and on body image. The first study concentrated specifically on students' perspectives of DMT and whether they believed that it would be beneficial to victims of trauma. The second study includes participants' engagement in three dance sessions that focus on movement activities geared towards improving body image. Researchers hypothesize that students who engage in dance sessions will have an improved self body image as well as an improved perspective of DMT.