2026 EPSCoR Summit Flash Talks Archive

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Designing Community Engagement, Impact, and Insights

Launching SIMCoast Boundary Organization to Connect Research, Communities, and Societal Impact

Vinka Craver, University of Rhode Island
E-RISE RII (#2438542)

NSF EPSCoR E-RISE projects aim not only to advance research capacity but also to ensure that scientific knowledge translates into societal impact. Achieving this goal requires effective mechanisms to connect researchers with communities, industry, and decision makers. The SIMCoast project focuses on the socio-ecological impacts of microplastics in coastal ecosystems and established a Boundary Organization to support collaboration among scientists, community organizations, industry partners, and government agencies in Rhode Island. This flash talk will describe the startup and early implementation of the SIMCoast Boundary Organization and its role in facilitating stakeholder engagement, knowledge co-production, and communication between research teams and external partners. The presentation will highlight how the initiative structured engagement activities, built partnerships across sectors, and developed mechanisms to ensure that research findings are shared with communities and stakeholders who can use them. The talk will also discuss key challenges encountered during early implementation, including coordinating across institutions, building trust with community partners, and aligning research timelines with stakeholder needs. It will share lessons learned that may inform similar efforts within EPSCoR and other interdisciplinary research initiatives.

From Water Stories to Research Insights: Lessons Gathered from Community Knowledge of Water Hazards

Liz Skilton, University of Louisiana at Lafayette
Focused EPSCoR Collaborations (FEC) (#2418434)

This flashtalk explores efforts to gather community interviews on water hazard experiences in Louisiana, Mississippi, and Alabama from April to November 2025. I will review how we collaborated with a transdisciplinary team to create questions that yield meaningful results, while documenting community histories at pop-up events called History Harvests across the tri-state area. The talk will cover strategies for community engagement, recording histories, and producing valuable research throughout this process.

Role of Flood Risk Models in Identifying and Reversing Disproportionate Community Impacts

Emad Habib, University of Louisiana at Lafayette
Focused EPSCoR Collaborations (FEC) (#2418434)

The impacts of extreme floods disproportionately affect communities with limited resources and infrastructure to prepare for and respond to flooding. This vulnerability is further compounded by historical disinvestment and development patterns that have pushed residents into high-risk areas. Flood impacts are not experienced uniformly, yet traditional modeling approaches often overlook localized priorities and unintended cross-jurisdictional effects. This can contribute to a reinforcing cycle of misinformation, misallocation of resources, and inequitable outcomes. Transparent, community-centered modeling is therefore critical to support equitable planning and informed decision-making. This study presents a co-production approach to examine how flood models can support the collaborative formulation, evaluation, and prioritization of mitigation investments across multiple jurisdictions. The overarching goal is to advance best practices in flood modeling that address unequal risk distribution, reflect the social and contextual realities of at-risk communities, and ultimately help reduce disproportionate impacts.

Equitable Nature-Based Solutions: AR Co-Creation of Community Stormwater Design for Resilient Cities

Johanna Barthmaier-Payne, Rhode Island School of Design
Focused EPSCoR Collaborations (FEC) (#2418379)

Nature-based solutions (NbS) are recognized as effective strategies for addressing urban flooding and extreme heat. However, conventional planning and design processes often limit meaningful participation from communities most impacted by climate change, creating barriers to equitable implementation. As part of the Equitable Nature-Based Climate Solutions project, this activity explores how augmented reality (AR) can support more inclusive, community-driven approaches to stormwater design. Through a series of co-creation workshops in three living hubs, Providence, RI; Manchester, NH; and Louisville, KY, community participants engaged with site-specific AR visualizations of potential nature-based stormwater interventions. Using accessible AR tools, participants co-created landscape design scenarios in situ, including hybrid recreational elements and green stormwater infrastructure. Participants proposed new ideas based on lived experience, neighborhood priorities, and environmental concerns. The workshops combine visualization with participatory design methods, including skill sharing, discussions, and think-aloud surveys. Through this approach, participants understand stormwater dynamics, assess tradeoffs, and contribute to potential interventions. By bridging technical expertise and community knowledge, this work demonstrates how immersive technologies can help co-produce responsive, place-based nature-based solutions and advance community-engaged climate resilience.

Community-Informed Urban Water Resilience Planning

Berneece Herbert, Jackson State University
Focused EPSCoR Collaborations (FEC) (#2418434)

Water crises in Jackson reveal not only infrastructure failure but also deeper challenges in urban planning, governance, and equitable service delivery. This flash talk presents a community-engaged qualitative study examining how residents experience water system disruptions and how these experiences shape perceptions of resilience, preparedness, and planning effectiveness. Using semi-structured interviews and a narrative-phenomenological approach, the research captures how past crises—including the 2022 water system failure and recurrent flooding—inform household-level adaptation, trust in public institutions, and perceptions of planning decisions. Findings highlight a critical

planning challenge: infrastructure interventions often prioritize technical solutions while overlooking social vulnerability, community knowledge, and uneven recovery outcomes. The talk demonstrates how integrating lived experience into planning processes can improve infrastructure decision-making, strengthen community trust, and support more equitable resilience strategies. By positioning residents as key informants in infrastructure planning, this work advances urban planning practice toward more inclusive, data-informed, and community-responsive approaches to water system resilience.

Embedding Knowledge Co-Production and Community Engagement into Research

Kristi Hansen, University of Wyoming
EPSCoR RII: Track-1 (#2149105)

In the Wyoming Anticipating Climate Transitions project (WyACT), academic researchers and engagement experts partner with Wyoming decision-makers and communities to understand, anticipate, and prepare for changes in water availability in the headwaters regions of western Wyoming. Approximately 50 investigators from over 15 departments across the University of Wyoming are conducting applied, integrated research motivated by the desire to build ecological, social, and economic resilience in the face of a changing water supply through co-production of knowledge and collaborative research with community partners (representatives from federal and state agencies, local governments, conservation districts, conservation and recreation interests). The project has ultimately been successful at facilitating community-inspired and community-led research that supports Wyoming's communities in anticipating and preparing for significant changes in water availability. In this presentation we share some of the challenges we faced in developing a common understanding within the WyACT project of knowledge coproduction and community engagement; and some of our strategies for overcoming these challenges. We also provide examples of cases where knowledge coproduction and other forms of engagement have been successful in improving research outcomes and shifting local conversations around water availability; and in improving current student/future researcher capacity to conduct engaged research. (Co-Presenters: Rebecca Witinok-Huber, Emma Carlson, Brent Ewers, Kristi Hansen, Jake Hawes, and Caitlin Ryan)

Leveraging Advanced Computation and Modeling in Research

Uncovering the Blackbox of Machine Learning Models for PFAS Groundwater Occurrence

Runwei Li, New Mexico State University
Focused EPSCoR Collaborations (FEC) (#2418751)

Per- and polyfluoroalkyl substances (PFAS) are persistent groundwater contaminants that pose long-term risks to water sources and public health. Predicting PFAS occurrence remains challenging due to high-dimensional environmental data and limited model interpretability. In this study, we benchmarked explainable machine learning models to predict PFAS occurrence in groundwater and to identify the dominant drivers governing contamination patterns. A comprehensive dataset of 12,406 groundwater characterization records collected between 2001 and 2019 was compiled with 172 explanatory features to describe PFAS source proximity, land use, hydrogeology, soil properties, meteorology, and sampling sites characteristics. Model interpretability was addressed using SHapley Additive exPlanations (SHAP), which revealed that sampling year and proximity to major PFAS sources were the dominant predictors across all models. Additional contributions were attributed to biosolids application sites, septic systems, soil texture, hydrologic features, land use, and precipitation patterns. SHAP interaction analyses further demonstrate strong temporal modulation of source-related predictors, reflecting shifts in contamination patterns associated with regulatory actions, evolving monitoring strategies, and secondary PFAS sources. Collectively, this study achieved interpretable prediction for PFAS occurrence in groundwater, and offered a transparent, data-driven framework to inform PFAS risk assessment.

High Performance and Scalable Computing for Dynamic Graphs: Challenges and Algorithmic Innovations

Shaikh Arifuzzaman, University of Nevada, Las Vegas
EPSCoR Research Fellows (#2323533)

Modern scientific and societal applications increasingly rely on dynamic graphs to model evolving relationships in data, from infrastructure networks to epidemiological systems. However, scaling dynamic graph analytics on high-performance computing (HPC) platforms remains a fundamental challenge due to irregular computation, high communication costs, and architectural heterogeneity. This talk presents recent advances

in algorithmic and systems co-design for scalable dynamic graph processing, developed under an NSF EPSCoR project. We introduce communication-efficient distributed algorithms, streaming and incremental graph techniques, and machine learning-based autotuning methods that adapt to diverse hardware environments. Together, these approaches enable significant improvements in performance, scalability, and portability across CPU/GPU systems. The talk will highlight key insights, open challenges, and opportunities for interdisciplinary collaboration, positioning dynamic graph analytics as a critical enabler of data-driven discovery in EPSCoR-relevant domains.

Super Nova Geant Simulations for IceCube Gen2

Sean Roubion, Southern University and A&M College
E-CORE RII (#2019597, 2140571)

We report a GEANT4~11.3--based simulation of the IceCube detector. The full 206-string IceCube geometry, together with a realistic ice model, has been implemented. Muons, electrons, and tau leptons can be simulated over an energy range from MeV to 100~TeV. Hadrons can also be simulated up to 100~TeV; however, in this work we present results only for supernova neutrino simulations. The resulting hits, including the effects of average digital optical module quantum efficiency, are recorded.

Convergent Research on Edge Artificial Intelligence

Na Gong, University of Alabama
Focused EPSCoR Collaborations (FEC) (#2611071, 2218046)

Edge Artificial Intelligence (Edge AI) has emerged as a transformative paradigm that enables real-time, energy-efficient, and privacy-preserving intelligence by processing data directly on edge devices rather than relying on cloud-centric architectures. Despite its promise, realizing practical Edge AI systems remains challenging due to the complexity of conventional AI algorithms, energy and development constraints of AI hardware, limitations in edge sensing, and the lack of effective co-design methodologies that integrate algorithms, hardware, sensing, and systems. To address these challenges, our NSF-funded RII Track 2 FEC project has established a multi-institutional research infrastructure that brings together complementary expertise from seven institutions across Alabama, Arkansas, and North Dakota. This flash talk will present key research outcomes enabled by this project, including advances in efficient Edge AI algorithms, efficient hardware accelerators, novel sensing devices, and integrated system design. The talk will

also highlight workforce development efforts, interdisciplinary training models, and collaborative practices. Finally, we will share practical lessons learned from building and sustaining a distributed research ecosystem, offering insights applicable to other large-scale, collaborative initiatives in emerging technologies.

Probabilistic Flood Mapping for Idaho Under Precipitation Uncertainty Using 2D Hydrodynamic Model

Md Saiful Ashraf Munna, Idaho State University

Flooding is among the most frequent and deadly natural disasters in the United States. In Idaho, flood hazards are driven by complex interactions between extreme rainfall and snowmelt across diverse watersheds, yet current flood maps often rely on single-value rainfall estimates that fail to capture uncertainty in extreme precipitation frequency analysis. Traditional momentum based mathematical modeling workflows demand extensive computational resources, and are prone to model instability which makes statewide probabilistic flood mapping largely impractical. This study deploys a Lagrangian rivulet-based 2D hydrodynamic model which tracks slope-driven fluid parcels, reducing computational complexity by large magnitude. The workflow spans rainfall preprocessing using NOAA Atlas 14 mean estimates and 90% confidence interval bounds across recurrence intervals of 50, 100, 500, and 1000 years and durations of 1, 6, 12, and 24 hours; large-scale flood simulation using statewide 30-m resolution DEMs; and geospatial postprocessing of inundation outputs. Key challenges include finding suitable ground truth dataset for calibration and validation, computational limitations and scalability. By advancing uncertainty-aware flood modeling beyond traditional approaches, this work builds research infrastructure that enables statewide and large-scale flood mapping, systematic comparison with conventional methods, pathways for broader regional applications and more robust decision-making tools.

Cultivating Talent and Building Student Participation in Research

Curating Institutional Memory: AI, Metadata, and Student-Led Digital Archiving

Russell Michalak, Goldey-Beacom College

Focused EPSCoR Collaborations (FEC), E-CORE RII (#2438144)

This case study examines a student-led, AI-assisted workflow for curating and describing 250 archival images at an emerging Hispanic-Serving Institution for both a public digital collection and a commissioned visual-history book. Two undergraduate co-creators routed 67 records into an AI-assist lane when drafting stalled, then verified and revised outputs using institutional sources, local authority files, and final librarian review. Drawing on student journals, task notes, and paired human draft-AI output sets, the project analyzed how AI shaped archival description, metadata quality, and public-facing storytelling. Findings show that AI helped accelerate early drafting but often introduced speculative dates, generic phrasing, and culturally flattening language. Student verification and revision removed unsupported claims and improved contextual specificity, inclusivity, and vocabulary alignment. The project demonstrates that undergraduates can effectively govern AI-assisted archival description within a human-centered accountability framework and offers a replicable quality-assurance model for libraries seeking to combine experiential learning, digital archiving, and ethical AI use. *(Co-Presenter: Rachel Gandhi)*

TRUE ACCCES 4C Model and Co-Mentoring for Student Success

Hannah Childs, Northern Kentucky University (#2225771)

This project introduces the 4C model, an integrative student success framework supporting the retention, graduation and career transition of STEM students. The model's four components—co-mentoring, career development, community building and content-area research experiences—address academic preparation, belonging, identity development and professional pathway formation. Grounded in a theory of change informed by Self-Determination Theory and the Four Frames framework, the 4C model emphasizes autonomy, competence and relatedness as core drivers of student success. They are operationalized through sustained, high-impact practices embedded in students' institutional experience, moving beyond isolated interventions toward a systemic,

relational and developmentally grounded approach. Implemented through the TRUE ACCCESS fellowship, the model engages students in a longitudinal experience integrating academic, social and professional development. By aligning faculty engagement, peer networks and institutional resources within a unified structure, the design disrupts siloed approaches and supports students in building navigational capital, developing professional identity and accessing culturally responsive forms of support often absent in traditional STEM pathways. This presentation introduces the full 4C framework and highlights co-mentoring as a key component, illustrating how reciprocal, non-hierarchical relationships foster belonging, competence and agency. *(Co-Presenters: Nicole Dillard, Seth Adjei, Madhura Kulkarni)*

STEM Strength: MICRA Project's Role in Developing the Next-Gen Workforce

Mirit Shamir, Kansas State University
Focused EPSCoR Collaborations (FEC) (#2316295, 2316296, 2316297)

The United States' competitiveness depends on fostering a workforce with strong capabilities in STEM. MICRA, a focused EPSCoR collaboration project between Kansas State University, University of Nebraska-Lincoln, and Langston University, was launched in August 2023. It aims to support rural livelihoods in the Central High Plains where rainfall is often very limited and aquifers used for irrigation are becoming depleted. To this end, our studies focus on the use of soil amendments that increase the water holding capacity in soil, and developing a competitive STEM workforce through a convergence model that integrates interdisciplinary research, professional skills development, education, early career support, and mentoring. The educational and mentoring components include a series of activities that cut across students' studies to enhance their technical and durable skills (e.g. team collaboration, science communication, etc.), and their ability to pursue a STEM career. These activities include seminar series; an interdisciplinary micro-credential in food, energy, water for credit at the graduate level; undergraduate training in engineering technology to prototype an inexpensive soil moisture sensor; and structured, individualized mentoring. Evaluation shows that MICRA students are developing expertise in their disciplines while expanding their knowledge in other disciplines, developing an interdisciplinary understanding of rural resiliency, and are becoming agents of change. *(Co-Presenters: Mirit Shamir, Darius Everett, Franklin Fondjo-Fotou, Vicky Fondjo, Gaurav Jha, Seunghee Kim, Rajib Saha, Gabriel Sampson, Daniel Schachtman, Abebaw Tadesse, Melanie Derby)*

MR-Driven Workforce Development and Industry 4.0 Skill Insights from WVU-USC

JuHyeong Ryu, West Virginia University

EPSCoR Research Fellows (#2429709)

Industry 4.0 is reshaping manufacturing, yet a persistent skills gap threatens competitiveness in EPSCoR jurisdictions. This flash talk presents two convergent results from NSF EPSCoR RII Track-4 research (Award #2429709) at WVU, executed through collaboration with USC. We developed a Mixed Reality (MR) ergonomic training prototype that integrates immersive XR environments with wearable motion sensors for real-time posture feedback during manufacturing tasks. The WVU-USC partnership leveraged digital twin infrastructure and robotics systems at USC's McNAIR Laboratory through a host-site research fellowship. This collaboration accelerated prototype development beyond what single-institution resources could achieve. We also analyzed over 900 U.S. manufacturing job postings to identify Industry 4.0 hybrid skill demands. The results show that employers increasingly require workers who combine traditional expertise with digital competencies such as data analytics, robotics programming, and IoT management. Both outcomes are validated through peer-reviewed journal and conference publications. This work aligns with EPSCoR priorities by strengthening research capacity, fostering interjurisdictional collaboration, and developing scalable workforce training models. Future directions include expanding this framework to broader applications such as rural workforce development, safety-critical training, and cross-sector implementation.

BESST: Research experience and career development for students paired with enhanced mentor training

Dyan Morgan, University of Kansas Focused
EPSCoR Collaborations (FEC) (#2225863)

Building Emerging STEM Scholars of Tomorrow (BESST) is an NSF EPSCoR-funded program at the University of Kansas designed to combat the negative impact that the COVID-19 pandemic had on undergraduate students' experiences. These negative impacts include limiting access to research opportunities, constraining professional networks, reducing preparedness to be competitive for graduate school, and reducing experience for

undergraduates seeking to directly enter the workforce after graduation. To promote success before and after graduation, students need access to networks and resources that build career readiness and transparency around the hidden curriculum to enter graduate school. They also benefit significantly from enhanced research experiences with mentors; however, the benefits of this experience depend greatly on the quality of their interactions with their mentor. Our program aims to combat these challenges by providing professional development for both students and mentors that are centered around building positive research experiences. This presentation will outline the programmatic elements of BESST, including student curriculum and mentor training plus community of practice, while highlighting lessons learned and future directions for the project.

Innovating with Data and Chemistry for the Future

From static to living databases: Lessons from building LimnoSTOICH

Jessica Corman, University of Nebraska-Lincoln
Focused EPSCoR Collaborations (FEC) (#2019596)

In many scientific fields, integration and harmonization of existing datasets from multiple sources enables quantification of phenomena at greater scales than otherwise possible. However, when this compilation happens, data gaps emerge and new data are often still being generated. Using the LimnoSTOICH database project as an example, we report our efforts to build a database from published, contributed, and novel data collection efforts. Upon initial publication, the LimnoSTOICH database included >50,000 observations of organismal elemental content from >3,000 sites across seven continents and >180 sources. The LimnoSTOICH database sets the stage for significant applications across ecology, evolutionary biology, biogeochemistry, and other disciplines. However, even with this extensive compilation effort, data gaps in taxonomic coverage, habitat representation, and environmental descriptions remain. We present options for further database updates, highlighting resource needs at project, institutional, and national levels based on database sustainability goals. (Co-Presenters: Chad Petersen, Eric Moody, Hal Halvorson, J. Harrison Edwards)

Peptoids as a Versatile Platform for the Engineering of Tunable Hydrogels

Alessia Battigelli, University of Maine
EPSCoR Research Fellows (#2429793)

Peptoids are peptidomimetic polymers constituted by N-substituted glycines. Due to their ease of synthesis, proteolytic resistance and ability to self-assemble into well-defined nanostructures, peptoids have emerged as versatile building blocks for the preparation of functional biomaterials are emerging as powerful building block for the development of novel functional biomaterials. By varying monomer types, sequence and chain length, their self-assembly can be precisely tuned to generate a a variety of nanoarchitectures, including nanoparticles, nanosheets, nanotubes and micelles. These structures provide adaptable platforms for applications spanning sensing, catalysis and drug delivery. Here, we present our synthetic strategy for the development of new functional peptoid-based hydrogels, exploiting click chemistry as crosslinking approach. By varying the monomer composition, we were able to tune the physico-chemical properties of the resulting hydrogels, specifically tailoring their swelling behavior and drug release profiles over time. To introduce responsiveness into the hydrogels, we synthesized peptide/peptoid hybrids where the peptide component can enhance biocompatibility or enable controlled hydrogel degradation, depending on its sequence. These combined features highlight the adaptability of the peptoid scaffold, positioning this platform as a modular and tunable alternative to conventional hydrogels for tissue engineering applications.

Coordinating a Greener Future: Multivalent Cations and the Hydrophobic Cellulose Surface

Xuefeng Zhang, University of Maine
EPSCoR Research Fellows (#2531598)

Cellulosic materials—paper, cardboard, molded fiber—are inherently hydrophilic, limiting their use in packaging applications that require water or moisture resistance. Current solutions rely heavily on PFAS-based coatings, which face growing regulatory pressure and end-of-life biodegradability concerns. Supported by NSF EPSCoR Research Fellows Award #2531598, this project investigates Metal-Ion-Induced Hydrophobization (MIM): a PFAS-free surface engineering strategy in which multivalent metal cations (Zr^{4+}, Fe^{3+}, Al^{3+}) coordinate with hydroxyl groups on cellulose surfaces, reducing surface energy and conferring durable water resistance. Using a Langmuir adsorption framework, we quantify metal ion binding thermodynamics and establish structure-property relationships linking

ion valency, surface coverage, and contact angle. MIM-treated molded fiber cups demonstrate water resistance competitive with conventional coatings. This work advances sustainable packaging science at the University of Maine's Advanced Structures and Composites Center, connecting forest bioproducts expertise with scalable manufacturing—aligned with EPSCoR's mission to build research competitiveness and regional economic impact.

Automated Multimodal Spectro-microscopy and its Application for Halide-based Solid-state Batteries

Dongchang Chen, University of New Mexico
EPSCoR Research Fellows (#2429078)

In this flash talk, we present our progress of the EPSCoR Research Fellow project, No. 2429078, in constructing a coupled optical and photoluminescence platform, specifically designed for halide-based solid-state batteries. The platform allows microstructural properties, measured via bright-field microscopy, and chemical properties, measured via photoluminescence spectro-microscopy, of Li-SSE interphase/interface studied all together in an automated fashion. Relying on such a capability, we can obtain the evolution of the SSB interphases from different perspectives as a function of various electrochemical parameters, allowing us to understand the correlation factors between microstructural features with chemical properties. Combining this capability with the rich chemistry of halide SSE, we can obtain a unique set of structure-chemistry-property relationships. The technique developed in this study is enriched with great opportunities to be applied in other solid-state energy storage/conversion systems and drive a transformative impact for this field.

Performance Analysis and Optimization of Fructose Memristor-Based Neuromorphic Systems (Jinhui Wang): Natural organic materials based memristors have demonstrated promising synaptic behavior, positioning them as strong candidates for synaptic devices in neuromorphic computing. This work demonstrates and evaluates a neuromorphic system based on fructose-memristors.

Advancing Knowledge through Biology and Beyond

Structural and Computational Characterization of Enzymes in the Berberine Biosynthetic Pathway

Chris Jurgenson, Delta State University

Plant-derived alkaloids are a rich source of biologically active compounds, yet the enzymatic mechanisms underlying their structural complexity remain poorly understood. The protoberberine alkaloid berberine is biosynthesized through oxidative transformations in plants such as Coptis japonica and Berberis species, but key enzymes in this pathway remain structurally uncharacterized, limiting mechanistic insight. This project focuses on tetrahydroprotoberberine oxidase (TBO), a flavoprotein that catalyzes the final oxidative conversion of (S)-canadine to berberine. Despite its central role, the structural and dynamic basis of TBO catalysis remains unresolved. This work defines TBO function using an integrated experimental and computational approach. Initial cryo-electron microscopy analysis indicates high-quality data suitable for structural characterization. Molecular dynamics simulations of enzyme–cofactor–substrate complexes derived from AlphaFold models using GROMACS will probe conformational dynamics, substrate positioning, and catalytic geometry, including donor–acceptor distances and orientations between FAD and the substrate carbon, as well as key stabilizing interactions. We hypothesize that TBO catalysis is governed by precise active-site organization and conformational dynamics that position substrate and FAD for efficient hydride transfer. This work will establish a molecular framework for oxidative catalysis in plant alkaloid biosynthesis.

Developmental Stage Drives Soybean Microbial Succession Despite Transient Effects of BTH Priming

Francella Arce, Louisiana State University
(#2418232)

We investigated how the defense inducer 2,1,3-benzothiadiazole (BTH) influences soybean root-associated microbiota across root compartments (endosphere and rhizosphere) at early vegetative (V3-V4) and late reproductive (R5-R6) stages under field conditions without any other management besides herbicide control. Diversity and differential abundance analyses revealed that plant developmental stage was the main driver of microbial

succession, with both root compartments showing temporal shifts in community composition. In the endosphere, early communities were enriched with genera such as Amycolatopsis, Streptomyces, and Niastella, whereas late communities were dominated by taxa commonly associated with root colonization and plant-microbe interactions, including Pseudomonas, Janthinobacterium, Flavobacterium, and Stenotrophomonas. Temporal restructuring was also observed in the rhizosphere, with early enrichment of Azoarcus and Defluviicoccus, and late enrichment of Bradyrhizobium, Paenarthrobacter, and Bacteroides. BTH treatment effects were compartment-specific and most pronounced during early growth, where endosphere alpha diversity decreased, but such effects diminished at late stage when community structure resembled untreated plants. These findings highlight the dominant role of plant developmental stage in shaping soybean microbiota and suggest a transient and compartment-specific influence of chemical priming on microbial community structure. *(Co-Presenters: Sandeep Gouli, Jong Hyun Ham)*

Microplastic Transfer Through a Benthic Food Web: Research Approach and Educational Opportunities

Anabela Maia, Rhode Island College
E-RISE RII (#2438542)

With high retention times, microplastics become a pervasive contaminant in coastal habitats. We focus on the Narragansett Bay, a coastal bay in Rhode Island with a strong history of ecological monitoring, to assess the societal and ecological impacts of nano and microplastics (NMPs) in coastal ecosystems. This project has three research driven components to track NMPs in the water and sediment throughout the Bay during wet and dry seasons; model these pollutants in the system; and investigate the trophic transfer of NMPs, focusing on the benthic ecosystem. Our approach is informed by stakeholder needs assessed through interviews conducted by our social science team. For the ecosystems approach, we have designed standard operating protocols to allow comparisons between samples processed at different institutions and equipped them with both human and physical infrastructure to allow for NMP identification in biological samples. We are focusing on the distribution and trophic transfer of NMPs within the invertebrate community and that extend to vertebrate consumers including fish and sea ducks. This project will include baseline and periodical field sampling, coupled with laboratory experiments where fish are exposed to known quantities of NMPs. Lastly, an Ecopath with

Ecosim approach will be used to track microplastics using Ecotracer. Educational activities for K-12 STEAM curriculum are also being developed. More information on our project can be found at www.simcoastri.org.

Surface Heterogeneity Effects on Biofilm Attachment in Patterned hBN–Cu Systems

Joseph Thalakkottor, South Dakota School of Mines and Technology
Focused EPSoR Collaborations (#2418750)

This study examines the attachment and biofilm development of Citrobacter freundii on chemically heterogeneous surfaces composed of hexagonal boron nitride (hBN) patterns embedded within a copper (Cu) layer on a silicon substrate. The heterogeneity arises from the contrasting reactivity of inert hBN and reactive Cu regions, providing a platform to evaluate how patterned two-dimensional materials influence microbial colonization. Biofilm formation was first characterized under static conditions using scanning electron microscopy (SEM) and confocal laser scanning microscopy (CLSM), which quantified surface coverage, thickness, and morphological differences across hBN and Cu domains. Distinct substrate-dependent variations in biofilm density and structure were observed, indicating that surface chemistry strongly influences initial microbial attachment. Dynamic exposure experiments were then conducted using a custom flow system that simulated hydrodynamic shear and introduced environmental constituents such as dissolved ions, organic matter, and native microorganisms. These tests assessed biofilm adhesion strength, mechanical stability, and redistribution under flow. The combined static and dynamic analyses provide insight into microbial behavior on heterogeneous 2D material systems. *(Co-Presenters: Faysal Niaz, Venkata Anantha Shayanam Kandadai, Bharat Jasthi, Venkataramana Gadhamshetty)*

High-Resolution Root Imaging Shows Bacterial Seed Consortium Improves Soybean Roots Under Drought

Sandeep Gouli, Louisiana State University
(#2418232)

Drought resilience in soybean is strongly constrained by the plant's ability to sustain root growth and biomass under water limitation. We evaluated a multi-strain bacterial seed consortium (Setm4) through seed treatment as a drought mitigation strategy based on greenhouse trials and high-resolution root imaging along with microbiome profiling to provide supporting context. Under controlled drought conditions (15-20% soil moisture), Setm4-treated plants maintained greater shoot biomass than untreated and carrier controls. High-resolution root imaging showed significant increases in total root length, root tips, root perimeter, surface area, and root volume, indicating enhanced soil exploration and resource acquisition, while root diameter and branching frequency remained largely unchanged. Growth-chamber experiments using 'rhizoboxes' at the drought condition (10-15% soil moisture) further confirmed increased secondary root formation and stem thickening in treated plants. Microbiome network analysis revealed stronger positive bacterial interactions and a higher positive-to-negative interaction ratio in seed treated conditions under drought, suggesting improved microbial network stability. Overall, root imaging-guided phenotyping provides a robust framework to validate microbial seed consortia that enhance soybean drought resilience through improved root system architecture and cooperative rhizosphere and endosphere microbiomes. *(Co-Presenters: Emmanual Lacueva, Francella Arce, Thomas Kinight, Jong Hyun Ham)*

Designing the Future through Advanced Infrastructure and Enabling Technologies

The Ole Miss Blazar Group: Monitoring & Modeling Blazar Jets Across the Electromagnetic Spectrum

Nicholas MacDonald, The University of Mississippi
EPSCoR Research Fellows (#2429473)

The Ole Miss Blazar Group has recently been established at The University of Mississippi (UM). Our group is involved in both the theoretical interpretation and observation of relativistic black hole jets (objects known as Blazars). The group is a part of UM's Center for Multimessenger Astrophysics (UMCMA). The Ole Miss Blazar Group has been awarded a National Science Foundation EPSCoR Grant (Award #: 2429473) to establish a partnership between UM and the Boston University (BU) Blazar Group. In particular, we are working to extend BU's optical polarimetric monitoring of a sample of Gamma-ray bright Blazars targeted by NASA's Imaging X-

ray Polarimetry Explorer (IXPE) satellite. Our group is now actively involved in Blazar optical polarimetric observations, and has made multiple trips to the Perkins Telescope Observatory (PTO) in Flagstaff, Arizona. The linearly and circularly polarized synchrotron emission from Blazar jets carry imprints of both the strength and orientation of the jet's collimating magnetic field as well as the plasma content of the jet's environment. Our relativistic jet simulations yield synchrotron polarization estimates that can be used to interpret both Very Long Baseline Interferometric (VLBI) jet observations and single dish light curves of jet variability. By attempting to bridge the gap between Blazar theory and observation, we aim to advance our understanding of the intrinsic plasma nature of relativistic black hole jets in three dimensions.

Evaluating EPSCoR Office Models for Sustainable Infrastructure

Alana Morgan, Kentucky Science and Engineering Foundation
E-CORE RII (#2438201)

This flash talk will highlight our investigation into the utility of an EPSCoR Jurisdictional office as groundwork for building a sustainable research support infrastructure. We will provide an overview of early discovery efforts in evaluating established EPSCoR offices across NSF EPSCoR-designated states, identifying different governance structures and best practices. Attendees will understand the methodology of early discovery as part of our activities to support the Jurisdictional committee through our E-CORE. The work to date has focused on stakeholder engagement to identify key barriers, such as limited administrative capacity, lack of a hub for proposal development, and insufficient financial pathways to support EPSCoR-related activities. To address these challenges, multiple options were explored, from creating a new organization to leveraging existing entities or fiscal sponsorship models. We also engaged in conversations with other EPSCoR Jurisdictions regarding their organizational and financial structures. Key lessons emphasize the importance of aligning solutions within existing ecosystems, avoiding duplication or competition, and developing sustainable funding strategies that extend beyond EPSCoR awards. As this work remains ongoing, the talk will also highlight next steps and invite collaboration, offering attendees actionable insights in developing an EPSCoR office. This work was done in part as fulfillment for a master's degree in public administration.

Advanced Wireless - Integration with Infrastructure Systems

Dryver Huston, University of Vermont
Focused EPSCoR Collaborations (FEC) (#2119485)

This flash talk summarizes a five-year effort to research advanced wireless methods to sense, assess and manage large built infrastructure. This is a collaborative effort with the University of Vermont, University of Maine, and Vermont State University. The vision for this project is to conduct combined research and capacity building effort addressing the use of through research into Advanced Wireless interactions with Internet of things, sensing and engineered Infrastructure and micro-robotic techniques. The project researched advanced wireless methods for built infrastructure that advances the state-of-the-art and develops human infrastructure through support of early-career faculty, student engagement in research and workforce development. The research focuses on three main areas: 1. Advanced wireless research enabled by AI, IOT, micro-robotics and quantum sensing, 2. Infrastructure use cases covering coastal structures, underground infrastructure, highway structures, rapid prototype evaluation of new structures, and geotechnical formations. The goal is to develop these use cases into Engineering Infrastructure Testbeds (EITs) that support research and implementation of advanced wireless methods. And 3. Workforce development and outreach that integrates stakeholders, students at K-12 up through postdoc levels, and junior faculty in all aspects of the research efforts.

Planetary Robotic Construction on the Moon and Mars Using Waterless Printing Concrete

Ali Kazemian, Louisiana State University
EPSCoR Research Fellows (#2327469)

This talk presents recent advances in robotic construction for extraterrestrial environments using 3D printed sulfur-regolith concrete (SRC), a waterless material derived from in-situ resources. The study investigates the printability, mechanical performance, and durability of SRC under space-relevant conditions. Results show that process parameters, particularly printing temperature and interlayer timing, critically influence shape stability and interlayer bonding. The material exhibits rapid strength development and demonstrates strong performance under vacuum and elevated temperatures, outperforming conventional cement-based systems in such environments. Additionally, material modification using DCPD significantly enhances strength and reduces degradation. The findings highlight the potential of integrating additive

manufacturing, robotics, and local materials to enable scalable, autonomous infrastructure for future lunar and Martian missions.

Dual-Functional Chickpea Starch Bioplastics: Bridging Edibility and Sustainability in Packaging

Md Abdur Rahim Badsha, Maryville State University
Track-I

The increasing demand for sustainable and safe packaging materials has driven the development of biodegradable and edible bioplastics from renewable resources. In this study, chickpea starch (CPS) was used to create dual-functional bioplastic films that are both strong and edible. Various CPS-based formulations were prepared, with the 1:2:2 blend showing the best performance. The resulting films displayed moderate tensile strength (3.63 MPa) and very high elongation at break (~623%), indicating they are highly flexible and suitable for packaging. Surface analysis showed a moderately hydrophilic nature (water contact angle ~70°), supporting controlled moisture interaction for short-term applications. Chemical resistance tests confirmed stability under alkaline and mildly acidic conditions, while water solubility (~40%) and biodegradability tests highlighted the material's eco-friendliness. Crucially, using non-toxic, plant-based components supports the possibility of edibility, expanding their use for food-grade packaging. Overall, CPS-based bioplastics offer a promising, eco-friendly alternative to traditional plastics, combining functional performance with sustainability and edibility. Future efforts will aim to improve mechanical strength and moisture resistance to expand their industrial use.

Supporting Community through Outreach and Workforce Development

Science at the Pub Curiosity Meets Community Fun

Benjamin Benson, Stanford Research
E-RISE RII

Science at the Pub is a community STEM engagement program I have helped lead for over eight years. During this time, we have engaged more than 1,500 participants and connected 56 STEM

professionals with their communities. Topics have ranged from the human body to quantum computing and cybersecurity. Through planning, feedback, and observation, we have learned which topics and times draw the strongest audiences, demonstrating that informal spaces can spark curiosity and meaningful conversations about science. *(Co-Presenters: Kara McCormick)*

Vis-a-thon

Georgia Rhodes, Rhode Island School of Design
E-CORE RII, (#2433276)

Vis-a-thon is an interdisciplinary art-science program that pairs STEM researchers with artists and designers to create visualizations that expand how complex research can be communicated, interpreted, and shared. Developed in connection with EPSCoR research communities, the program gives participants a structured framework for collaboration through workshops, critique, and intensive team-based production. Rather than treating visualization as a final packaging step, Vis-a-thon positions it as a mode of inquiry that can clarify research questions, reveal new interpretive possibilities, and make specialized work more accessible to broader audiences. This flash talk will highlight both the program's successes and the challenges that come with building collaboration across fields with different methods, vocabularies, and expectations. By reflecting on the design of the program and the conditions that help teams succeed, the talk will offer a concise case study in how creative collaboration can strengthen the impact and visibility of EPSCoR-supported research. *(Co-Presenters: Stewart Copeland)*

From Conversation to Action: Engaging Rural Communities on Climate Resilience

Mary Emery, University of Nebraska-Lincoln
Focused EPSCoR Collaborations (FEC) (#2316368)

Building community capacity is essential for resilience in the face of changing climates. Extreme weather events can thrust this need into the forefront of local conversation, creating a rare opening for meaningful engagement with data and partnerships. This project worked with a rural community initially skeptical of climate change, which found itself confronting an extreme drought spreading across most of the state. Researchers can leverage these moments of climate

crisis to spark conversations, but those conversations must move to action. *(Co-Presenters: Raquel Johnson)*

Advancing National Ecological Observatory Network-Enabled Science and Workforce Development with AI

Sydne Record, University of Maine
EPSCoR Research Fellows (#2429418)

Biodiversity is essential to human wellbeing and the functioning of the Earth's ecosystems. This flash talk describes an EPSCOR project at the University of Maine to leverage artificial intelligence (AI) to extract information related to life on Earth from imagery generated by the NSF-funded National Ecological Observatory Network (NEON). This flash talk will showcase some of the success the project has had in capacity building and workforce development. Examples will be about partnering with the National Ecological Observatory Network to inform ways that innovative uses of AI may streamline the Observatory's operations and the development of a graduate level introductory course in AI and Ecology. A secondary goal will be to discuss challenges faced in continuing this work at the University of Maine (e.g., lack of computational resources).

Building Collaborations, Pathways, and Structures for Educational Success

Introducing the Center for STEM Education Research and Translation (SERT)

Treshonda Rutledge, American Institutes for Research/NSF Center for STEM Education Research and Translation

Introducing the Center for STEM Education Research and Translation (SERT) (Treshonda Rutledge): The Center for STEM Education Research and Translation (SERT) is a newly launched, National Science Foundation–funded resource center designed to strengthen connections across the STEM education ecosystem—from PreK–12 classrooms and beyond. Launched in March 2026, SERT responds to a persistent challenge in the STEM ecosystem: research and innovation often move slowly, unevenly, or incompletely

between researchers, practitioners, and systems. This flash talk introduces SERT's mission, vision, and early design choices, highlighting how the Center is intentionally structuring a bidirectional research to practice pipeline that values educators as evidence generators, not just evidence users. The talk will surface opportunities to build a national, community-centered infrastructure that supports STEM education across formal settings. Participants will learn how SERT is working to (1) connect researchers and practitioners across disciplines and roles, (2) translate research evidence into usable, practice-informed resources, and (3) create accessible entry points for engagement across the STEM PreK–12 ecosystem. The session will conclude with concrete ways participants can connect with, contribute to, and benefit from SERT as the Center grows.

Scaling AI Literacy with Cross-Campus Collaboration and Ethical Frameworks

Russell Michalak, Goldey-Beacom College
E-CORE RII (#2438144)

Artificial intelligence literacy is becoming essential for strengthening research capacity and preparing the next-generation STEM workforce. This lightning talk highlights how "leadership from the middle" can help institutions advance AI literacy through faculty development, library instruction, and cross-campus collaboration. Drawing on the CALM framework (Communication, Adaptability, Learning, Management) and the Academic Librarian Framework for Ethical AI Policy Development (ALF), the presentation demonstrates how middle leaders translate institutional strategy into practical learning initiatives that support responsible AI use. Using examples from Goldey-Beacom College, the session illustrates how AI literacy programs integrated into faculty development and first-year writing courses can help students develop critical thinking, ethical awareness, and digital fluency using AI-enabled research and learning tools. The talk will also address institutional challenges such as policy ambiguity, faculty concerns, and uneven access to emerging technologies. By aligning instructional innovation with workforce development and research capacity goals, this model demonstrates how institutions can build sustainable AI literacy ecosystems that support student success and emerging STEM talent pathways.

The Invisible Infrastructure of K–12 STEM Education: How Relationships Enable Impactful Programs

Damaris Borden, Rhode Island College
E-CORE RII (#2433276)

K–12 STEM education pathways succeed not only because of strong curricula or funding, but through the often unseen relational work that makes meaningful collaboration possible. We highlight how intentionally plugging into Rhode Island's STEM ecosystem (e.g. attending community events, connecting with partners across sectors, following snowball-style introductions, and engaging in informal needs-assessment conversations) has surfaced shared priorities, persistent gaps, and emerging opportunities in K-12 STEM education. By centering trust-building, listening, and relationship stewardship, this work has enabled our team and partners to align efforts, uplift one another's initiatives, and co-create programming that responds to real needs in schools and communities. Our goal is to share practical strategies for developing this 'invisible infrastructure' to strengthen formal and informal K–12 STEM education and support students in pursuing higher education and careers in STEM fields. To show what this approach has already enabled, we draw on examples such as funding teacher mini-grants, supporting EPSCoR projects in their K–12 outreach, contributing to the Rhode Island Experiential Learning Navigator, and developing student-facing programs like SHORE and Teen Science Cafés. After this session researchers and project staff will have a clearer sense of how to act as ecosystem connectors to support sustainable STEM pathways aligned with educational standards and workforce needs. (Co-Presenters: Anabela Maia)

Understanding Student Barriers in Economics and Building Pathways Forward

*Christopher Pascua, *Kapi'olani Community College at University of Hawai'i*
E-CORE RII (#2225756)

Barriers to degree completion in economics are shaped by structural, cultural, and institutional factors that extend beyond the classroom. This flash talk presents findings from a student-led research project examining these barriers to graduation in economics at the University of Hawai'i. Utilizing Q methodology, qualitative interviews, and a culturally grounded Kaʻao research framework rooted in Indigenous knowledge systems, this study identifies key challenges faced by historically underrepresented demographics in economics education. These challenges include cost of living pressures, difficult

quantitative coursework, limited representation, and uncertainty around career pathways. Going beyond the identification of barriers, this presentation focuses on how the Transcending Barriers to Success in Economics (TBSE) Program is responding to these challenges. Through mentorship, community-based learning, and applied research opportunities, TBSE works to strengthen students' sense of belonging, build clearer connections to careers, and support transfer pathways into economics programs at the University of Hawai'i at Mānoa. This project demonstrates how student-driven, culturally grounded research can move beyond identifying barriers to creating pathways to success that were previously inaccessible or constrained by those barriers. (Co-Presenters: Denise Konan)

In-Person Immersion Days Surfacing ACCESS Challenges

Sarah Otterbeck, Clemson University
BEC (#2225816)

Designing synchronous programming for students scattered across multiple institutions is challenging enough, but coordinating meaningful, in-person professional development for that same population can feel nearly impossible. In this lightning talk, we will share how we've approached building Immersion Days for students from two institutions spanning an unusually wide academic spectrum: from second-year undergraduates to PhD candidates, and from full-time students to working professionals with families. The goal of this session is to surface the practical design tensions we navigated: supporting a diverse group, accommodating wildly different schedules, and making the in-person experience worthwhile for everyone. Rather than a full case study, we focus on a few specific decisions, unexpected challenges, and small wins from our first two Immersion Days. Attendees will walk away with a sense of how we balanced ambitious goals with limited time, how we structured activities for mixed-level groups, and a few logistical decisions that shaped the day – including ones we had to make on the fly. This talk benefits anyone supporting students across geographically distributed campuses or spanning multiple academic levels. If you are navigating (or anticipate having to navigate) the tension between providing high-impact, in-person learning opportunities and the realities of student availability, this session offers practical insights and a candid look at what has actually worked for us. (Co-Presenters: Kelly Lazar)