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Predicting Federal Student Loan Repayment: An Integrated Predictive Framework with Institutional and Temporal Validation

Undergraduate Presenter(s): Lucas Alcoba, ENMU

Author: Dr. Prabha Shrestha, ENMU

With rising student loan debt in the United States, understanding institutional repayment outcomes is essential for improving graduates' financial security. This study extends our prior work by developing a machine learning framework to predict the College Scoreboard seven-year repayment rate, the share of borrowers who have not defaulted and have reduced their principal seven years after entering repayment. Using institution-level data from the U.S. Department of Education, the study compares repayment outcomes across public, private nonprofit, and for-profit institutions.

The framework compares penalized regression, support vector regression, tree ensembles, a multilayer perceptron, and a stacked ensemble using RMSE and R^2 . A combined grouped and temporal validation strategy will test generalization to unseen institutions and future data years. Friedman tests with Kendall's W will compare model performance across repeated validation folds. Linear mixed-effects models with institution random effects will replace conventional ANOVA to estimate sector and year differences, with Tukey-adjusted contrasts and effect sizes. Interpretability methods will identify influential predictor groups.

Preliminary results show that institution-level validation yields more conservative accuracy than random splits (support vector regression $R^2 \approx 0.78$ – 0.82). Nearly all variation in repayment lies between institutions ($ICC = 0.98$). At equal completion rates and Pell share, for-profit institutions show repayment rates about 12 percentage points lower than public institutions. These findings support more transparent, evidence-based accountability and aid policy.

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The Effect of Forest Treatment on Soil Infiltration in the Sangre de Cristos

Undergraduate Presenter(s): Anna Barnum, UNM

Author: Anna Barnum, UNM

Author: Eva Stricker, UNM

Author: Rae Devan, UNM

Author: Magda Garbowski, NMSU

Author: Alex Webster, UNM

Author: Niall Hanan, NMSU

Author: Marcy Litvak, UNM

Wildfire is increasing in both frequency and severity in the Southwestern U.S.. There are a variety of strategies to mitigate wildfire risk, such as thinning and prescribed burns. Wildfire mitigation has a notable impact on the structure and function of a forest. However, it is not well understood how soil characteristics are affected by forest treatment. Given the importance of water cycling in the hot and dry climates of the Southwest, we set out to investigate how various wildfire mitigation strategies affect the infiltration rate of soil. We expected there to be a difference in infiltration rate between plots of differing treatment. We worked at an inholding of the Santa Fe National Forest and visited 50 plots within 2334 hectares. The forest treatments applied to the site in years 2019-2024 included thinning in preparation for mastication or chipping, lop and scatter, and pile burning. We used the NRCS Infiltration Rate Protocol at two quadrats within each plot to collect infiltration rate data. Data was analyzed with R using linear mixed models.

We found no significant difference in infiltration rate as a function of forest treatment. It was not visually apparent that any factors of slope, aspect, or canopy cover had an impact on infiltration results, either. This was surprising, considering wildfire mitigation strategies modify surface vegetation, canopy cover, and overall, disturb soil surface. It is possible that the treatments haven't yet had an effect on soil due to their relatively recent enactment on the forest.

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Beyond Aesthetics: How Landscaping Rock Choices Can Reduce Urban Heat Island Mitigation

Undergraduate Presenter(s): Faith Bartos, CNM

Author: Faith Bartos, CNM

Author: Amber Awelagte, CNM

Author: Melanie Will-Cole, CNM

Urban Heat Islands (UHI) can occur when natural landscapes are replaced by materials that absorb heat, typically resulting in higher air and surface temperatures in urban areas. Pavement has been widely studied, and far less attention has been given to the role landscaping rocks play in affecting UHI in urban environments. This study investigated how the characteristics of landscaping rocks such as color, composition, and size can contribute to surface heating in outdoor conditions. Temperature measurements were collected from 19 different landscaping rock materials using various thermal sensors. Throughout the data collection period, air temperature and environmental conditions were also recorded to compare the changes in rock surface temperatures throughout June and July. Results showed that darker, denser rocks reached a higher maximum temperature and retained much more heat than lighter colored rocks that typically remained cooler during the day and cooled down much faster when in shade and cooled rapidly during the evening hours. These findings suggested that the selection of rock-based materials can affect urban temperatures and contribute to the intensity of the UHI effect. When selecting rock-based material for landscaping, choosing a rock with lower heat retention may help reduce surface and air temperatures in dryer urban environments such as Albuquerque.

This work was supported by NSF Grant Award 2246468.

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Survey of Surfactant Additives for Accessing High Energy Densities in Redox Flow Batteries: Viologen Anolytes as a Test Case

Undergraduate Presenter(s): Olivia Boatman, NMT

Author: Olivia Boatman, NMT

Redox flow batteries are a promising platform for long-duration grid energy storage, but increasing their energy density requires operating at high concentrations of redox-active species, where degradation and membrane crossover accelerate capacity fade. Viologens are widely studied aqueous analytes, yet their reduced forms are prone to aggregation and decomposition, which worsen as concentration increases. Surfactant additives offer a simple, non-synthetic strategy to address this: micelle formation can sequester redox-active species, potentially suppressing degradation pathways and limiting crossover. Here, three surfactants are surveyed of differing charge, cationic cetyltrimethylammonium chloride (CTAC), anionic sodium dodecyl sulfate (SDS), and neutral Triton X-100, as additives to the anolyte of 25mM dextrosil-viologen/25mM 4-hydroxy-TEMPO redox flow batteries. All cells used 1M KCl supporting electrolyte, and the catholyte was held constant. A cell containing 1M KCl without surfactant served as the baseline. Based on our trials thus far, CTAC was the best performing additive, while SDS performed the worst. Diffusion coefficients of dextrosil-viologen were measured by cyclic voltammetry (Randles-Ševčík analysis), rotating ring-disk electrode linear sweep voltammetry (Koutecký-Levich analysis), and NMR. Preliminary results show that surfactant charge strongly influences viologen performance and provide design criteria for selecting additives to enable higher energy density redox flow batteries.

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Giants of the Past: Are Mammoths Forever a Mystery?

Undergraduate Presenter(s): Kai Bullock, ENMU; Lydia Pando, ENMU

Author: Kai Bullock, ENMU

Author: Lydia Pando, ENMU

Megafauna have been a speculated idea to explain human migration into North America, but it is important to recognize the differences in evolution between Columbia mammoths and woolly mammoths and understand that those differences take a lot of time in consistent environments. We are left with many questions and answers when it comes to this highly popular species. How long has the mammoth been around in America? And what evidence do we have to talk about the impact humans had on them? These are important questions, as how mammoths died is a highly debated topic, especially when it comes to bone beds in the Blackwater Draw, New Mexico site, the Lehner, Arizona site, and Miami, Texas site. We have evidence that suggests human and climate differences. In this research, we apply our knowledge of the Blackwater Draw site and create comparisons. We can infer and apply these methods to other sites; we heavily considered the work of other scholars and the notes from excavations on these sites to make a possible conclusion about the cause of death and factors that may have led to the extinction of the Columbia mammoths. These results point to humans, environmental changes, some even say that another meteor may have taken away our megafauna. We can conclusively say that our dear Mammoths still leave us with more questions than answers: whether it was humans killing them out, catastrophes, or simple climate change, the results are deep in our earth waiting to be exhumed.

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Investigating Spatial Location and Phenotypic Variation in Pathogenic Lamin Mutations

Undergraduate Presenter(s): John Burghart, NMHU

Author: John Burghart, NMHU

Author: Dr. Steven Karpowicz, NMHU

Laminopathies are a family of diseases caused by a mutation on the LMNA gene. The subsequent alteration of its product Lamins A and C results in a wide array of phenotypic expression, which varies significantly among even an individual point mutation. Laminopathies such as EDMD and FPLD present symptoms isolated to specific muscle and fat tissues, respectively. While a plethora of research exists on the subject, the mechanisms behind this specificity remain unknown. Utilizing bioinformatic programs such as MEGA and AlphaFold, as well as the LMNA UMD database, our goal is to identify or exclude possible correlations between the spatial locations of the mutations and the resulting disease mechanisms. Amino acid sequence alignment is used to identify trends both in mutation grouping by disease class and in disease variation by residue position. 3-D modeling of the mutations and associated disease, in conjunction with a model representing areas of tissue specific protein interactions, provides insight as to how Lamins gain or lose function upon mutation. Thus far, class-specific trends have been identified and are being investigated in relation to their common mechanisms of disease, such as protein mis-localization, increased solubility, and epigenetic modifications. This project aims to illustrate how the mechanisms of pathogenesis for prominent laminopathies may depend on the particular amino acid substitutions and their locations within pre-lamin A.

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Improving Text Classification Efficiency Through a Data-Driven Selective Dataset Reduction

Undergraduate Presenter(s): George Candal, ENMU

Author: George Candal, ENMU

Author: Dr. Essa Imhmed, ENMU

Transformer-based text embedding models have significantly improved classification performance. However, training classifiers on large-scale datasets remains computationally expensive, especially when datasets contain redundant or ambiguous instances that do not meaningfully contribute to model learning.

In this study, we propose an instance selection method for text classification that performs clustering analysis and uses the Silhouette score to identify representative instances within each cluster. Instances with scores above an empirically tuned threshold, determined through multiple experiments, are retained, while the remaining instances are removed. We evaluate our proposed method against a baseline method, Condensed Nearest Neighbor (CNN) (Cunha et al., 2023), which constructs a reduced dataset by retaining misclassified instances while removing correctly classified ones.

We conduct several experiments to compare the two reduction methods across multiple classifiers, including Decision Tree, Random Forest, SGDClassifier, LinearSVC, and XGBoost, using E5 embeddings on the Stanford Sentiment Treebank (SST-2) dataset. Our experimental results show that the proposed Silhouette-based method improves classification accuracy by an average of 0.23%, reduces classifier training time by an average of 11%, and reduces the dataset size by an average of 12%. In contrast, the baseline CNN method achieves an average data reduction of 80% and an average runtime reduction of 81%, but decreases classification accuracy by an average of 1.3% compared with training on the original dataset. Overall, our findings suggest that our proposed method outperforms the baseline method, offering a more balanced trade-off between classification accuracy, training time, and data reduction.

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Next-Generation Paper-Based Uric Acid Sensor Enabled by Nickel–Indium Sulfide Nanostructures

Undergraduate Presenter(s): Lynette Castillo, NTU

Author: Lynette Castillo, NTU

Author: Justin Platero, NTU

Author: Joshua Platero, NTU

Author: David Willie, NTU

Author: Makeiyla Begay, NTU

Author: Avery Begay, NTU

Author: Schinda Kumar Ray, NTU

Author: Thiagarajan Soundappan, NTU

Uric acid is an important biomarker in urine, and elevated levels are associated with conditions such as gout and kidney dysfunction. Therefore, the development of low-cost, sensitive, and portable detection methods is essential for point-of-care monitoring. In this study, we present a nickel indium sulfide (Ni–In–S) nanomaterial–modified paper-based electrochemical sensor for the rapid detection of uric acid. The sensor was fabricated by drop-casting trace amounts of Ni–In–S nanomaterials onto the working electrode of a paper-based platform, which enhances electrochemical performance by increasing surface area and improving electron transfer efficiency. The modified sensor exhibits improved sensitivity and a lower limit of detection compared to the unmodified paper electrode, demonstrating its effectiveness for uric acid sensing. Overall, this work highlights the potential of Ni–In–S modified paper-based sensors as a simple, cost-effective, and portable platform for on-site biomarker detection and point-of-care diagnostics.

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Ranavirus Detection Using Loop-Mediated Isothermal Amplification (LAMP) Assay

Undergraduate Presenter(s): Aneliese Cdebaca, ENMU

Author: Aneliese Cdebaca, ENMU

Ranaviruses are a group of viruses in the family Iridoviridae that infect a diverse assemblage of ectothermic vertebrates, including fish, amphibians, and reptiles. These viruses are known to cause morbidity through tissue death and organ failure, which can lead to mass-mortality events. Amphibians are among the most imperiled classes of vertebrates, and pathogens are often recognized as significant contributors to their declines. To rapidly detect ranavirus infection in amphibians, conservationists need an efficient, field-based assay. Here, we examine the role of a Loop-Mediated Isothermal Amplification (LAMP) assay as a rapid method for detecting ranavirus in amphibian field samples. A LAMP assay amplifies DNA with high specificity under isothermal conditions, providing rapid results. It has become a promising nucleic acid amplification technique for rapid pathogen detection, suitable for field applications; however, its use for detecting ranaviruses has been minimally tested. This technique utilizes eight primers to bind with and amplify specific regions of the target DNA sequence, which is the ranavirus major capsid protein (MCP) sequence. The primers are added to a reaction mixture containing DNA, master mix, and the target DNA, which is then incubated at 65°C for 30–60 minutes to amplify the target DNA. The results are visualized using a straightforward colorimetric assay and gel electrophoresis. Here, we present the results of our efforts to validate and standardize the LAMP assay for detecting ranavirus, as well as results from testing tadpoles for the specific strain Frog Virus 3.

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Evaluation of the Antioxidant Activity of *Ericameria nauseosa* Using the DPPH Radical Scavenging Assay

Undergraduate Presenter(s): Ana Chavez, CNM

Author: Ana Chavez, CNM

Native plants in the American Southwest, such as *Ericameria nauseosa*, other known as Rubber Rabbitbrush, have a long history of traditional medicinal use for treating inflammation and fevers. Oxidative stress caused by unstable free radicals contributes to cellular damage and diseases like cancer, driving the search for safe, natural antioxidants. While traditional and industrial potentials are recognized, laboratory evaluations of this native shrub's antioxidant properties are still emerging. To explore its potential for future drug treatments, this study investigates the antioxidant activity of *Ericameria nauseosa* using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. Extract samples from the whole plant, stems, and leaves were prepared using serial dilutions, and a spectrophotometer was used to measure absorbance changes and calculate half-maximal inhibitory concentration IC₅₀ values. The results showed that leaf extracts had the highest antioxidant potency with an IC₅₀ value of 51.5 ug/ml, compared to whole plant (260.0ug/ml) and stem extracts (458.0 ug/ml). These findings demonstrate that the leaves are a rich source of active antioxidant compounds. This research highlights the promise of native plants in developing accessible disease prevention methods and opens new avenues for undergraduate-led pharmacological studies.

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Evening Urban Heat Retention and Potential Mental Health Stress in Albuquerque, New Mexico

Undergraduate Presenter(s): Brandon Clifton, CNM

Author: Brandon Clifton, CNM

Author: Anahi Mendieta, CNM

Author: Phillip Tennant, CNM

Author: Melanie Will-Cole, CNM

Extreme heat can intensify physiological strain, disrupt sleep and recovery, and contribute to psychological stress, particularly when urban surfaces retain heat into the evening. Neighborhood-scale heat exposure in Albuquerque, New Mexico, remains insufficiently characterized. This study evaluated the timing and magnitude of urban heat exposure and identified periods that may be most relevant to heat-related mental-health stress. From May 27 through July 29, 2026, mobile transects (tracking temperature and other environmental parameters) were conducted along a repeated Albuquerque route during morning (0800-0900), afternoon (1400-1500), and evening (1900-2000) sampling periods. Air temperatures were captured with an Airbeam-3 sensor/logger. The Airbeam temperature data was corrected using co-located “ground truth” temperature measurements via a Kestrel-5000 hand held environmental sensor. The rural temperature data, required for determining the Urban Heat Island Intensity (UHII/ ΔT) was obtained via a fixed HOBO weather station located in Tijeras, New Mexico. Fifty-one transect sessions were analyzed, including 46 sessions paired with rural measurements. Mean absolute urban-rural temperature differences (ΔT) were 5.9 °F in the morning, 4.6 °F in the afternoon, and 10.8 °F in the evening. All 12 paired evening transects were warmer than the rural reference, with a mean urban excess of 10.8 °F. This result confirms that the 2-mile transect area exhibited a localized Urban Heat Island Effect, demonstrating measurable warming at the neighborhood scale. The transect (Airbeam corrected temperatures) and rural (HOBO) air temperatures showed a moderate positive relationship ($R^2 = 0.45$). The consistent evening excess indicates that Albuquerque's urban environment can remain substantially warmer after daytime heating declines. Persistent evening heat may reduce opportunities for thermal relief, interfere with sleep and recovery, and increase cumulative psychological strain among residents with limited access to cooling. Although mental-health outcomes were not measured, established research shows that extreme heat is correlated with worsened mood, elevated stress, sleep disruption, and increased psychiatric emergencies. By documenting a clear evening heat-exposure pathway, when temperatures remained highest and cooling was most limited, our results highlight a period strongly associated in the literature with heightened psychological strain. Thus, while the study does not demonstrate a causal mental-health effect, it identifies

a scientifically supported window of vulnerability that should guide future real-time assessments of stress, mood, fatigue, and sleep, and inform targeted cooling and mental-health outreach during extreme heat.

This work was supported by NSF Grant Award 2246468.

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Statistical Benchmarking of Dewatered Cake Solids at Three Water Reclamation Facilities: Preliminary Results

Undergraduate Presenter(s): Andrew Cole, ENMU

Author: Prabha Shrestha, ENMU

Author: Andrew Cole, ENMU

Author: Dipak Dulal, ENMU

Sludge dewatering is a resource-intensive but essential step in wastewater treatment, and benchmarking performance across facilities can help reduce hauling costs and improve efficiency. We present preliminary results from a multi-facility statistical benchmarking framework comparing dewatered cake percent solids, the primary indicator of dewatering efficiency, across three water reclamation facilities (WRFs).

Operational data were obtained from Cedar City Regional WWTF (UT; daily records, 2021–2026), St. George Water Reclamation Facility (UT; monthly, 2019–2025), and the City of Watsonville WWTP (CA; monthly, 2019–2020). Cedar City's daily readings were aggregated into monthly means ($N = 152$ facility-months). One-way ANOVA and pairwise t-tests, corroborated by non-parametric tests, compared mean cake solids across facilities. A multiple regression with heteroskedasticity and autocorrelation-robust standard errors was used to examine operational predictors at Cedar City.

Mean cake percent solids differed significantly across facilities ($F(2,149) = 129.40$, $p < .001$, $\eta^2 = .635$): St. George averaged 20.4% ($SD = 2.1$), Watsonville 16.8% ($SD = 1.2$), and Cedar City 14.1% ($SD = 2.7$). All pairwise differences remained significant after Tukey's HSD correction. At Cedar City, polymer dosage and digester percent solids were positively associated with cake dryness, while capture rate showed a modest negative association, suggesting a trade-off between solids capture and cake dryness ($R^2 = .19$).

More than six percentage points separated the highest- and lowest-performing sites. These preliminary results, from three of nine targeted facilities, demonstrate the feasibility of multi-site statistical benchmarking and motivate continued data collection on equipment type, chemical conditioning, and facility characteristics as drivers of this variation.

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Landmark-Based Identification of Tooth Indentations on Microvertebrates Allows for Interpretation of Ecologic Relationships During the Eocene-Oligocene Transition and in a Modern Paraguayan Microsite

Undergraduate Presenter(s): Elena Catherine De Santo, UNM

Author: Elena Catherine De Santo, UNM

Author: Alexandra Apgar, UNM

Author: Christian Colman, Facultad de Ciencias Exactas y Naturales en Paraguay (FACEN)

Author: Yennifer Sarubbi Jacks, Facultad de Ciencias Exactas y Naturales en Paraguay (FACEN)

Author: Ashley Poust, UNL

Author: Cory Redman, Grand Rapids Public Museum

Author: Ricardo Souberlich, Facultad de Ciencias Exactas y Naturales en Paraguay (FACEN)

Author: Jason R. Moore, UNM

Microvertebrates are the most abundant vertebrates but are an underutilized resource in palaeontologic research. Despite the importance of microvertebrates, ascertaining predator-prey relationships is difficult as remains are sparse and fragmentary. Taxonomic identification of microvertebrates is often impossible; morphological identification is challenging. We used qualitative and quantitative descriptions alongside Procrustes analysis of taphonomic landmarks to identify the biters of microvertebrate remains from the White River Group of Nebraska, USA, as well as modern microvertebrates from the Paraguayan Chaco. This assemblage allows us to validate the method where predator-prey relationships can be verified.

A subset of 1,066 microfossils and 592 modern bones were analyzed for bite marks; 7.70% and 3.21% of the respective assemblages contained tooth indented bones. All three assemblages have bites concentrated on the appendicular skeleton. The Geomorph package in R was used to record the coordinates and size of each suspected tooth mark alongside the cusp patterns from the teeth of potential biter genera. Observed indentation patterns were compared to potential biters using Procrustes analysis and fuzzy data matching, and the most likely biters were identified. Three fossil genera were likely to produce the majority of the tooth indentations, suggesting an omnivorous or carnivorous diet. Molar area

ratios were then used to independently confirm that the common biters were likely omnivorous or carnivorous while the infrequent biters were likely insectivorous. This approach is a powerful tool to study animal dietary behavior in the fossil record.

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Sustainable Biochar Filters for Microplastic Removal: Continuous-Flow Performance, Regeneration, and End-of-Life Strategies

Undergraduate Presenter(s): Tito Ornella Esther Astrid Djedje, ENMU

Author: Climesia Elikplim Soglohu, ENMU

Author: Tito Ornella E. A. Djedje, ENMU

Author: Oluniyi O. Fadare, ENMU

Biochar is a low-cost, low-carbon filter material that could remove microplastics from wastewater. However, most studies test biochar in small batch experiments using clean, lab-made microplastics in synthetic water, and few examine continuous-flow performance, regeneration, or end-of-life management. We reviewed published research on micro- and nanoplastic removal using biochar and biochar-based composites. From an initial 278 records, we retained 267 peer-reviewed articles after removing duplicates and ineligible studies. Only 13 continuous-flow column studies reported enough detail (column geometry, empty-bed contact time, bed volumes treated, flow rate, particle size, and polymer type) for quantitative comparison. In these studies, biochar filters removed 80–95% of microplastics sized 1–500 μm at contact times of 10–30 min and flow rates of 1–10 mL min^{-1} , and treated roughly 100–500 bed volumes before significant breakthrough. Biochar trapped particles through interception, straining, and entanglement, and captured more microplastics than sand filters of similar grain size. Removal increased with particle size and was generally higher for water-repelling polymers, such as polystyrene and polypropylene, than for biodegradable or more polar plastics. Evidence on regeneration and disposal remains limited and fragmented. Magnetic or modified biochars kept 70–95% of their initial removal capacity over several reuse cycles, but regeneration often demands much energy, and few studies checked whether it fragments microplastics, forms toxic by-products, or releases greenhouse gases. Biochar filters show strong potential for continuous-flow microplastic removal. However, uneven geographic coverage, incomplete reporting, scarce regeneration data, and unknown end-of-life impacts slow their sustainable use.

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Urban Heat Island Effect on Water Stress in Urban Vegetation

Undergraduate Presenter(s): Claire Eiting, CNM

Author: Claire Eiting, CNM

Author: Nicholas Martinez, CNM

Author: Kamran Bakhtair, CNM

Author: E. Blauw, CNM

Author: Melanie Will-Cole, CNM

The Urban Heat Island effect (UHIE) is characterized by elevated air and surface temperatures in urban environments relative to surrounding rural areas. Because a larger share of the population lives in urban areas than in rural areas, studies have examined the best ways to address UHIE effects to keep people cool in the hot summer months. While many studies demonstrate the effectiveness of green spaces in mitigating UHIE effects, few consider water conservation and plant water stress. To investigate how the UHIE affects plant water stress in the arid city of Albuquerque, New Mexico, a study was conducted along a well-defined 2.5-mile mobile transect loop in a high-traffic commercial area known as the Winrock Mall. Twice a week, three times a day, sensors were used to collect pedestrian-level air and surface temperatures, relative humidity, particulate matter, and observational data along the transect. Preliminary results not only confirm that the Albuquerque Winrock Mall area is an Urban Heat Island within the city but also show that many plants along the transect are water-stressed or at risk of water stress despite regular irrigation. However, many factors affect a plant's water stress, including distance from urban materials, precipitation, and humidity, all of which must be considered when selecting vegetation for an urban area. We expect these findings to shed light on which plants are robust enough to survive the hot, arid climate and, in turn, the UHIE.

This work was supported by NSF Grant Award 2246468.

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Study of T1 and T2 Relaxation Times of Sodium Cytosine Monophosphate in the Presence of Bimetallic Complexes of a Furan-Based Polyamine Macrocycle

Undergraduate Presenter(s): Devyn Ericksen, ENMU

Author: Devyn Ericksen, ENMU

Author: Md Mhahabubur Rhaman, ENMU

Magnetic resonance imaging (MRI) needs suitable contrast agents (CAs) to diagnose diseases. Bioresponsive MRI CAs respond to biological signals or pathological abnormalities, interact with molecular biomarkers via selective binding, and even respond to various pH and oxidative stress conditions. This field demands the study of various metal-ion complexes with versatile ligands to expand the capability of clinical diagnosis. In that case, first-row transition metal ions such as Fe(III), Mn(II), Co(II), Ni(II), and Cu(II) have received considerable attention due to their diverse chemistry, comparatively low toxicity, and moderate magnetic susceptibility. In our research, a furan-based polyamine macrocycle was synthesized via the Schiff base reaction of 2,5-furandicarboxaldehyde and N-methyl-2,2'-diaminodiethylamine in high-dilution methanol, followed by a sodium borohydride reduction. This macrocyclic ligand contains two furans and six amine functional groups. It was used to prepare paramagnetic bimetallic complexes of several first-row transition-metal ions. T1 and T2 relaxation times of various ¹H NMR peaks and phosphate peaks of sodium cytosine monophosphate were measured in the presence of these complexes and compared with those of a similar Gd(III) complex. Acknowledgment: This work was primarily supported by Eastern New Mexico University's internal grant PIRR3. Ms. Devyn, an undergraduate student, was supported by the Presidential Green & Silver scholarship. This project acknowledges the New Mexico Legislature for funding the Nuclear Magnetic Resonance Spectrometer.

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Repatriating the Forgotten

Undergraduate Presenter(s): Aiden Gamble, ENMU

Author: Aiden Gamble, ENMU

Colonization has impacted many areas, if not most, of Africa. In this research I focus on two case studies: the case of Sara Baartman and her repatriation as well as an ongoing case report of an Egyptian skull. Baartman is one of the most famous representations of successful repatriation. She was kidnapped from her home and paraded around Europe as an attraction due to a genetic disorder called Steatopygia. After dying at age 26, her body was on display in a museum from 1816 to 1974, with both a cast of her body as well as her skeletal remains and pickled reproductive organs. These were removed from the exhibit after 1974 and were housed in a storage room until 2002 when she was properly repatriated due to the efforts of both Nelson Mandela and Diana Ferrus. The cranial remains plan to be repatriated, however, not many international laws exist in North America. The ongoing case report was done in March of 2025 and will be continued throughout next year. Analysis of the Egyptian remains results of the case report consist of a biological profile, curation standard photographs, an inventory of taphonomic and postmortem damages, as well as a possible non-human element and a handwritten provenance index card. Results will be dependent on collection of information in the next coming years. This author plans to go in depth on how to bring international laws of repatriation to North America and to allocate other artifacts of lost history.

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Photoresist Spin-Speed Effects on Film Thickness, Uniformity, and Pattern Transfer Accuracy

Undergraduate Presenter(s): Dylan Gonzales, CNM

Author: Dylan Gonzales, CNM

Author: Evelyn Martinez, CNM

Author: Emma Fuentes, CNM

Author: P. Yellu, CNM

Author: Melanie Will-Cole, CNM

Photolithography is a foundational process in microelectronics manufacturing because it defines the precise patterns that become functional device structures, linking circuit design to fabrication outcomes. This study investigated the effect of photoresist (PR) spin speed on the PR layer thickness, uniformity, and the resultant critical feature dimensions across patterned wafers. Silicon/silicon dioxide (Si/SiO₂) wafers coated with AZ 1518 photoresist were prepared at three spin speeds: 500, 1500, and 3000 RPM. Photoresist thickness was measured at nine locations across each wafer using profilometry, while critical feature widths and spacing were measured by optical microscopy with image-analysis software. Increasing spin speed decreased average photoresist thickness and improved thickness uniformity, with 3000 RPM producing the thinnest and most uniform film. However, changes in patterned feature dimensions were feature-dependent and did not follow a single trend with increasing spin speed. Our findings demonstrate that spin speed is a critical process parameter for controlling photoresist thickness and uniformity. They also highlight the importance of evaluating individual critical dimensions when optimizing spin-coating conditions to achieve accurate, uniform, and reproducible pattern transfer during photolithography.

This work was supported by NSF Grant Award 2246468

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Ensemble Learning for Ames Mutagenicity Prediction Using Molecular Descriptors and Graph Neural Networks

Undergraduate Presenter(s): Hyunmo Goo, ENMU

Author: Hyunmo Goo, ENMU

Author: Dipak Dulal, ENMU

Author: Prabha Shrestha, ENMU

Accurate prediction of chemical mutagenicity can support early identification of compounds that warrant experimental safety testing. The Ames test measures the ability of chemicals to induce mutations in bacteria and provides a widely used endpoint for computational screening. Existing approaches include descriptor-based classifiers, graph neural networks, and ensembles combining different molecular representations and prediction models. Molecular descriptors summarize calculated properties, while graph neural networks learn representations from atoms and bonds.

We investigated whether combining descriptor-based and graph neural models could improve Ames mutagenicity prediction. In particular, we asked whether a neural model could add predictive value to an ensemble even when its standalone performance did not exceed that of a descriptor-based classifier. Using public development data from the Therapeutics Data Commons AMES dataset, we developed descriptor-based classifiers, neural models combining descriptors and learned graph representations, and ensembles formed by averaging their predicted probabilities. Our main comparison paired XGBoost trained on Mordred descriptors with a neural model integrating those descriptors and atom-level graph representations. Following exploratory model selection, we evaluated selected combinations using repeated cross-validation. We kept molecular scaffold and identity groups separate between training and evaluation and trained learned representations within each split. We assessed both discrimination between Ames-positive and Ames-negative compounds and the accuracy of predicted probabilities.

In the current analysis, the ensemble improved discrimination and reduced probability prediction error relative to the descriptor classifier alone. The neural model alone did not outperform this baseline, indicating that its value as an ensemble component was not reflected by its standalone performance.

For Ames prediction, these findings support considering a model's contribution to an ensemble alongside its standalone performance. This approach may help improve computational prioritization of compounds for experimental mutagenicity testing. Further work will compare alternative representation and model combinations and evaluate selected models on independent data.

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Effects of Land Cover and Shade on Diurnal Urban Heat Retention Along the University of New Mexico Transect

Undergraduate Presenter(s): Mackenzie Groves, CNM

Author: Mackenzie Groves, CNM

The Urban Heat Island (UHI) effect develops when urban surfaces absorb and store heat, producing warmer conditions than surrounding rural environments. At the neighborhood scale, differences in pavement, vegetation, shade, and water can create distinct microclimates over short distances. This study evaluated how land cover and shade influence surface heating and diurnal heat retention along a repeated approximately 2.3-mile mobile transect through the University of New Mexico campus and adjacent neighborhoods in Albuquerque, New Mexico. Thirteen primary sampling locations represented high-traffic sections of Central Avenue, tree-lined residential streets, a dark asphalt road/parking area, Johnson Field, shaded green space surrounding a pond, and recreational areas. Measurements were collected during morning, afternoon, and evening sampling periods at approximately five-minute intervals. Surface-temperature measurements included concrete, asphalt, gravel, and grass under shaded and sun-exposed conditions. Formal UHI intensity (ΔT) was calculated for 29 paired transect sessions from June 24 through July 29, 2026 using UNM Kestrel air temperature and simultaneous rural-reference temperature from a HOBO station in Tijeras, New Mexico. Mean urban-rural ΔT was -1.8°F in the morning, $+2.8^{\circ}\text{F}$ in the afternoon, and $+10.4^{\circ}\text{F}$ in the evening. All nine paired evening sessions were warmer than the rural reference, demonstrating persistent evening urban heat. Across 1,498 surface-temperature observations, afternoon sun-exposed surfaces were substantially warmer than paired shaded surfaces. Mean afternoon shade benefits were approximately 36.0°F for concrete, 30.1°F for asphalt, 32.0°F for gravel, and 22.1°F for grass (all $p < 0.001$). Heat-retention analysis also showed that Stop 8, the unshaded dark-asphalt road/parking area, had the smallest mean afternoon-to-evening surface-temperature decrease (5.9°C), compared with 11.6°C across the other stops ($p < 0.001$), indicating greater retained heat. These results show that UHI intensity is strongest after daytime heating declines and that shade and surface characteristics strongly influence localized thermal conditions. Increasing shade, vegetation, and the use of lower-heat surface materials may reduce pedestrian heat exposure in urban Albuquerque.

This work was supported by NSF Grant Award 2246468.

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Robust UAV Trajectory Planning Under User Location Uncertainty

Undergraduate Presenter(s): Orran Hart, ENMU

Author: Orran Hart, ENMU

Author: Jiangqi Hu, ENMU

In post-disaster environments, unmanned aerial vehicles (UAVs) can rapidly provide wireless connectivity when terrestrial infrastructure is unavailable. However, conventional UAV trajectory-planning methods generally assume that ground users' reported locations are accurate. In urban areas, buildings and other obstructions can introduce substantial localization errors, causing a trajectory optimized for the reported user distribution to perform poorly in the actual environment. This work develops an uncertainty-aware action-selection method for robust UAV trajectory planning under user-location uncertainty. Using a spatial localization-risk map, the proposed method generates plausible user-location realizations around the reported positions and evaluates candidate UAV actions across these realizations. The resulting action values are combined with those of the reported topology to select a trajectory that is less sensitive to location perturbations. The method operates only during inference and therefore requires neither retraining nor additional model parameters. Simulation results across multiple urban layouts and uncertainty levels show that the proposed approach consistently improves lower-tail performance and reduces the probability of severe throughput degradation compared with conventional deep reinforcement learning based on reported locations alone. These results demonstrate that explicitly accounting for location uncertainty can improve the reliability of UAV-assisted emergency communication systems.

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Document Extraction by Unifying Textual and Visual LLM Outputs

Undergraduate Presenter(s): Justin Hovious, ENMU

Author: Justin Hovious, ENMU

Author: Dr. Eduardo Ceh-Varela, ENMU

Extracting structured data from PDFs remains notoriously prone to textual errors and structural loss. Our objective is to design an ensemble AI agent that unifies the structured outputs of a Visual Large Language Model (VLLM) and a pipeline combining Optical Character Recognition (OCR) with a Large Language Model (LLM). To accomplish this, we introduce an ensemble framework featuring an LLM-based "Unification Agent" that receives the independently generated outputs of the VLLM and OCR+LLM pipelines and reconciles their agreements and discrepancies to produce a unified structured output. The resulting unified output, along with the individual baseline outputs, will be evaluated against ground-truth annotations from the FUNSD dataset using token-level precision, recall, and F1. We hypothesize that reconciling complementary extraction outputs will reduce extraction hallucinations and structural mismatches compared with the individual VLLM and OCR+LLM baselines. By open-sourcing our codebase and prompting strategies, we aim to accelerate research in multimodal document understanding and ensemble-based information extraction.

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Installing a PV Array to Recharge Unmanned Aerial Vehicles (UAVs) and Extend Their Range

Undergraduate Presenter(s): Kevin Johnson, ENMU; Cole Nicholson, ENMU

Author: Jacob Johnson, ENMU

Author: Kevin Johnson, ENMU

Author: Cole Nicholson, ENMU

Author: Dr. Allamehzadeh, ENMU

A PV array is another technology to recharge a UAV's battery to prolong its mission. Solar energy technology is a mature, well-developed science, making it an efficient and inexpensive source of renewable energy. Solar modules are manufactured in various sizes, power ratings, and weights for use in applications such as solar battery charging, large-scale electricity generation in solar farms, powering remote communications towers, and electric vehicle battery charging. The main limitation of UAVs is the limited power of their batteries. Increasing the number of batteries is not an option due to their weight. An alternative method is to recharge or power up their battery via solar modules. In this research paper, we discuss various solar technologies, including their power, weight, and efficiency, to find a suitable PV technology for recharging UAV batteries or powering them to extend their mission.

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High-Voltage Power Line and Wireless Power Transfer to Charge Up a UAV Battery

Undergraduate Presenter(s): Jacob Johnson, ENMU

Author: Jacob Johnson, ENMU

Author: Hamid Allamehzadeh, ENMU

Unmanned Aerial Vehicles (UAVs) have recently been used in many areas, such as parcel delivery, civil engineering inspection, power line inspection, inspection of wind turbine blades for defects, and modern warfare. They are available in different sizes, weights, and technologies, with a wide range of capabilities. To extend their mission, increasing battery size or the number of batteries is an option, given the batteries' limited weight. High-power lines emit electromagnetic fields (EMFs) in their vicinity. Due to their high voltage and power, it is hazardous to use that energy directly in UAVs. Wireless power technology is a mature science for transferring energy wirelessly to an object. This technology has been used in many areas, including remote charging of electric vehicles, recharging pacemaker batteries, and wireless charging for cell phones. There are two main methods of wireless charging: capacitive and inductive. In this paper, we investigate and simulate the EMF of a high-voltage power line and the inductive WPT method for wirelessly transferring energy from high-voltage power to re-energize a UAV battery. The technology is applied to extend the range of UAVs' missions.

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Comparative Evaluation of Transfer Learning-Based CNN Models for Lung Cancer Classification Using CT Scan Images

Undergraduate Presenter(s): Willy Kana Feudjio, ENMU

Author: Willy Kana Feudjio, ENMU

Author: Shakya Sarbagya, ENMU

Lung cancer remains one of the leading causes of cancer-related mortality worldwide that accounts for a significant number of cancer-related deaths each year. Early detection and accurate differentiation of lung abnormalities are essential for timely treatment and improved patient survival. Computed Tomography (CT) imaging has become a widely used diagnostic tool for identifying lung abnormalities. However manual interpretations of CT scans are time consuming and susceptible to human error. This study presents a comparative analysis on the use of lightweight deep learning models with other base models to be deployed in resource-constrained edge devices for classification of lung CT scan images into three categories: benign, malignant, and normal. Transfer learning was employed using four Imagenet-pretrained convolutional neural networks (CNNs), namely DenseNet21, Resnet 50, Efficient Net B0, and InceptionV3 on IQ-QTH/NCCD lung cancer dataset. These models were selected due to their proven effectiveness in image recognition tasks and their varying computational requirements, making them suitable candidates for deployment in practical medical applications.

The experiment results demonstrate the effectiveness of transfer learning for automated lung cancer diagnosis. Among the evaluated models, DensetNet 21 achieved the highest classification accuracy of 94.8%, outperforming the other architectures. These findings suggest that Dense Net is a promising solution for developing efficient and accurate computer aided diagnostic system for lung cancer detection on edge computing platforms. Furthermore, the use of efficient deep learning models can contribute to the deployment of diagnosis tools on edge devices, improving accessibility to advanced medical imaging analysis in remote and resource-limited healthcare settings.

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Pavement, Parking Lots, and Heat: Characterizing Commercial Land-Use Hotspots in a Semi-Arid Urban Heat Island

Undergraduate Presenter(s): Nicholas Martinez, CNM

Author: Nicholas Martinez, CNM

Author: Claire Eiting, CNM

Author: Kamran Bakhtiar, CNM

Author: E. Blauw, CNM

Author: Melanie Will-Cole, CNM

Urban heat islands (UHIs) are a growing concern in rapidly developing cities, particularly in semi-arid regions where extensive impervious surfaces and limited vegetation create localized areas of elevated temperature. While satellite observations capture regional heat patterns, they may not fully represent fine-scale thermal variability experienced at the pedestrian level, particularly within commercial land-use zones where large parking lots and low vegetation cover consistently produce hotter microenvironments. This study characterizes localized urban heat hotspots within commercial zones in the Winrock/Uptown district of Albuquerque, New Mexico, and evaluates how these ground-level thermal patterns compare with satellite-derived land surface temperature. Ground-based data are collected along a 2.5-mile urban transect twice weekly over a 12-week period during morning, afternoon, and evening sampling periods, measuring near-surface air temperature, humidity, wind speed, particulate matter, and surface temperatures using a Kestrel weather meter, AirBeam sensor, and infrared thermometer, with corrected air temperatures benchmarked against a rural HOBO reference station to quantify urban heat island intensity. Preliminary results indicate that commercial hotspots show the strongest urban heat island signal during evening hours, with minimal or reversed differences in early morning. These findings suggest commercial land-use zones retain and re-emit heat well after sunset, a pattern with direct implications for urban planning, heat mitigation strategies, and the use of satellite remote sensing for neighborhood-scale heat monitoring in semi-arid cities. Future analysis will incorporate additional environmental datasets, such as vegetation cover and precipitation, to further contextualize these findings. This work was supported by NSF Grant Award 2246468.

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Evaluating the Accuracy of Students Using a Decision-Tree Tool in Tooth Identification

Undergraduate Presenter(s): Kailey McCann, ENMU

Author: Kailey McCann, ENMU

Analysis of teeth based on class, arcade, position, and side is an essential tool for forensic anthropologists to identify remains. Though an essential skill, identification of teeth is challenging for students. This project evaluates if the accuracy of tooth identification improves with the use of a decision-tree tool such as a flowchart. Students were tasked with identifying seven teeth in two different sessions based on class, arcade, position, and side. The first session occurred with only background knowledge of teeth. The second session occurred two weeks later after covering dentition in class and with the use of a flowchart. Data suggests overall accuracy increased with the use of a flowchart, especially in the categories of class, arcade, and position. Generally, 92% (n=13) of students reported the flowchart to be helpful. The data suggest the flowchart increased overall accuracy by 22% and an increase of 28% excluding side data. This pattern is consistent among all tooth types except for canines where class nor side increased while the other metrics did. In review of both students' recommendations and the data, siding instructions need improvement and further clarification. Overall, a decision-tree approach to tooth identification demonstrates merit as a teaching tool for advancement in forensic anthropology education.

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Synthesis of Di-Carbonyl-Terminated Ladder-Type Hexa(p-phenylene)

Undergraduate Presenter(s): Marissa McCulloch, ENMU

Author: Marissa McCulloch, ENMU

Author: Bhagat Singh, ENMU

Author: Juchao Yan, ENMU

Author: Clement Azure, ENMU

Organic solar cells (OSCs) offer several advantages over traditional photovoltaic technologies, including flexibility, low weight, and potential cradle-to-grave environmental benefits. Despite recent advancements, OSCs currently achieve low power conversion efficiencies (PCEs). Further improvements are restricted by the complexity of their molecular structures and the limited understanding of localized electron movement within conjugated polymers. We postulated that di-carbonyl-terminated ladder-type hexa(p-phenylene) could demonstrate a better charged transport than previously studied tetra- and penta(p-phenylene) ladder-type structures. The longer π -conjugated system, electron-withdrawing terminal carbonyl groups, rigid ladder-type structure, and solubilizing alkyl side chains are intended to promote more favorable energy-level alignment, improve molecular packing in these polymers, and support more efficient charge transport. We hypothesize that the target compound could exhibit enhanced photosynthetic properties, higher charge-carrier mobility, and improved performance of OSCs when used as an active material by contributing to a higher PCE. My poster will present the synthesis, purification, and characterization of the fourth intermediate compound (2,7-dibromo-9,9-dihexyl-3,6-dimethyl-9H-fluorene) (88% yield) as a white powder. This is a foundational step in the synthetic pathway of di-carbonyl-terminated ladder-type hexa(p-phenylene) for future investigations of structure–property relationships and charge-transfer behavior aimed at increasing the PCE of OSCs.

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Urban Heat Island: Investigating Microclimatic Variations Across Residential, Green and Developed Capus Areas

Undergraduate Presenter(s): Anahi Mendieta, CNM

Author: Anahi Mendieta, CNM

Author: Brandon Clifton, CNM

Author: Philip Tennant, CNM

Author: Melanie Will-Cole, CNM

The Urban Heat Island (UHI) effect has been broadly investigated for years; this urban phenomenon is associated with the relative warming of cities in contrast to rural environments. Urban design and landscape can greatly contribute to the rapid heating of surrounding areas, impacting human health, thermal comfort, wildlife and even energy demand. But there is no single solution that will help mitigate its effects as climate varies among different regions. In the field of urban climatology many methods have been developed to better understand this phenomenon and evaluate factors that influence urban temperatures. To study the variability of different microclimates within Albuquerque, NM a 2-mile transect observing three distinct locations was developed; A residential area, an urban green space and a campus area. Air temperature, relative humidity, ground temperature among other readings were noted twice a week, three times a day, for a 12-week period. Our findings suggest that shade, building arrangement, surface materials and airflow collectively influence spatial temperature differences and thermal comfort. These findings suggest that thoughtful urban planning and landscape design may help mitigate the urban heat island effect. This research provides insight into planning strategies that will help create urban environments that work with the local climate.

This work was supported by NSF Grant Award 2246468.

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Assessing Microscale Physiological Heat Stress in Urban Pedestrian Environments

Undergraduate Presenter(s): Yenyi Nkontchu, CNM

Author: Yenyi Nkontchu, CNM

Author: Yifan Zhang, CNM

Author: Mackenzie Groves, CNM

Author: Melanie Will-Cole, CNM

As urbanization accelerates worldwide, the Urban Heat Island Effect (UHIE) has emerged as a major environmental and public health challenge, elevating ambient temperatures and physiological heat stress in urban environments. Although numerous studies have investigated urban heat islands, thermal comfort, and human heat exposure, most have focused on broader spatial scales, providing limited insight into microscale physiological heat stress. By conducting field-based measurements across diverse urban microenvironments in Albuquerque, New Mexico, this study investigates localized variations in physiological heat stress and their relationships with environmental conditions. Results reveal substantial microscale variability in heat exposure, with afternoon periods, sun-exposed surfaces, and areas with limited shade generally experiencing greater thermal stress. Surface temperature was strongly associated with WBGT, while shaded locations experienced considerably lower surface temperatures, highlighting the importance of localized environmental conditions in determining pedestrian heat exposure. These findings provide a scientific basis for identifying localized heat-risk environments and informing targeted heat mitigation strategies, urban planning, and future predictive heat-stress modeling. This work was supported by NSF Grant Award 2246468.

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Micropost-Integrated Acoustofluidic Devices for Enhanced Microparticle Trapping and Release

Undergraduate Presenter(s): Rowan Oglesby, NMT

Author: Rowan Oglesby, NMT

Author: Dr. Menake Piyasena, NMT

Author: Dhanika Senavirathna, NMT

Author: Ayomal Fernando, NMT

The occurrence of nano and microplastics (MNPs) in the natural environment has emerged as a serious threat to human health. Various studies have demonstrated that MNPs can get into the human body via food and water. This can potentially degrade human health. Isolating small particles, especially in the sub-micron to nano range, has long been a challenge for researchers; it often involves lengthy, multi-step procedures that can be expensive and time-consuming. Therefore, this research project aims to develop an inexpensive, quick, flow-through method for separating MNPs. This can be accomplished using acoustic forces integrated in a microfluidic device with posts. A microfluidic device is first designed using CAD software, before being created on a silicon wafer via photolithography, followed by deep reactive ion etching and anodic bonding. An acoustic transducer attached to the microfluidic device generates acoustic forces that move the MNPs to central pressure nodes, where they are pinned against microposts. After the transducer is turned off, the trapped particles are released and flow back out of the microfluidic device.

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Surviving the Desert Sun

Undergraduate Presenter(s): Philip Tennant, CNM

Author: Philip Tennant, CNM

Author: Anahi Mendieta, CNM

Author: Brandon Clifton, CNM

Author: Melanie Will-Cole, CNM

Many studies examining temperature effects on animal behavior focus on single species or small populations, limiting broader ecological interpretation. In contrast, this study adopts a wider lens to investigate how Urban Heat Islands (UHIs) and temperature variability influence animal behavior across multiple taxa within the Albuquerque region. We integrate field collected temperature measurements with wildlife and incident records from Albuquerque Animal Control, ABQ Biopark, the New Mexico Department of Game and Fish (NMDGF), and the U.S. Department of the Interior (USDOI) to evaluate how UHI driven temperature increases relate to changes in movement, habitat use, activity patterns, and behavioral responses. By combining environmental data with diverse wildlife datasets, this study provides a more comprehensive assessment of how animals respond to localized heat stress across an urban landscape. This approach allows us to identify both direct and indirect behavioral shifts associated with elevated temperatures, including altered daily activity cycles, increased nocturnal movement, changes in habitat selection, and potential increases in human–wildlife interactions. Together, these findings contribute to a broader understanding of ecological impacts of UHIs and underscore the importance of continued monitoring of temperature linked behavioral changes across species.

This work was supported by NSF Grant Award 2246468.

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Investigating the Potential Applications of *Salsola tragus* Through Natural Product Extraction and Bioactivity Screening

Undergraduate Presenter(s): Emma Tyrrell, UNM

Author: Emma J. Tyrrell, UNM

Author: Audrey J. Lee, UNM

Author: Jacob A. Greenberg, UNM

Salsola tragus, commonly known as tumbleweed, is an invasive plant that creates challenges for agricultural producers and land managers in New Mexico. Despite its negative impacts, this plant may represent an underexplored source of natural products with potential biological applications. Investigating its chemical composition and biological activity could help identify opportunities to increase its value to New Mexico communities while addressing challenges associated with its invasive growth. This project aims to develop a reproducible extraction protocol for recovering plant-derived compounds from *S. tragus* and investigate their potential biological activity. Initial work will focus on establishing consistent extraction methods suitable for subsequent chemical characterization and bioactivity screening. Extracts will be evaluated for antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay and for potential anti-inflammatory activity using Bovine Serum Albumin biological assays. Mass spectrometry will be used to characterize the chemical composition found in the plants and will help identify compounds of interest. These analyses will provide preliminary information about the relationship between extraction conditions, phytochemical composition, and biological activity. By investigating the potential applications of an abundant invasive plant, this research seeks to establish a foundation for future studies exploring whether *S. tragus* could serve as a locally available source of bioactive compounds and provide new opportunities for research and resource utilization in New Mexico.

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Estimating Local Economic Development in New Mexico Using Remote Sensing and AI

Undergraduate Presenter(s): Angelina Vozza, NMT

Author: Jiakai Zhang, NMT

Author: Shiyan Zhang, NMSU

Author: Jun Zheng, NMT

Author: Angelina Vozza, NMT

This study develops an AI-based framework to estimate local economic development in New Mexico at fine spatial resolution. Economic statistics reported for administrative areas often obscure within-county variation, particularly in rural areas. We integrate satellite remote sensing, geospatial data, and socioeconomic indicators from the American Community Survey (ACS), combining nighttime lights, land use, road networks, and demographic and economic characteristics. These variables are harmonized to a common grid aligned with nighttime light data, with areal interpolation applied where necessary. Using county-level gross domestic product (GDP) as the target variable, we apply random forest models to estimate grid-level economic output through spatial downscaling. Model performance is assessed at the county level by aggregating grid-level predictions and comparing them with reported county GDP. The resulting estimates characterize the spatial distribution of economic activity across New Mexico, helping identify local development disparities and providing geographically detailed evidence to inform infrastructure investment and economic development planning.

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Estimating the Rates of Haemosporidian (Apicomplexa: Haemosporida) Infection and Turnover in Birds of Northwest New Mexico

Undergraduate Presenter(s): Anna Walker, ENMU

Author: Emily Arias, ENMU

Author: Anna Walker, ENMU

Author: C. Johnathan Schmitt, ENMU

Although commonly thought of as uniquely infecting humans in the tropics and causing the disease malaria, haemosporidians in fact parasitize a diversity of vertebrate hosts other than humans. Indeed, over 5,000 species of haemosporidians are known to infect birds, while 95% of human malaria cases are caused by only two species. Preliminary studies of haemosporidians infecting birds have demonstrated important impacts on the fitness, range limits, and community structure of birds; yet haemosporidian parasites remain unsurveyed in most bird species and communities. Indeed, haemosporidian infections in birds appear to be common, including here in New Mexico. I conducted a survey of haemosporidian parasites infecting birds in the Chuska mountains, a previously unstudied region of northwest New Mexico. Specifically, I screened 47 avian host individuals, representing 10 species. Within the Chuska mountains, I discovered a combined infection rate of 117%, which is higher than reported in any previous study of haemosporidians in New Mexico. At the host species level, I discovered that infection rates were also higher than previously reported for the avian species screened. Initial genetic analysis of these haemosporidian infections indicates a high diversity of rare species, rather than a small number of common species. While many of these haemosporidian species have been detected in previous studies, including within birds of New Mexico, I have also identified some putatively undescribed new species. These results highlight our nascent understanding of species diversity in haemosporidians and the need for continued screening.

To that end, I am currently in the process of screening a larger sample of host individuals and comparing patterns of community turnover, or change in haemosporidian species composition, between the Chuska mountains and other mountain ranges in New Mexico. In conclusion, my research is generating a novel dataset and insights that will deepen our understanding of these important biotic interactions in New Mexico.

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Particle-Size Distribution and USDA Soil Texture Classification for Improved Irrigation Management in Arid Pistachio Orchards

Undergraduate Presenter(s): Richard Ybarra, NMSU

Author: Anthony Ybarra, NMSU

Author: Dr. Salim Bawazir, NMSU

Soil texture plays a central role in irrigation efficiency, water retention, and crop performance in arid agricultural systems. This study analyzes soil from a drip-irrigated pistachio orchard near Lordsburg, New Mexico to evaluate how particle-size distribution influences water movement and storage. As part of a broader field investigation, soil samples were collected from multiple boreholes at successive depths, and sample S1-2 (10–20 inches) was selected for detailed laboratory testing. Particle-size distribution was determined using sieve analysis following ASTM C-136 and hydrometer testing of the fine fraction passing the No. 200 sieve. As described in the report, 'the sieve analysis showed that 2.27% of the tested sample passed through the No. 200 sieve,' while hydrometer readings provided the full distribution of silt and clay particles. Combined results indicated a normalized composition of 47% sand, 36% silt, and 16% clay, placing the soil in the loam category on the USDA texture triangle. The loam texture suggests balanced hydraulic behavior: sand promotes infiltration and drainage, while silt and clay enhance water-holding capacity. These characteristics are advantageous for pistachio production, where consistent soil moisture is essential for tree growth and nut development. Understanding texture-driven water behavior provides a foundation for improving irrigation scheduling and optimizing water use in arid orchards. Future work will expand analysis across additional depths and integrate hydraulic testing to better link texture with field-scale irrigation performance.

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Small Scale Experimental Study of Interactions Between Stormwater Runoff and Pervious and Coated Concrete

Undergraduate Presenter(s): Yifan Zhang, CNM

Author: Yifan Zhang, CNM

Author: Yenyi Nkontchu, CNM

Author: Mackenzie Groves, CNM

Author: Melanie Will-Cole, CNM

The increase in temperature in urban areas compared to rural areas has been documented as the Urban Heat Island effect. This effect is partly attributed to large surface areas of impervious materials such as concrete or asphalt, resulting in high surface temperatures. Current research shows that these areas store heat into the night and is a major contributor to the thermal pollution of nearby water bodies. Compared to rural areas, urban areas often have higher volumes of stormwater runoff, and higher runoff temperatures. This can be attributed to higher average surface temperatures, and runoff being unable to seep into impervious areas. In response, pervious concrete has been proposed as an alternative to regular, impervious concrete in city planning.

Research suggests that pervious concrete, compared to impervious concrete, can have lower surface temperatures and provides better draining. However, there is a lack of research that examines the interactions between pervious concrete and stormwater runoff. This study aims to investigate the differences between impervious concrete, pervious concrete, and other techniques of concrete cooling. This includes specialized cooling coatings, and persistent shade. In this study, modules of impervious concrete, pervious concrete, coated impervious concrete, and coated pervious concrete were created. These modules were left in the sun, and surface temperatures were collected over the course of the day. Interactions with rainfall were simulated by covering the surface of the module with water and recording the water temperature over time. In addition, a mobile transect in a small area around the University of New Mexico was conducted. We recorded the surface temperatures of common surfaces such as concrete, asphalt, gravel, and grass to provide insight into the differences between pervious and impervious materials. These transects occurred 3 times a day during the summer of 2026.

Preliminary results showed that impervious concrete showed higher surface temperatures and higher runoff temperatures compared to other modules. The runoff also had the most difficulty infiltrating the impervious concrete. In addition, within the mobile transect, impervious materials such as concrete and asphalt averaged the highest surface temperatures. Additionally, consistent shading lowered surface

temperatures for all materials. We expect this research to provide insight into different methods of lowering urban runoff volume and temperature and mitigating the Urban Heat Island Effect.

This work was supported by NSF Grant Award 2246468

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When Garlic Meets Chile: Natural Synergy Against Antibiotic-Resistant Foodborne Pathogens

Graduate Presenter(s): Getrude Amoah, ENMU

Author: Getrude A. Amoah, ENMU

Author: Manuel F. Varela, ENMU

The escalating threat of antimicrobial resistance (AMR) in foodborne pathogens necessitates exploration of natural alternatives. Garlic (*Allium sativum*) contains allicin, which disrupts bacterial metabolism, while chile (*Capsicum* spp.) contains capsaicin, which compromises membrane integrity. This study investigated the antibacterial efficacy of garlic and chile extracts, comparing two chile varieties (hot vs. medium-hot) and their synergy against four clinically significant bacteria: *Salmonella enterica* serovar Typhi, *Escherichia coli*, *Klebsiella pneumoniae*, and *Staphylococcus aureus*. Extracts were prepared using aqueous and 95% ethanol solvents. Antimicrobial activity was assessed via agar disc diffusion, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and checkerboard synergy assays. Garlic demonstrated potent, consistent activity against all strains (MIC: 3.9–15.6 mg/mL). Interestingly, medium-hot chile ethanol extracts unexpectedly showed superior inhibition compared to hot chile, suggesting that factors beyond capsaicin concentration, such as synergistic interactions with other phytochemicals, may influence antimicrobial efficacy. Water extraction yielded no inhibition for chile, confirming ethanol as the optimal solvent. The combination of water-extracted garlic and ethanol-extracted chile produced synergistic effects, reducing MICs below individual values. Pure capsaicin replicated this synergy, confirming allicin-capsaicin interaction as a key mechanistic basis. Checkerboard assays with streptomycin and erythromycin revealed fractional inhibitory concentration (FIC) indices ≤ 0.5 for optimized combinations, indicating broad-spectrum synergy across antibiotic classes. These findings demonstrate that extraction method and chile variety significantly influence antimicrobial efficacy. The garlic-chile synergy offers a natural strategy to enhance antibiotic activity at reduced doses, addressing AMR while improving food safety.

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A Dynamic Bioeconomic Model of Pathogen Control of Kale in Controlled-Environment Agriculture (CEA)

Graduate Presenter(s): Sujaan Aryal, UNM

Author: Sujaan Aryal, UNM

Author: Jingjing Wang, UNM

Pathogen contamination threatens crop productivity, food safety, and profitability in controlled environment agriculture (CEA). Yet the socioeconomic aspects of CEA remain largely unexplored. This study develops a dynamic bioeconomic model of sanitation and pathogen control efforts for a hydroponic greenhouse, using kale as the example. We model healthy kale biomass and pathogen pressure as key state variables. The producer chooses a sanitation effort, an aggregate index of integrated pest management practices, to maximize net discounted profit over a single 35-day crop cycle. Sanitation acts as an investment in a biological stock: effort today lowers the pathogen pressure the crop faces for the rest of the cycle. We parameterize the model with the Cornell CEA greenhouse accounting tool and University of Wyoming kale trial data. Simulations show the profit-maximizing sanitation effort is about 60% above baseline practice, thereby raising annual operating profit from \$46,208 to \$54,401 for a 2,700 ft² greenhouse. However, sanitizing at three times baseline effort forgoes \$16,312 per year relative to the optimum, showing diminishing returns. Since our baseline estimates come from a well-managed CEA operation at Cornell, these estimates are likely conservative; a less well-managed system would likely gain more from sanitation.

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Synthesis and Characterization of Di-Carbonyl-Terminated Ladder-Type Hexa(p-phenylene) for Probing Electron Delocalization

Graduate Presenter(s): Clement Akutam Azure, ENMU

Author: Clement Azure, ENMU

Author: Yan, Juchao, ENMU

Although polymer solar cells have achieved a record-high power conversion efficiency of $\sim 21\%$, widespread commercialization remains limited by a fundamental problem: the lack of control and mechanistic understanding of localized electron movement within donor-acceptor conjugated systems. In previous work, nitrile-functionalized ladder-type oligo(p-phenylene)s served as useful spectroscopic reporters for electron delocalization; however, nitrile groups are rarely present in photovoltaic polymers. To overcome this limitation, carbonyl functionalities offer a more representative and synthetically versatile reporter unit. In this work, we focus on the design, multistep organic synthesis, and molecular characterization of a novel di-carbonyl-terminated ladder-type hexa(p-phenylene). We outline the synthetic strategy used to construct the rigid, planarized hexamer backbone and establish reaction optimization pathways for the terminal functionalization. This work provides a tailored, structurally well-defined molecular framework designed to target and elucidate charge-delocalization behavior in conjugated organic materials.

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Study of the T1 and T2 Relaxation of Water in the Presence of Paramagnetic Compounds

Graduate Presenter(s): Rachael Bobie, ENMU

Author: Md Mhahabubur Rhaman, ENMU

Magnetic resonance imaging (MRI) is a widely used method for obtaining anatomical images to diagnose various diseases. MRI depends on two parameters: the Longitudinal Relaxation Time (T1) and the Transverse Relaxation Time (T2). Each tissue has its own relaxation time to return to its original state, which depends on its composition and condition. MRI distinguishes normal tissue from pathological tissue based on proton density, T1 and T2 relaxation times, and water diffusion rates. Generally, tissue T1 and T2 relaxation times are longer, making it difficult to obtain bright images; therefore, contrast agents are needed to address this. Nowadays, gadolinium-based contrast agents are the most used MRI agents. However, there are many risks associated with the use of Gd-CAs, such as severe allergic effects, nephrotoxicity, and deposition within the brain. Demand for gadolinium-free MRI contrast agents motivated inorganic chemists to explore paramagnetic transition-metal complexes as potential alternatives. In our research, Co(II), Ni(II), Cu(II), and Gd(III) bimetallic complexes of pyridine-based polyamine macrocycle (L) were investigated to measure water T1 and T2 relaxations. The ligand L was synthesized from the Schiff base reaction of 2,5-dicarboxaldehyde and 2,2'-diamino-N-methyldiethylamine in methanol at high dilution, followed by NaBH₄ reduction. The ligand L was characterized with NMR spectroscopy. Then, it was converted to bimetallic complexes and characterized with infrared spectroscopy. These paramagnetic compounds were studied to measure the T1 and T2 relaxation times of water.

Acknowledgment: This project acknowledges the Department of Physical Sciences at Eastern New Mexico University.

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Sociohydrology on Grand Bahama: How Small Island Communities Continue to Navigate Freshwater Recovery 7 Years Post Hurricane Dorian

Graduate Presenter(s): Tanasee Boswell, ENMU; Jasper Joe, ENMU (undergraduate)

Author: Tanasee Boswel, ENMU

Author: Jasper Joe, ENMU

Author: Caitlyn Streseman, ENMU

Author: Yubitzu Truong, ENMU

Following the destruction of Hurricane Dorian (2019), Grand Bahama continues to recover. Damages from Hurricane Dorian included infrastructure, flooding, and saltwater contamination of wells. Grand Bahama, like many small subtropical islands in the Caribbean, depends on its freshwater lens, replenished by rainfall. The freshwater flows above denser seawater, making it highly vulnerable to extreme weather events. Understanding how these freshwater resources recover after hurricane-induced salt-water intrusion is essential for strengthening long-term water security and community resilience. The 2026 National Science Foundation International Research Experiences for Students Program (NSF IRES-GB) examines the socio-hydrological dynamics of freshwater lens recovery post-Hurricane Dorian. Using the hypothesis that socio-political pressures and post-disaster management decisions can influence the natural recovery of freshwater systems, student researchers conducted six weeks of interdisciplinary fieldwork, working with interested Bahamian citizens and water management personnel. Hydrological research consisted of water and soil salinity measurements, water-level monitoring, soil moisture, collection of water for stable isotope analysis, and infiltration experiments with the goal of evaluating water quality, salt levels, and aquifer recovery. Comparatively, the anthropological team used interviews, surveys, focus groups, and ethnographic observation to examine how residents, policy advocates, and water experts understand and respond to post-disaster water challenges.

Integrating hydrological and social data, this research contributes to the emerging field of socio-hydrology improving understanding of how small-island communities navigate extreme storms, limited freshwater, and recovery pressures. The data and findings conducted by the 2026 cohort will contribute insight into groundwater resilience and sustainable water-management in vulnerable island environments.

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HADES, the New Mexico Rotating Detonation Engine Materials Testbed Facility

Graduate Presenter(s): Mario Cestari, UNM

Author: Mario Cestari, UNM

Author: Dimitrios Vrocharis, UNM

Author: Micah Wolbrecht, UNM

Author: Brendan Canales, UNM

Author: Logan Bermudez, UNM

Author: Kerly Reyes-Contreras, UNM

Author: Alejandro Ramirez De Jesus, UNM

Author: Jeremy Williams, UNM

Author: Evan Unruh, Aerojet Rocketdyne

Author: Jeffrey Stout, Aerojet Rocketdyne

Author: Georgios Koutsakis, UNM

Rotating detonation engines (RDEs) have shown potential to become the new class of propulsion and power generation engine. The real advantage may not solely stem from a more efficient thermodynamic process but rather from the system's compactness. Most research on RDEs has concentrated on determining their operational parameters, thrust and pressure generation, and combustion characteristics, rather than on which materials are required for the combustor walls. Typically, the tests have been relatively short-duration tests with heat-sink chambers or with extensively cooled components. Materials used in these configurations range from copper, steel, fused quartz, ceramic matrix composites, or a combination of carbon-carbon composite and copper have been successfully operated for short periods of time. However, these materials may not be satisfactory for sustained operation under high-power conditions because they do not meet the very exacting requirements expected for the long term. These include being subject to very rapid (kHz and higher) thermal pulses, large thermal gradients and hypersonic detonation shockwaves.

The University of New Mexico has developed the world's first academic RDE materials testbed for sustained material exposure. This unique facility provides an opportunity to study the effects of rapid thermal cycling, high-frequency shock waves, and oxidation/corrosion on different candidate materials. In-situ materials data will inform material selection for future RDEs, enabling longer-duration operation and advancing the field of detonation-based propulsion. This poster will present each individual subsystem, its capabilities along with preliminary engine data, and the progress on testing thermal barrier coatings (TBCs) on this environment for the first time in the open literature.

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Music Training-Associated Modulation of Resting State Functional Connectivity in Children with Fetal Alcohol Spectrum Disorder

Graduate Presenter(s): Hyesun Choi, Mind Research Network / UNM HSC

Author: Hyesun Choi, Mind Research Network/UNM HSC

Author: Andrea Romero, Mind Research Network

Author: Donovan Roberts, Mind Research Network

Author: Jaynie Hakeem, Mind Research Network

Author: Dina Hill, UNM HSC

Author: Fletcher Christensen, UNM

Author: Geoffrey Harman, UNM

Author: Kamilla Venner, UNM HSC

Author: Julia Stephen, Mind Research Network

Topic/Problem: Fetal Alcohol Spectrum Disorders (FASD) affect about 1 in 20 children, yet few evidence-based interventions exist. Music training (MT), which may drive neuroplasticity in musicians, is associated with cognitive, behavioral, and sensorimotor benefits in typically developing children. In children with autism, MT modulated resting-state functional connectivity (rsFC), with post-MT rsFC linked to improved social communication. However, MT's benefits and neural effects in children with FASD are unclear.

Methods: Twelve children aged 8-16 with FASD were analyzed from a crossover trial of 12 weeks each of MT and music listening (ML; control) in randomized order. Eyes-closed (EC) and eyes-open (EO) resting-state magnetoencephalography (MEG) was recorded at baseline, post-MT, and post-ML. Phase locking value (PLV) in an a priori temporal-parietal network was analyzed with linear mixed effects models including hemisphere, eye condition, and random subject effect.

Results: Visit affected alpha and beta PLV (both $p < 0.001$). Alpha (8-14 Hz) PLV was higher post-MT versus baseline and post-ML (both $p < 0.001$). Beta (15-29 Hz) PLV was lower at post-ML versus baseline ($p < 0.001$) but not at post-MT ($p = 0.531$). In EO only, post-MT also differed from baseline ($p = 0.020$; visit x condition:

$p=0.014$). Higher post-MT alpha PLV correlated with improved focused attention (Continuous Performance Test Hit Reaction Time Block Change; $p=0.004$), though not FDR-significant.

Implication: Twelve weeks of MT showed altered resting-state PLV in alpha and beta bands in children with FASD. With 90% retention and high satisfaction, our findings support MT's potential for neural modulation. Larger studies with longer MT and cognitive-behavioral outcomes are ongoing.

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Removal of Uranium From Water Using a Water-Insoluble Urea Polymer

Graduate Presenter(s): Gifty Dudzilah, ENMU

Author: Gifty Dudzilah, ENMU

Uranium contamination of water is a major environmental issue, particularly in regions where groundwater is a primary source of drinking water. The presence of uranium in water requires the development of effective materials to remove uranium from aqueous systems. Adsorption-based treatment approaches are particularly attractive because appropriate adsorbent materials can interact with dissolved metal ions and help separate them from water. This study focuses on synthesizing and applying a water-insoluble polymeric ligand to remove uranium from aqueous solution. The study emphasized the effect of ligand amount and contact time on uranium removal. The polymeric ligand was synthesized by refluxing tris(3-aminopropyl)amine with 1,4-diisocyanatobenzene in chloroform for 24 hrs. After synthesis, the water-insoluble product was washed with water and isolated by filtration. The synthesized material was characterized by Fourier-transform infrared (FT-IR) spectroscopy to study changes in functional groups related to polymeric formation. In addition, X-ray Diffraction and transmission electron microscopy were used to characterize the ligand. The ligand's ability to remove uranium was examined by contacting different amounts of the synthesized material (0.02-0.13 g) with 10 mL of 0.01 M aqueous uranyl acetate solution. The effect of contact time on uranium removal was investigated by running experiments at 30, 60, and 90 min. After treatment, we centrifuged the mixtures at 4000 rpm to separate the solid ligand from the aqueous phase. We determined the uranium remaining in solution by UV-Vis spectroscopy. We calculated the uranium removal efficiency, distribution coefficient (K_d), and adsorption capacity (q) from the experimental data. These parameters provided complementary information about the percentage of uranium removed from solution, the distribution of uranium between the aqueous and solid phases, and the quantity of uranium associated with a given mass of adsorbent. The results showed that the synthesized water-insoluble polymeric ligand could remove the uranium from aqueous solution. Under the tested experimental conditions, uranium removal efficiency was 90% with 0.128 g Ligand and 90 minutes of contact time.

Overall, the results suggest that the synthesized water-insoluble polymeric ligand can be used as an adsorbent to remove uranium from contaminated water. The material's high uranium removal efficiency provides a basis for continued investigation for environmental remediation applications. Further studies, including additional material characterization, optimization of adsorption conditions, and testing under environmentally relevant water conditions, could help determine the practical applicability for treating uranium-contaminated water. This project was sponsored by Eastern New Mexico University's internal grant PIRR3. Ms. Gifty acknowledges the Sponsor Project at Eastern New Mexico University for providing the graduate assistant position and travel support. [Return to Table of Contents.](#)

Contamination, Blood Chemistry and Osmotic State of an Imperiled Turtle (*Pseudemys gorzugi*) in a Salt-Stressed River

Graduate Presenter(s): Spencer Duffendack, ENMU

Author: Spencer Duffendack, ENMU

Author: Amber Schaarschmidt, ENMU

Author: Anna Walker, ENMU

Author: Richard Cooper, ENMU

Author: Drew Davis, ENMU

Author: Corey Green, ENMU

The Pecos River represents an important aquatic environment in the Chihuahuan Desert that is undergoing severe anthropogenic disturbance, including marked salinity increase and pollution. Additional research is needed to effectively plan targeted conservation efforts for threatened taxa inhabiting the Pecos River. The Rio Grande Cooter (*Pseudemys gorzugi*) is a species of turtle that inhabits the degrading Pecos River, is conservation dependent, and requires further research to inform management decisions. The objectives of this study were to 1.) characterize contaminants and their concentrations within and outside of known *P. gorzugi* habitat along the Pecos River, 2.) characterize the physiological state of *P. gorzugi* along the gradient of salinization in the Pecos River and its tributaries, 3.) use these data to create a distribution model to predict suitable habitat for *P. gorzugi* and inform conservation efforts. Water quality parameters including specific conductance (salinity) and samples for contaminant analysis were collected at 28 sites with known presence or absence of *P. gorzugi* across the Pecos River. Water contaminant samples were sent to the Nebraska Water Center for broad contaminant screening (metals, inorganic Hg, organic pesticides, PFAS). We captured *P. gorzugi* across its range using hoop-net traps and collected 1–2 mL of blood from each individual. Blood was analyzed in the field using an i-STAT blood chemistry analysis system to determine blood Na⁺, K⁺, Cl⁻, iCa²⁺, BUN, and glucose. We hypothesized that *P. gorzugi* distribution will be negatively correlated with contaminant and conductivity levels in the Pecos River.

We also hypothesized that turtle blood chemistry will vary across the Pecos River such that blood osmolytes are elevated in individuals inhabiting environments with higher conductivity. The data collected during this study will be valuable as a reference for further monitoring the health of wild populations as well as the success of head-started turtles within the Pecos River Basin.

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Soil Carbon Response to Forest Management Treatments in Mid-elevation Forests of NM

Graduate Presenter(s): Aviva Elliott, UNM

Author: Aviva Elliott, UNM

Author: Anna Barnum, UNM

Author: Dr. Eva Stricker, UNM

Author: Dr. Rae DeVan, UNM

Author: Dr. Marcy Litvak, UNM

Forests cover 21% of New Mexico's land, with 54% of those forests classified as mid-elevation where management practices have impacts on forest health, regeneration post-wildfire, and hydrology. While thinning is a critical management practice, it differs in whether or not biomass is left on site or removed. The goal of this study is to establish soil organic carbon (SOC) response associated with these common forest management practices. To evaluate SOC response we have collected soil samples at two depths (0-10 cm and 10-30 cm) from experimental plots in Glorieta Canyon near Santa Fe, New Mexico. Using mass spectrometry we will quantify the amount of SOC present in each sample and compare these values across treatment types. Additionally, we will assess how bulk density and litter depth are related to SOC stocks varying with treatment type. We hypothesize that thinning in conjunction with the removal of biomass from the site, through pile and burn or mechanical removal, will significantly decrease the amount of organic carbon in the soil. Identifying management practices that increase the amount of SOC in forest soils in mid-elevation forests of New Mexico enhances carbon sequestration capacity, safeguards biogeochemical cycles, and accelerates forest regeneration post-wildfire under changing climatic conditions.

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Antimicrobial Properties and Mode of Action of Cinnamon and Cumin on *Escherichia coli* and *Staphylococcus aureus*

Graduate Presenter(s): Reuben Enchill, ENMU

Author: Reuben Enchill, ENMU

Author: Dr. Manuel F. Varela, ENMU

The growing problem of antimicrobial resistance highlights the need to find new ways to control harmful bacteria. The long-term goal of this research is to identify natural antimicrobial agents that may help reduce reliance on synthetic antibiotics. This study examined the antimicrobial properties of cinnamon and cumin against *E. coli* and *S. aureus*. The objective was to evaluate their ability to inhibit bacterial growth and possible cellular changes caused by the extracts. I hypothesized that cinnamon and cumin would cause concentration-dependent changes in bacterial cells, with different effects on Gram-negative and Gram-positive bacteria. Ethanolic extracts of both spices were prepared and tested using broth microdilution to determine their minimum inhibitory (MIC) and minimum bactericidal concentration (MBC). Time-kill assays also examined changes in viable bacterial counts over time. Gram staining and live/dead fluorescence microscopy were used to observe changes in cell morphology and membrane integrity. Cinnamon showed MIC/MBC values of 1.56/3.13 mg/mL against *E. coli* and 6.25/12.50 mg/mL against *S. aureus*, while cumin showed MIC/MBC values of 3.13/6.25 mg/mL against both bacteria. The cinnamon and cumin combination showed stronger activity, particularly against *S. aureus*, with a FICI of 0.28, indicating a synergistic interaction. In the time-kill assays, the combination treatment produced the strongest reduction in viable cells, with no colonies detected at later time points for both bacteria. These findings show that cinnamon and cumin have antimicrobial activity and their combination may provide greater activity than either extract alone. The microscopy results further helped examine possible cellular changes associated with treatment.

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Do Protein Language Models Capture Pathogenicity or Host Phylogeny? A Benchmark and Error Analysis on Orthohantavirus

Graduate Presenter(s): Rakibul Islam, NMT

Author: Rakibul Islam, NMT

Author: Clovis Barbour, NMT

Author: Paris Salazar-Hamm, NMT

Author: Huixin Zhan, NMT

Orthohantavirus is a genus of zoonotic RNA viruses maintained in animal reservoirs that can cause severe human disease after spillover. Identifying sequence features associated with pathogenicity is important for understanding viral evolution, spillover risk, and disease surveillance. In this study, we evaluated whether protein language models (PLMs) can distinguish reservoir-associated from human clinical sample-associated protein sequences, used here as a pathogenicity proxy, and whether their performance generalizes beyond closely related sequence groups. Using a curated dataset of 452 protein windows, we compared TF-IDF logistic regression, ProtBERT, ProstT5, and four ESM2 variants under repeated stratified cross-validation. We then evaluated representative models using sequence-identity-grouped cross-validation at 95%, 90%, and 85% identity for the S and M genome segments. Under conventional evaluation, ESM2-t6 achieved the highest macro-F1 (0.823), while TF-IDF achieved the highest ROC-AUC (0.911) and PR-AUC (0.728). However, discrimination weakened substantially under the strictest sequence-grouping condition. For the S segment, mean ROC-AUC decreased from 0.828 at 95% identity to 0.442 at 85% for TF-IDF, and from 0.842 to 0.516 for ESM2-t33. Increasing the available training fraction did not restore S-segment discrimination at 85% identity, while M-segment performance remained limited across grouping thresholds. Misclassification patterns were concentrated in specific host groups, genome segments, and protein windows. These findings suggest that apparent pathogenicity-proxy discrimination depends substantially on lineage-associated sequence structure and highlight the importance of sequence-similarity-aware evaluation for assessing generalization beyond closely related viral groups.

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Predicting Drought Intensification Using Machine Learning: Analyzing Transition Patterns and Environmental Drivers

Graduate Presenter(s): Suhithareddy Kantareddy, NMT

Author: Suhithareddy Kantareddy, NMT

Author: Zhang, Jiakai, NMT

Author: Shiyan Zhang, NMSU

Author: Jun Zheng, NMT

Drought is a major environmental challenge that affects water availability, agriculture, and ecosystems across the United States. Understanding how drought conditions develop and intensify is important for improving early warning systems and supporting water resource management. This research investigates the use of machine learning to predict drought intensification and identify the environmental factors associated with changes in drought severity.

The study integrates historical drought intensity records with meteorological data from ERA5-Land, including temperature, precipitation, soil moisture, evaporation, wind speed, and solar radiation. Initial experiments focused on predicting continuous drought intensity using a Random Forest model. However, prediction errors increased at higher drought severity levels, motivating a shift toward identifying drought intensification events. A binary classification model was developed to predict whether drought conditions would intensify in the following month, achieving a test accuracy of approximately 68% and a ROC-AUC of 0.725 when current drought intensity was included as a predictor.

Building on these findings, the research examines individual drought severity transitions, such as D0 to D1 and D0 to D2, to better understand how environmental conditions influence different levels of intensification. An initial transition-specific model for D0 to D1 achieved approximately 67.5% accuracy and a ROC-AUC of 0.716. SHAP analysis identified precipitation, accumulated precipitation, seasonal patterns, and temperature as important predictors. Spatial explainability analysis using GeoShapley also revealed differences in environmental contributions between New Mexico and the broader continental United States.

These findings demonstrate the potential of explainable machine learning to identify patterns associated with drought intensification. By examining individual severity transitions and their environmental drivers, this research aims to support more interpretable drought prediction models and contribute to improved drought monitoring and preparedness.

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Investigating Enzymatic and Nonezymatic Degradation of Thiazolidine Rings

Graduate Presenter(s): Andre Lonch, NMHU

Author: Andre Lonch, NMHU

Author: John Burghart, NMHU

Author: Dr. Steven Karpowicz, NMHU

Thiazolidine ring compounds are molecules that can non-enzymatically form biological precursors at nearly 100% yield under physiological conditions. The equilibrium favors product formation, but they have yet to be observed accumulating in cells. We are investigating means of degradation of these compounds enzymatically by D-Amino Acid Oxidase (DAAO) and non-enzymatically by glutathione molecules, including GSH, GSSG, and GSSH. Using NMR spectroscopy to observe the structural changes between the reactants and products, we may infer whether these products can be recycled to form useful molecules for the cell. Our aim is to explore a biochemical mechanism of product steady-state regulation. Thus far, we have observed structural alterations in thiazolidine ring compounds following reactions with DAAO, GSH, GSSG, and GSSH, which suggests potential degradation pathways. As thiazolidines can form from abundant molecules of central carbon metabolism, it is relevant to gain fundamental knowledge of biochemical mechanisms that can depress steady-state concentrations of thiazolidines.

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A Threshold-Based Abstention Layer for Surgical Vision-Language Models

Graduate Presenter(s): Hemanth Reddy Madduri, NMT

Author: Hemanth Reddy Madduri, NMT

Author: Jun Zheng, NMT

Author: Huixin Zhan, NMT

Gallbladder removal is among the most common surgical procedures, and bile duct injury remains its most serious complication. Surgeons prevent this injury by confirming the Critical View of Safety (CVS), a three-part visual check (cleared hepatocystic triangle, gallbladder separated from the cystic plate, and exactly two structures entering the gallbladder) performed before the cystic duct and cystic artery are clipped and cut. Automated tools are being developed to assess CVS from surgical video, but they answer every scene, even when uncertain. False positives are especially dangerous: a tool that wrongly reports CVS as achieved may lead a surgeon to cut before the anatomy is clearly identified, risking injury to the bile duct. We evaluated whether letting a vision-language model (VLM) abstain on uncertain scenes improves its reliability. An open-source VLM assessed CVS in 61,620 video frames from 15 expert-labeled operations in the public Cholec80 dataset, and frames below a confidence threshold were deferred for surgeon review. Without abstention, the model was wrong in 31.6% of frames, almost entirely through false positives. With abstention, the system answered 84.4% of frames (coverage), deferred 15.6%, and reduced its error rate on answered frames to 19.5%. False positives fell from 31.5% to 16.3% of all frames, nearly halving the most dangerous type of error. Threshold-based abstention thus offers a simple, effective way to reduce unsafe errors in surgical VLMs.

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Evaluating Vision-Language Models for Safer Gallbladder Surgery

Graduate Presenter(s): Shefali Mandal, NMT

Author: Shefali Mandal, NMT

Author: Hemanth Reddy Madduri, NMT

Author: Huixin Zhan, NMT

Gallbladder surgery is one of the most common surgical procedures, but injuries can occur when important anatomical structures are misidentified. To reduce this risk, surgeons use a visual standard called the Critical View of Safety (CVS) to confirm that the anatomy is clearly understood before cutting.

In this study, we examine whether an artificial intelligence model can evaluate CVS from short surgical video clips and, importantly, recognize when it is uncertain and should defer the decision to a human expert. We tested a vision-language model on 4,093 six-second video segments and evaluated not only how often it was correct, but also the types of mistakes it made, how consistent its decisions were, and whether uncertain or incorrect cases could be corrected during a second evaluation.

The model achieved 75.03% overall accuracy without additional training. When we required the model to reach a high confidence level before making a decision, it successfully flagged 99.12% of its errors for further review. Among the cases it chose to answer, accuracy increased to 99.69%, while the model provided decisions for approximately 70% of the video segments. However, several clinically important errors remained. In particular, nine of 20 cases in which CVS was actually achieved were incorrectly classified as clearly negative. A second evaluation also failed to correct any of 12 selected incorrect or uncertain cases.

These findings show that high overall accuracy does not necessarily mean an AI system is safe for clinical use. Medical AI should be evaluated not only on whether it gives the correct answer, but also on whether it can recognize uncertainty, identify potentially dangerous mistakes, and appropriately defer difficult cases to human experts.

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3D Printing in Action: Stories from K-12 Classrooms

Graduate Presenter(s): Sumanth Reddy Nandhikonda, NMSU; Riges Krishnaraj, NMSU

Author: Riges Krishnaraj, NMSU

Author: Sumanth Reddy Nandhikonda, NMSU

Author: Sayantan Maity, NMSU

Author: Suparna Chatterjee, NMSU

Three-dimensional printing (3DP), or additive manufacturing (AM), is increasingly used in K-12 education to stimulate students' interests in science, technology, engineering, and mathematics (STEM) through hands-on design and printing. Successful integration requires schools and educators to consider how the technology can support existing curricular goals rather than serve as a stand-alone activity. The study explored "How do K-12 teachers enact 3D printing in diverse classroom contexts?" The qualitative case study approach was used to collect and analyze data from classroom observations, lesson plans, reflections, and individual interviews from three K-12 teachers who participated in the professional development and then implemented it in their classes. The analysis focused on how teachers integrated 3DP into classroom instruction across different subject areas and the instructional strategies used to support student learning. Findings indicated that teachers adapted 3DP to subject-specific objectives while fostering creativity, problem-solving, and engineering design thinking. In seventh-grade science, students designed rainwater harvesting systems and helmets using engineering design principles. In eleventh-grade computer science, students used a Design–Code–Print approach to create components of a future city. In seventh-grade ELA, students translated literary concepts into 3D-printed character models based on story elements and traits. Across the cases, teachers integrated 3D printing into existing curricula rather than treating it as a standalone activity, using project-based learning and design challenges to apply subject-specific concepts through authentic problem-solving experiences. These findings suggest that professional development supports teachers' integration of 3DP across diverse contexts and highlights its potential to enhance STEM and non-STEM learning experiences.

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Thiazolidine Formation from Biologically Relevant Aldehydes and Cysteamine: Potential Histamine Agonists or Antagonists

Thiazolidine Formation from Biologically Relevant Aldehydes and Cysteamine: Potential Histamine Agonists or Antagonists

Graduate Presenter(s): Lawrence Ongboja, NMHU

Author: Lawrence Ongboja, NMHU

Author: Dr. Steven Karpowicz, NMHU

Biologically active amines and polyamines undergo oxidative metabolism to produce reactive aldehydes that may interact with cellular compounds. Understanding these reactions is important because aldehyde-derived products may influence biological processes. Although amino aldehydes can react with compounds containing amino and thiol groups, their reactions with cysteamine require further investigation. This study examined thiazolidine formation from an amino aldehyde model compound and explored diamine oxidase (DAO) activity using histamine as a reference substrate.

We used tert-butyl (3-oxopropyl)carbamate as a model aldehyde and investigated its reaction with cysteamine before and after acid-mediated Boc deprotection. We characterized the reaction mixtures using nuclear magnetic resonance (NMR), Raman spectroscopy, and UV-Visible spectroscopy. Proton NMR showed a decrease in the aldehyde signal near 9.5 ppm and the appearance of new resonances following cysteamine addition. Two-dimensional NMR revealed proton-carbon correlations consistent with formation of a new product. Raman measurements also showed decreased thiol-associated signals, supporting chemical changes during the reaction. Together, these findings support the proposed formation of a thiazolidine derivative, although additional structural confirmation is needed.

We also investigated DAO-catalyzed histamine oxidation using a hydrogen peroxide detection assay. Preliminary measurements revealed substantial background signals, indicating the need for further assay optimization.

These findings provide spectroscopic evidence supporting amino aldehyde-cysteamine reactions and establish a foundation for investigating enzyme-generated aldehydes and their potential biological significance.

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Modeling the Behavior of Thermal Radiation in Translucent Ceramic Barrier Coatings

Graduate Presenter(s): Carldon Pascual, UNM

Author: Carldon Pascual, UNM

Author: Michael Presby, NASA

Author: Jeffrey Eldridge, NASA

Author: Bryan Harder, NASA

Author: Georgios Koutsakis, UNM

As temperatures rise for a black body, the emissive power increases exponentially and shifts to shorter wavelengths according to Wien's Law. Over time, engines have shifted towards higher combustion temperatures to favor higher efficiency and power. Many of these engines are protected by ceramic coatings to prevent melting. As the shift to higher temperatures continues, thermal radiation is a growing concern as these coatings are translucent in the bandwidths where thermal radiation is greatest. A 1-D heat transfer model was created to understand the behavior of thermal radiative fluxes in a two-layer system consisting of a thin ceramic coating and a superalloy substrate. From this model, the convective, conductive, and radiative thermal fluxes along with the temperatures throughout the coating and substrate can be quantified and examined. The objective is to determine the overall contribution of thermal radiation at higher temperatures, and its importance for the development of future ceramic coatings.

A previous experimental study is considered to validate the model. This previous work involves using a carbon dioxide laser (10.6 μm wavelength) to apply a uniform heat flux to a Nickel-based superalloy with a 7 wt.% Yttria-stabilized zirconia (7YSZ) thermal barrier coating (TBC). The TBC and superalloy surface temperatures are measured with a single and two-color pyrometer, respectively. The sample also features a sensing layer at the TBC-bond coat interface to enable luminescence-based measurements of the coating-metal interface temperature.

The temperature gradient through the system is predicted using the 1-D model based on the material thermal properties and thermal fluxes. The results from the model are shown to correlate well to the experimental data.

This research is based upon work supported by the New Mexico Space Grant Consortium (NMSGC) SpaceGrant Fellowship through a NASA Cooperative Agreement No. NM-80NSSC25M7069

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Hotspot Stability of Freight Vehicle Crashes Involving Vulnerable Road Users: A Spatiotemporal Perspective

Graduate Presenter(s): Daniel Pineda Agudelo, UNM

Author: Daniel Pineda-Agudelo, UNM

Author: Carlos Rivera-Gonzalez, UNM

Author: Oriana Calderon, UTK

Author: Manuela Cordoba-Misas, UTK

Freight vehicles and vulnerable road users (VRUs), i.e., pedestrians and bicyclists, share urban and regional road networks despite major differences in mass, visibility, and physical protection. Previous freight–VRU transportation safety research has largely emphasized crash characteristics, injury severity, or static hotspot maps, providing limited insight into whether high-risk locations are newly emerging, sustained, or intermittent over time. This study addresses that gap by examining the spatiotemporal stability of freight–VRU crash hotspots in New Mexico and Tennessee and relating those patterns to roadway exposure and operating conditions. Crash records from 2013–2023 in New Mexico and 2015–2024 in Tennessee were standardized by severity and aggregated into annual 1 km² grid cells. Space–time cubes, the Getis–Ord Gi* statistic, and Emerging Hot Spot Analysis classified statistically significant locations as New, Consecutive, Sporadic, and other hotspot types. INRIX-derived average daily traffic (ADT) and average median speed were then compared across hotspot and no-pattern zones, with Welch’s two-sample t-tests used for total-crash comparisons. New, Consecutive, and Sporadic hotspots dominated in both states, demonstrating that freight–VRU crash concentrations are temporally dynamic. In New Mexico, hotspots were concentrated around major urban areas and selected corridors. Statewide hotspot typologies had significantly higher ADT than no-pattern segments ($p < 0.001$), while hotspot segments generally had lower average median speeds. These findings show that temporal hotspot classifications, combined with network context, can help transportation agencies and land use planners distinguish emerging from sustained safety concerns and prioritize context-sensitive freight, pedestrian, and bicyclist interventions.

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Integrating Agentic AI into Workflow Management: A Framework for Increasing Productivity

Graduate Presenter(s): David Smith, ENMU

Author: David Smith, ENMU

Agentic Artificial Intelligence (AI) has the potential to transform workflow management to automate routine tasks, enhance decision support systems and improve operational efficiency. These capabilities offer opportunities to increase productivity and manage workloads with less increased demand for resources. Organizations may lack a structured approach for how to integrate Agentic AI into existing workflows and how to evaluate its effectiveness. This research will reveal what Agentic AI integration might do for project managers through assessment, adoption and implementation of AI-enabled workflow capabilities. This study will address the question about the relationship between the framework methods and the application tools. Workflow activities like goal setting, budgeting, reporting, coordination, documentation, risk management, stakeholder communication and even e-mail management occupy a sizeable part of any manager's day. This research begins with an analysis of current workflow practices and identifies opportunities where AI integration can provide measurable improvements. Research methods include literature review, interviews, surveys and practical experimentation. The study will anticipate workflow performance before and after AI integration using measures such as simulated productivity, process efficiency, decision quality, workload capacity and user satisfaction. Findings will be used to develop a decision model to address workflow assessment, AI readiness, opportunity identification, capability mapping, tool evaluation, implementation and governance. The expected outcome is a practical framework that enables project managers to integrate Agentic AI into existing workflows, evaluate its impact and identify solutions that deliver sustainable productivity improvements while maintaining transparency, accountability and appropriate human oversight.

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When Voices Are Ignored: Lessons on Community-Engaged Research From Two Case Studies in Grand Bahama

Graduate Presenter(s): Caitlyn Streseman, ENMU

Author: Caitlyn Streseman, ENMU

Author: Yubitzu Truong, ENMU

Author: Tanasee Boswell, ENMU

Author: Jasper Joe, ENMU

The Commonwealth of the Bahamas, a small island developing state (SIDS), is no stranger to scientific research. However, despite the vast amount of research done, very little research has actively incorporated local Bahamian voices. This research explores two projects, both conducted in The Bahamas, that prioritized community opinions. The first, a sociohydrology project measuring the social and environmental resilience on Grand Bahama Island following a catastrophic hurricane, incorporated Bahamian voices spanning from local government employees to local fishermen to attempt to understand how individual citizens are still affected post disaster and their perceptions of water and policy makers. The second project, centered around an archaeological collection from Grand Bahama Island, included Bahamian voices through consultation with staff of the National Museum of The Bahamas and local Bahamians to ascertain interest levels in archaeology and what locals wished to learn. While the projects focused on separate topics, the results of both highlighted the interest of Bahamian communities and their desire for their voices to be heard within academia, emphasizing the importance of community engaged research. Not only are these results of these projects contribute to the framework of community engaged research in the areas of sociohydrology and archaeology, the results contribute to the broader discussion of community engaged research within small island developing states.

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Sociohydrology in Grand Bahama: Stakeholder Mapping of Water Dynamics

Graduate Presenter(s): Yubitzy Truong, ENMU

Author: Yubitzy Truong, ENMU

Hurricane Dorian's landfall in 2019 produced unprecedented drinking water shortages on Grand Bahama as storm surge and infrastructure failures disrupted the island's already vulnerable freshwater lens. Although the hydrological impacts of the storm are well documented, far less attention has been given to the historical, institutional and political processes that shape how water is managed. This project applies a sociohydrological framework to examine the co-evolution of humans and the now limited freshwater in Freeport, Grand Bahama.

Drawing on fieldwork conducted with the National Science Foundation and International Research Experience for Students over the span of 6 weeks in Grand Bahama; the data collected uses a stakeholder based system to better understand these interactions into Causal Loop Diagrams. Historical account, environmental data and participant observation are integrated to evaluate how anthropogenic factors shape resilience following extreme weather events.

The findings highlight how water resilience on Grand Bahama are not solely hydrological but social issues that are deeply influenced by legacy decisions and uneven resource access. By foregrounding human environment interactions, this research contributes to broader discussion of resource management, climate adaptation and the future of sustainable water planning for small island communities.

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From Dragonflies to Drones: Biomimicry as Engineering Design Bridge in Inclusive Elementary Science Classroom

Graduate Presenter(s): Mary Yalnaty, NMSU; Suneetha Yalnaty, NUSD

Author: Mary Edwina Yalnaty, NMSU

Author: Dr. Suparna Chatterjee, NMSU

Author: Suneetha Yalnaty, Science Teacher NUSD

This poster explores how to introduce elementary students to the exciting world of drone technology through the lens of biomimicry. Biomimicry, the practice of observing and imitating nature's patterns to solve human challenges, offers a highly accessible bridge for young learners to connect biology with the engineering and technology. By studying nature's flyers like dragonflies, whose unique flight mechanics have directly inspired the development of advanced flapping wing drones, students can easily grasp basic aerodynamics such as lift and drag. This chapter offers a framework for five week engineering module in grades 3-5 that move students from observing biological flight to designing and testing simple uncrewed aerial vehicles. The framework advances a 3 phase instructional arc: sustained observation of biological phenomena such as dragonfly and avian flight; abstraction of underlying physical principles including lift, drag, thrust and stability; and application to those principles through iterative engineering design. Each phase is analyzed for its disciplinary demands and its accessibility, with universal design for learning used to surface the design decisions that determine whether all learners can participate meaningfully. Particular attention is given to students receiving special education services and multilingual learners, including differentiated participation roles, multiple means of representing aerodynamic concepts, and language scaffolds for engineering discourse. The module is presented as a design case grounded in the author's classroom practice as an elementary special education and multilingual educator, rather than as an empirical study. Its purpose is to make instructional reasoning visible and transferable. The chapter concludes with the design principles that educators can adapt across grade bands, content areas and technology contexts, including settings without a drone access. In doing so, it addresses a persistent equity gap in which inclusive classrooms receives reduced access to engineering rich science instruction.

The key takeaways are:

- Actionable K5 Lesson modules: Discover age-appropriate sequenced activities like “Nature's Flyers” and “Biomimicry Brainstorm”, which challenge student groups to connect animal flight characteristics directly to drone design.

- Foundational STEM Integration: Learn how to use biological inspiration to teach fundamental physical concepts, specifically lift and drag, using high accessible materials such as paper airplanes, balloon rockets, and simple drone models.
- Fostering 21st century skills: See how combining biomimicry and drone modeling naturally encourages collaboration, critical thinking, and creative problem solving.
- Safety and classroom management: Gain practical strategies for establishing a safe learning environment for drone education, including designated “no-fly zones”, managing simple equipment, and structuring safe obstacle courses for student models.

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Development of Cellulose Reconstitution from Lignocellulosic Biomass from *Salsola tragus*

Post-baccalaureate Presenter(s): Rue Allison, UNM

Author: Rue S. Allison, UNM

Author: Muhammed M. Saeed, UNM

Author: Jacob A. Greenberg, UNM

Lignocellulosic biomass is a renewable resource composed primarily of cellulose, hemicellulose, and lignin. This project investigates cellulose reconstitution from locally collected, dried *Salsola tragus*, commonly known as tumbleweed, an invasive plant that creates challenges for agriculture and land management in New Mexico. By exploring potential uses for this abundant plant, this research aims to identify opportunities to turn an agricultural and environmental challenge into a valuable resource. The current protocol uses Schweizer's reagent, a copper-ammonia complex that dissolves cellulose, to facilitate its separation from other plant components. Because the reagent is unstable, we have developed a protocol to prepare fresh reagent for each experiment. Different tumbleweed breakdown methods and acid concentrations are being evaluated to improve sample consistency and cellulose reconstitution. Developing an efficient and reproducible protocol will establish a foundation for future lignin isolation and characterization from tumbleweed biomass. Future work will focus on isolating lignin and investigating its potential antioxidant and anti-inflammatory properties. Additional research may explore lignin as a renewable, carbon-rich resource with potential applications in other fields. This project represents an initial step toward evaluating the potential value of an invasive plant through biomass processing and natural product research.

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STEM in Plain Sight: The Hidden Science of Family and Consumer Sciences

K-12 Teacher Presenter(s): Elizabeth Aragon, Gadsden High School

Author: Elizabeth Aragon, Gadsden High School

Family and Consumer Sciences (FCS) draws on scientific inquiry, quantitative reasoning, technology, and applied problem-solving in familiar contexts, including food science, nutrition, textiles, and human development. Despite these connections, FCS is often discussed separately from conventional science, technology, engineering, and mathematics (STEM) disciplines. This developing literature review examines the conceptual basis for understanding FCS as applied STEM and considers what disciplinary recognition could mean for broader participation in STEM learning.

The purpose of this research is to synthesize interdisciplinary scholarship on the scientific and experiential foundations of FCS and evaluate arguments for recognizing FCS as an applied STEM discipline. Three guiding questions inform the review: (1) How do the content and instructional practices of FCS align with characteristics commonly associated with STEM education? (2) What historical or disciplinary boundaries shape the visibility of FCS within STEM discourse? (3) What potential implications might this recognition have for accessible STEM learning experiences, particularly for girls and young women?

The review draws on Kolb's experiential learning theory to examine how authentic tasks, experimentation, reflection, and application connect FCS instruction to STEM learning. Bandura's self-efficacy theory provides a lens for considering how opportunities for successful participation in applied scientific tasks may relate to learners' confidence. Gender and disciplinary recognition also frame questions about which educational experiences are recognized as STEM and whose participation those classifications make visible.

The project uses a narrative, conceptually organized literature review. Sources will be examined across FCS education, STEM definitions and integration, experiential learning, self-efficacy, and gender participation. The synthesis will compare recurring concepts, identify areas of alignment and disagreement, and distinguish documented evidence from proposed implications.

The intended contribution is a defensible conceptual argument for considering FCS within applied STEM education, alongside a clearer account of where further evidence is needed. The literature review and thematic synthesis remain in progress; findings will be presented as preliminary and appropriately qualified. No original participant data are being reported, and any claims about effects on girls' or women's STEM participation will be limited to what the reviewed evidence supports.

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Economic Impact of Forest Wildfires on Six Counties within the Santa Fe National Forest in Northern New Mexico.

Postdoc Presenter(s): Mariam Gharib, NMSU

Author: Mariam Gharib, NMSU

Author: Sawssan Boufous, NMSU

Wildfires are common in the forested areas of the Southwestern US. In 2022, the state of New Mexico experienced the worst wildfire in its history, the Hermit's Peak-Calf Canyon Fire, which burned over 340,000 acres of forested terrain in the Santa Fe National Forest, resulting in deaths and damage to homes, watersheds, and the water supply etc. Various studies have examined the effects of Santa Fe National Forest wildfires on water quality and air quality. Still, none has examined the economic impacts of forest wildfires on communities adjacent to the Santa Fe National Forest, despite rising wildfire risk. The purpose of this study is to examine the economic impact of forest wildfires on six counties within the Santa Fe National Forest. Specifically, we examine the effects of wildfires on per capita income, the number of employed people, and the unemployment rate. To do this, we will use a 25-year county panel dataset from 2000 to 2024 and a Two-Way Fixed Effects Model for the analysis. We expect the economic effects of wildfires to vary across counties, and the policy implication is that there is a need for more government intervention in counties that are more economically affected by wildfires.

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