National Sustainability Society

Contribution Descriptions
NATIONAL SUSTAINABILITY SOCIETY INAUGURAL CONFERENCE

TOURS

Port of Seattle Waterfront Walking Tour

Tour the Seattle Waterfront and learn about sustainability initiatives from the Port of Seattle, including: the Seattle Waterfront Clean Energy Strategic Plan; shore power at cruise ship terminals; sustainable building practices at Pier 69 and elsewhere; zero-emission cargo-handling equipment; zero-emission drayage trucks; and related maritime sustainability initiatives, including ferry electrification and the Pioneer Square Habitat Beach.

Coalition Building for Campus Decarbonization Tour
Speakers: Lisa Dulude, David Woodson, Mark Kirschenbaum, Marilyn Ostergren

Tour: The workshop will begin with a tour of the University of Washington's Steam Plant. The tour will showcase UW's existing infrastructure and our innovative clean energy transformation strategy including sewer heat recovery, thermal energy storage and deep lake cooling. The Seattle campus decarbonization strategy is more than an infrastructure replacement project; it is an opportunity to mobilize the UW community around a commitment for urgent climate action while expanding living lab learning opportunities on campus.

Walking tour of UW campus
Speaker: Daimon Eklund

The UW Sustainability Office will give a sustainability walking tour of campus.

The Understory, Horticultural Tour of Amazon Spheres
An insider tour of the Spheres, created to reconnect people to nature through biophilic design and provide a space to take in the positive effects of exposure to nature. Each plant inside The Spheres was chosen from the Amazon Plant Collection and is expertly cared for by members of Amazon Horticulture.

Washington Park Arboretum Walking Tour

The Washington Park Arboretum is an urban oasis on the shores of Lake Washington. Jointly managed by the University of Washington Botanic Gardens, and the City of Seattle Parks and Recreation Department, its 230 acres contain a dynamic assortment of plants, some found nowhere outside the Pacific Northwest. Take a guided walk through the Arboretum and discover this beautiful living collection and the sustainability learning opportunities it provides to the diverse Seattle population.

Coalition Building for Campus Decarbonization Discussion
Speakers: Lisa Dulude, David Woodson, Mark Kirschenbaum, Marilyn Ostergren

After the tour, participants will gather for a workshop to begin exploring how organizations define and commit to decarbonization. Decarbonization means different things to different institutions relative to values and mission, priorities and targets, and timelines. The presenters/facilitators will offer and solicit different approaches for creating clear definitions to be used as tools of engagement, target setting, implementation, reporting, and gauging progress. Next, the presenters/facilitators will share and solicit strategies for creating buy-in from key stakeholders for decarbonization planning and implementation. While funding is always a challenge for large campus infrastructure projects, often the decision to move forward depends on effective communication, engagement, and buy-in from leadership to prioritize resources. UW will share and solicit tools and processes for collaborating across broad-ranging stakeholders to craft, communicate, and emphasize the value of system-wide decarbonization, including the cost of doing nothing. Examples include articulating the financial benefits of infrastructural and environmental resiliency, identifying overlapping priorities that stretch dollars, and leveraging policy to advance planning and implementation.

WORKSHOPS

A1 Thriving at the Intersection: How to be a Multidisciplinary Sustainability Practitioner
Speaker: Debbie Namugayi

Working as a sustainability practitioner for large institutions or companies requires professionals to be skilled as expert generalists who bridge traditional disciplinary boundaries to drive solutions. This workshop equips aspiring and current sustainability practitioners with the skills and knowledge to navigate the multidisciplinary landscape.

A2 Closing the Implementation Gap: From Awareness to Action
Speakers: Jennifer Tabanico, Amy Cabaniss

The community-based social marketing framework has helped sustainability professionals across the globe build effective behavior change programs. This workshop introduces participants to this framework through hands-on exercises, and case studies demonstrating its efficacy in fostering behavior change.

A3 Navigating Conflict and Dysfunction in Conversations
Speaker: Kari McLeod

This workshop will support sustainability practitioners and educators to promote collaborative, innovative, and dynamic conversations where great ideas emerge from hearing multiple viewpoints and resolving differences by working with positive conflict, not dysfunctional conflict. Using David Kantor’s theory of communication, Structural Dynamics, you will learn to facilitate better conversations that prompt positive changes. Kari McLeod is a leadership team coach and faculty member with TeamCatapult

A4 The Key Competencies in Sustainability Framework
Speakers: Krista Hiser, Meghann Jarchow

In this workshop, learners, educators, and practitioners will gain an overview of the Key Competencies in Sustainability Framework (KCFS) and how the framework is being used by educators and practitioners at different levels, contexts, and dimensions of education. Participants will preview the learning module and workbook, with opportunities to discuss how they teach, learn, and assess Key Competencies in their own work. While primarily oriented to higher education, the workshop is relevant to anyone engaged in Sustainability Education.

A5 Sustainability Leadership: Training Tools for Collaboration
Speaker: Margaret Krebs

A consortium of leading transdisciplinary (TD) thought leaders and practitioners, was formed to identify key elements of what researchers need to know, do, and be in the context of transdisciplinary research and to create training curriculum, guidelines, and frameworks to disseminate widely. The “TD Collaboratory” will share a TD Design Guide aimed to lead TD scholars interested in training others through the process of designing audience-tailored trainings and identifying relevant and appropriate teaching modules and materials.

B1 Life Cycle Assessment of Bio-based Materials and Systems
Speakers: Indroneil Ganguly, Francesca Pierobon

Life cycle assessment (LCA) is an internationally recognized method for assessing the environmental impact of products and processes throughout their life cycle. This workshop combines theoretical knowledge and applications of LCA to bio-based products and systems.

B3 Participatory Modeling for Climate Justice
Speakers: Moira Zellner, Maya Negev, Deb L. Morrison

Participatory modeling (PM) is a collaborative approach to formalize shared representations of a problem and design and test solutions through a joint modeling process. This workshop will introduce and test an initial version of fora.ai, a new PM platform developed at Northeastern University. The platform is an intuitive digital environment that enables diverse stakeholder groups to collaboratively interact with embedded simulation models to understand real world socio-environmental problems and create novel and impactful solutions.

B4 Best Practices for Sustainability Degree Programs
Speakers: Krista Hiser, Teri Balser

This workshop introduces participants to a synthesized set of Best Practices for sustainability programs in eight grounded areas of program practice: Unit Organization, Curriculum, Pedagogy, Assessment, and support areas of Leadership, Campus & Community, Faculty Support and Student Support. Participants will gain an overview of these Best Practices as part of a unique and context-sensitive process for program evaluation and accreditation. This workshop is designed for anyone with an interest in strengthening Sustainability Education programs in higher education.

B5 How the Scientific Community Can Guide Corporate Biodiversity Reporting
Speakers: Benjamin Miller, Dan Brown

A changing regulatory environment and consumer culture is compelling companies to account for their impacts on biodiversity and ecosystems. This workshop brings together sustainability practitioners and scientists to critically and constructively evaluate the metrics recommended by the Corporate Sustainability Reporting Directive CSRD, and build consensus around scalable measurement methodologies for these metrics.

C1 Decarbonization Pathway Tools
Speakers: Alan Jacobsen, Mengya Tao, Vinod Kumar Konaganti, Ofei Mante

In this workshop, we will describe and demonstrate tools our team has developed to quickly evaluate different decarbonization options for packaging materials, building materials, drop-in fuels, and hydrogen. These tools provide an in-depth understanding of the impact of different decarbonization solutions for each of these sectors, which in turn, will help organizations prioritize investments towards the most impactful solutions. With each tool, a user can easily and quickly build and understand the potential impact of different decarbonization scenarios without having life cycle assessment (LCA) expertise or coding experience.

C2 Navigating Science-Policy Interface for Impact
Speaker: Caitlin Grady

This workshop is designed to bridge the gap between sustainability science and public policy. Aimed at a diverse audience including students, scholars, practitioners, and policy-makers, this session will demystify the process of integrating academic research and expertise into the policymaking world. Whether you're a seasoned researcher or a student just beginning to explore the realm of sustainability, this workshop will offer valuable insights into how your work can contribute to meaningful policy changes and societal impacts. This workshop will equip participants with the tools and knowledge needed to effectively translate their research and expertise into actionable public policy.

C3 How to Choose Decision-Support Tools for Climate Assessments
Speakers: P.J. Tillmann, Alejandro Paredes

In this workshop, participants will learn how to choose between the many available decision-support tools and datasets when completing a climate vulnerability assessment or hazard-specific climate impact

assessment. Participants will learn from a few short case studies in how tools were selected to support vulnerability assessments, sea-level rise planning, extreme heat, and other adaptation needs. At a minimum, we plan to review NOAA and Washington Sea Level Rise Projections, FEMA Flood Zones, Tree Equity Score, the California Heat Assessment Tool, The Greenlining Institute's equity guidebook for adaptation, and census data (including EJScreen).

C4 Dismantling Structures and Patterns of Unsustainability
Speaker: Adam Lerner

This workshop seeks to enhance the diffractive sensemaking skills of participants to see the cultural structures that undergird their organizations and the patterns that continue to perpetuate unsustainability. It invites participants to reflect on their own context and patterns as a microcosm of the larger system they inhabit. The workshop will request participants to bring in photographs of specific types of institutional spaces to sense the invisible cultural elements at play within them. We will use these photographs to see the metaphoric ways these sites provide context for the institutions' culture of (un)sustainability. After understanding these institutional patterns through roundtable and open dialogue, we will spatially orient them to the Three Horizons framework with an exercise to identify sustainability interruptions for what is ready to die through hospicing and interventions from what is ready to be amplified through catalyzing.

PLENARY SESSIONS

Plenary Keynote Presentation: The Sustainability Challenge: Scale and Speed:
Speaker: Amy Luers

Plenary Keynote Presentation: The Drawdown Roadmap: A Hopeful, Science-Based Plan to Address Climate Change
Speaker: Jonathan Foley

Plenary Keynote Presentation: Toward Just Sustainabilities
Speaker: Julian Agyeman

Closing Plenary Prize Panel
The 2024 National Sustainability Society Annual Achievement Award Winner (Minnesota's Climate-Smart Municipalities Program)

Commissioner David Howard Senjem (Olmsted County Board of Commissioners), Dr Sabine Engel (University of Minnesota), and Ken Smith, President and CEO of District Energy attended the NSS Conference to receive the achievement award and present on the project.

The North American National Champions for the Frontiers Planet Prize: Dr. Jason Rohr, Galla Professor and Chair of the Department of Biological Sciences, Interim Co-Director of the Boler-Parseghian Center for Rare and Neglected Diseases, University of Notre Dame, and Dr. Umberto Berardi, Canada Research Chair in Building Science, Professor & BeTOP Director, Toronto Metropolitan University, Canada

SYMPOSIA AND ORAL SESSIONS

INFLUENCING SUSTAINABILITY DECISION MAKING

Transforming Lifestyles: Insights from Hong Kong
Speaker: Alvin Li

What factors drive individuals to embrace sustainable behaviors in Hong Kong – a vibrant, multicultural metropolis grappling with distinctive socioeconomic challenges? With a population of 7.5 million, constrained development space, and congested infrastructure, Hong Kong offers a compelling case study for transformations towards sustainable living. Despite its challenges, the region has demonstrated progress through government campaigns and educational initiatives. Our research extends previous studies in Canada (Vancouver, Guelph-Wellington, and Quebec) and Finland, emphasizing the examination of motivational profiles and revealing the underlying drivers influencing individual choices and behaviors.

We employed a rigorous mixed-methods approach, utilizing in-depth interviews and surveys with a diverse sample of Hong Kong residents, encompassing different age groups, socioeconomic backgrounds, and cultural diversities. Cluster analysis and robust statistical methods were applied to identify key motivators driving sustainable behaviors. In the first instances, survey and interviews have focused on attitudes towards fashion consumption and meat consumption, with broader work ongoing. By exploring the motivational factors steering sustainable lifestyles in Hong Kong, this research enriches the discourse on the factors at the individual level that motivate behaviors, and the implications of these for understanding, at the societal level, how to support transitions towards sustainable living. This should provide the basis for actionable insights for policymakers, businesses, and civil society organizations. These insights inform the development of environmentally friendly products and services, fostering inclusive and people-focused growth in organizations, communities, urban environments, and businesses committed to sustainability."

Socio-environmental influences on land turnover in US public rangelands
Speaker: Luci Lu

This study investigates the socio-environmental factors influencing the frequency of changes in permit holders for public grazing lands in the United States, also known as land turnover rates. In the US, ranchers obtain permits from the Bureau of Land Management to graze livestock on designated public land areas called allotments. The frequency of changes in permit holders for these allotments varies across different regions and over time. Allotments with frequent changes in permit holders are more likely to be managed by short-term users rather than multi-generational ranching families, and therefore may not have longer-term land management plans in place compared to the latter. Therefore, understanding the patterns and complex drivers of land turnover plays a critical role in developing long-term sustainable practices for managing public grazing lands. To analyze the influence of environmental and social factors on turnover frequency, we combined archival land tenure data from the Bureau of Land Management with open-access satellite time series. We retrieved data on changes in permit holders for over 600 allotments managed by the Bureau of Land Management Las Cruces office, dating back to 1938. We used classification and regression tree analysis to examine the relevance of socio-environmental factors in predicting changes in permit holders at the allotment level. These factors included natural resource endowments, climatic variability, conservation policies, infrastructure expansion, extractive and recreational activities, and proximity to borders. This study provides data-driven policy recommendations to promote sustainable land management in rangeland socio-environmental systems.

What makes people buy secondhand products on DSP?
Speaker: Hana Kim

Digital sharing platforms (DSPs) can act as catalysts for developing a circular economy by providing users access to information on secondhand products in an online marketplace. These platforms alleviate reservations about purchasing used items by providing reliable information about the products and sellers. Understanding DSP users' motivations, attitudes, and behavioral intentions is crucial for encouraging more citizens to participate in DSPs and fostering a circular economy. Various motivations, including economic, environmental, social, and enjoyment factors, along with individual characteristics such as sociodemographic features and past DSP experiences, can influence attitudes and behavioral intentions toward buying secondhand goods. Danggeun, the predominant DSP for secondhand goods in Korea, derives its name from the abbreviation of 'in your neighborhood' in Korean language and also translates to "carrot" in Korean (a homophone), making it easier for users to remember. This platform's rapid growth is attributed to its innovative model, which allows users to find secondhand products only within their local vicinity (within a radius of 7-10 km). Focusing on the socio-environmentally innovative characteristics of this DSP model, this study aims to explore the roles and interplay of the motivating factors by conducting structural equation modeling on data collected from an online survey with 450 citizens of Seoul. Understanding the interplay of these factors can assist DSP providers in developing strategies to attract individuals interested in sustainable consumption and help policy practitioners create opportunities to develop a circular economy through DSPs.

Who's Word: A Study of Trust in Drinking Water Information Sources Among Vulnerable Populations
Speaker: Jaron Rothkop

Climate change is expected to have a significant adverse impact on the safety of U.S. drinking water systems, many of which already struggle with aging infrastructure and lack of investment. Each year, 56% of the U.S. population is served by a community water system that does not meet EPA standards, with residents of minority and low-income communities being the most affected. Research has shown that these residents are distrustful of official sources of information about their water quality, especially during drinking water emergencies caused by extreme weather events. It is crucial for municipal authorities to

inform the public about the safety and health risks of the drinking water system during such emergencies. Our goal was to identify the most trusted sources of information for residents facing a drinking water crisis and the factors influencing trust in these sources. To achieve this, we conducted collaborative research with community members and organizations in Newark, New Jersey, and South-Central Los Angeles, California. Residents were surveyed about their experiences with drinking water and their trust in various sources of information. We hope that our findings and recommendations will be used by municipalities, utilities, and community organizations to better inform the public about the safety of their drinking water and direct them to contingency solutions during an emergency.

Participatory modeling for environmental planning and policy
Speaker: Moira Zellner

Recent research, professional, and funding agendas have re-surfaced the importance of knowledge co-production and ethical participation to address urban tensions worldwide: urbanization and rapid climate change, disproportionately impacting socially vulnerable populations. Despite the potential of data-driven technologies to address these tensions, they have fallen short from their promise. We present a participatory modeling (PM) platform, fora.ai, to build on existing strengths of DT and overcome their most prevalent limitations. This platform is organized around the iterative steps in PM: problem definition and goal setting, preference elicitation, collaborative scenario-building, simulation, tradeoff deliberation, and solution-building. We demonstrate the platform's effectiveness when embedded in a stakeholder-led process that integrates diverse knowledge, data sources, and values in pursuit of equitable green infrastructure (GI) planning to address flooding. The immediate visualization of simulated impacts, followed by reflection on causal and spatial relationships and tradeoffs across diverse priorities, enhanced participants' collective understanding of how GI interacts with the built environment and physical conditions to inform their intervention scenarios. Participants shifted from untested beliefs to designs that were specifically tailored to the problem in the study area and the diversity of values represented, attending to both localized flooding and neighborhood-level impacts. They also derived generalizable design principles that could be applied elsewhere. We show how the combination of specific facilitation practices and platform features leverage the power of data, computational modeling, and social complexity to contribute to collaborative learning and creative and equitable solution-building for urban sustainability and climate resilience.

WATER SUSTAINABILITY AND ENVIRONMENTAL JUSTICE

Coastal habitats improve disaster resilience in Puerto Rico
Speaker: Maxwell Perkins

As climate change worsens, flooding from extreme weather and sea-level rise continues to threaten coastal populations. Tropical storms are increasing in frequency and intensity – and they regularly cause humanitarian crises. These storms damage key energy infrastructure in isolated island states, leading to prolonged blackouts. Puerto Rico is especially vulnerable to coastal hazards because its electrical grid is still weakened from Hurricane Maria in 2017. In Puerto Rico, coastal ecosystems such as mangroves, coral reefs, and seagrass beds buffer shorelines and offer natural protection against future storms. To quantify how much these habitats reduce the risk of flooding damage, we used a spatial model that takes in biophysical data and estimates a coastal exposure variable. The input data consisted of GIS layers for habitats, geomorphology, sea-level rise, relief, and storm surge. The model shows that 17,000 people live on habitat-protected coastlines that would be highly exposed if those habitats disappeared. These coastlines include major port cities with substations and fuel terminals that deliver power to the entire island. As urbanization and global warming further degrade coastal habitats, Puerto Rico loses its best defense against tropical storms. The spatial model can help prioritize which vulnerable communities receive resilience funding and where to avoid siting tourism to preserve ecosystems. Our model also considers the potential for protected areas to conserve habitats under future sea-level rise scenarios. This study serves as framework for leveraging interdisciplinary connections between conservation biology, climate science, disaster science, and global development policy to address coastal sustainability challenges.

From páramo to huerta: Water as a site of community autonomy and identity in Bogotá
Speaker: Ame Min-Venditti

Previous research on nature-based solutions has found their transformative possibilities may depend on participation and site-specificity (Wolff et al). In Bogotá, Colombia, residents of the communities San Cristóbal, Usme, and Ciudad Bolívar have long faced and resisted displacement due to the local government's designation of their land as "high risk". Within this urban landscape, many watercourses make their way from the Sumapaz páramo (highland savannah) via quebradas (streams) through

communities and their gardens (huertas) into major rivers. These bodies have woven complex socio-ecological relationships throughout space and time (Ríos En Bogotá, 2023). We sought to discern historical, existing, and desired future relationships to water in these three communities. Using a photovoice approach, community members with connections to local activism, environmental work, and artistic projects expressed the multitudes of what water meant to them, such as one participant's quote: "es lo que viene desde arriba" (it's what comes from above). By focusing on youth voices, we invoke and invest in an "imaginary of care", and by incorporating community gardens and their stewards into our study, we learned how interconnected communal foodways, local organizing, and artistic expression are in these communities.

Participatory approach as a tool for transforming the future of water in communities of Yucatán, Mexico
Speaker: Bertha Hdz-Aguilar

Environmental crises such as climate crisis, water pollution and scarcity have become a growing concern in urban and rural areas. In cities of the global south, it has been observed that climate change impacts are often analyzed in a fragmented manner, which means that one risk or impact dimension is prioritized and feedbacks between risks tend to be ignored. In the case of water problems, most of the research is about access defined as a quantity or quality of water, and how communities face water problems, a few of them talk about how communities oversee their water resources, in order to maintain and conserve them. In this sense, we propose a participatory approach to strengthen capacities and knowledge in communities on the management of natural resources supporting the importance of long-term conservation. In other words, the participation and collaboration of communities in the collection of data on-site cannot work by themselves, requiring continual support of several actors and partnerships. Also, we need innovative methodological strategies to create more engagement from all of the stakeholders, for example, urban qualitative scenarios to capture communities and governments' perception about the future of the water in the socio environmental system. The goal with this is to move towards sustainability in water management.

Te Mauri AIO - a traditional Māori healing approach to Cyclone Gabrielle
Speaker: Robbie Richardson

During the aftermath of cyclone Gabrielle, Rongoā, Traditional Māori healing practices, play a crucial role in supporting the well-being of whanau in Aotearoa. With the resurgence of Rongoā practitioners, a range of healing techniques are offered to bring comfort and relief to those who are most vulnerable. Recognizing the need for assistance, Manawatu-based Rongoā practitioners connected with their Hawke's Bay team to assess the situation and realized that support was essential to alleviate the difficult circumstances faced by the affected communities. In response, a dedicated team of seven practitioners from Manawatu traveled for 2.5 hours to Napier-based marae, Pukemokimoki. Their mission was to provide Rongoā Māori to the whanau in need. Understanding the importance of inclusivity, the practitioners also involved rangatahi (youth) in their team. By doing so, they aimed to address the specific needs of the young ones and bring them comfort during this challenging time. The whanau who had been impacted by the cyclone had experienced significant trauma, having lost everything and enduring the distressing process of being rescued from their homes. As a result, the practitioners observed various symptoms among the whanau, including anxiety, depression, post-traumatic stress disorder (PTSD), and a sense of disconnection. To address these emotional and psychological challenges, Rongoā Māori served as a healing space for the affected whanau, offering solace and support. By providing immediate relief, the practitioners also aimed to empower whanau by helping them build resilience equipping whanau with the tools and knowledge to navigate future challenges and strengthen their well-being.

LEARNING TO CLOSE THE IMPLEMENTATION GAP

How to Make Sustainability Part of Everybody's Job: Lessons Learned from Microsoft
Speaker: Drew Wilkinson

In most organizations, environmental sustainability is tasked to a tiny, chronically under-resourced team that also lacks visibility and influence. What would happen if sustainability was a cultural value and a part of everybody's job? Microsoft is well known as a corporate sustainability leader with its commitments to become carbon negative, water positive, and zero waste by 2030. Lesser known is its member employee community and the integral role it plays in driving sustainability work across the entire company. Learn how Microsoft employees self-organized into a Community of Practice and why engaging the entire workforce is necessary for all organizations to meet their sustainability commitments, attract and retain top talent, and continuously innovate in an era of climate disruption

Essential tensions in workforce training for urban sustainability
Speaker: Robert Hobbins

It is imperative that cities become more inclusive, safe, resilient, and sustainable, and society's need to imagine, design, and implement innovative strategies has never been greater. Less clear is whether universities are preparing the next generation of professionals with the knowledge and skills to deliver on these goals. The research team at the Center for Urban Transformations (NSF Award #2203718) investigates the essential tensions that arise in an interdisciplinary graduate workforce training program to prepare future sustainability leaders with the knowledge and skills to advance sustainability transformations in cities. Through engagement with community and practitioner partners, students, faculty, surveys, and focus groups, several key tensions are identified. The integration of diverse disciplinary perspectives presents challenges in structuring training programs, particularly concerning knowledge co-production with community partners and fulfilling accreditation requirements. Tensions arise concerning the assessment of progress and outputs in transformative work, underscoring the value of engagement and reflexivity. Tensions appear related to career trajectories, including the dichotomy between preparing students for emerging versus traditional career paths. The relevance of formal certifications for interdisciplinary work and the equilibrium between depth and breadth of skills, methods, and knowledge acquisition are discussed. Lastly, there is the tension between program flexibility and stability, acknowledging the necessity of emergent approaches while ensuring a well-defined structure to support student learning.This research contributes to a deeper understanding of the complexities surrounding workforce development for sustainability transformations in cities, offering insights to equip students for the evolving demands of sustainability research and practice.

"Digestible" climate education - science cooking demos
Speaker: Carla Ramsdell

Food and cooking are fundamental to our species and climate education framed within the context of a science-based cooking demonstration is an engaging entry-point to improved climate change literacy. This presentation will discuss the evolving work of a previous industry energy engineer, present food physicist to improve the general public's understanding of the urgency of climate action through cooking demonstrations. Currently based in a university with a strong sustainability commitment, the author was struck by the limited audience drawn to guest speakers focused on topics related to renewable energy or climate change. The members of these audience were a mix of university faculty, staff and students and community members, but the majority of them were individuals already deeply committed to climate mitigation agendas. How can we draw others outside of this bubble of action into this critical work to address the urgency of our climate crisis? This presenter has found that a wider population will attend a cooking show focused on a skillet pizza … who wouldn't? And, while this cooking demonstration is progressing, and the smells are infiltrating the room, there is a captive audience able to learn about the science of climate change and ways we can, as individuals and as a community, help to mitigate future emissions. Based on the success of these public lectures, a physics general education college course and student-based online cooking series have been developed to attract a diverse student population to improved climate literacy and action.

Embedding sustainability science in Australia's national science agency: Transferrable lessons
Speaker: Peat Leith

Research organisations increasingly attend to complex, challenge-related questions that require transdisciplinary capacity. They are drawn in by pressing and broad environmental and societal matters of concern. They need to fill ever wider gaps evident in the innovation and governance systems. CSIRO, Australia's National Science Agency, is no exception. It has invested in sustainability science capability through a five-year, AUD$18 million research program. It has brought 17 new early career researchers into the organisation to work with senior researchers on transdisciplinary projects that tackle complex problems for and with regional Australia. For example: how might we ensure a rapidly growing critical minerals industry can create positive futures for historically disadvantaged First Nations communities? How do we develop social measures that can guide investment in natural capital? How can leading indicators of natural capital proactively inform intervention before habitats decline or ecosystems shift to less desirable states? Three years in, this program of work – CSIRO's Valuing Sustainability Future Science Platform – provides transferrable lessons about innovation to embed and institutionalise sustainability science. Drawing on mixed methods data from the program's evaluation, along with reflections of its leadership team, we explore how, why and where innovation for sustainability can effectively catalyse transdisciplinary approaches to closing the implementation gap, at least in our context. The talk focuses on navigating forms of incumbency, institutional logics and relationships, and networks. The proactive co-creation of ambitious, forward-looking, yet humble projects, their implementation with practitioners and policy-makers, provide lessons that underline pathways for workforce development.

Sustainability leadership competencies: practitioner view
Speaker: Lindsey MacDonald

Organizations outside of academia are making bold commitments to respond to the interrelated climate, biodiversity, and environmental injustice crises, requiring a diverse and dynamic set of leadership skills and competencies among current and future employees. Simultaneously, sustainability leadership programs in higher education are growing in scale, scope, and reach. However, many higher education programs tend to develop goals and competencies from a perspective based on learning outcomes derived from environmental education theory rather than from the skills needed in the professional world. Our study assesses relationships between desired competencies of sustainability practitioners and the competencies delivered by sustainability leadership programs in higher education. We deployed a survey for graduates of six sustainability leadership degree programs. The survey - with over 300 respondents - gathered data on graduates' work experience after graduation, the perceived sustainability values and desired competencies of their employer organization, and whether their educational experience provided competencies which were useful in both the hiring process and in their jobs. Our results show that collaboration/teamwork, communication, technical/content knowledge and vision/strategic thinking form a cluster of the most desired competencies. The competencies related to interaction stand out as consistently rated very high in terms of workplace value yet often not directly addressed in sustainability leadership training programs. Overall, survey respondents appear generally satisfied with academic sustainability leadership programs but desire to build competencies that are more aligned with the professional world. We hope this work helps to narrow the gap between sustainability leadership training and the execution of bold organizational commitments.

FROM CRITIQUE TO RE-ENVISIONED SUSTAINABILITIES

Since the late twentieth century, there has been an ongoing and sustained critique of the prevailing paradigms and practices driving conservation, governance, food systems, and infrastructure development, among other fields. These critiques, emanating from Indigenous and peasant communities, social and natural scientists, and others, have highlighted the ways in which dominant systems of thought and practice fail to meet the needs of people–especially the most marginalized–while also exacting heavy tolls on the more-than-human world. In light of these critiques, there is a pressing need to identify new principles, models, and paradigms that are more just, equitable, and integrative and that embody substantive steps forward in the pursuit of sustainability and justice. Building on Paul Robbins' metaphor, there is a need not only to employ the "hatchet" of critique, but also to plant "seeds" of a better future. This pre-organized symposium brings together students and faculty from the University of Georgia and partners working to re-envision sustainability futures across disciplines and sectors. Contributions will include a paper on "rethinking conservation" that explores the troubled history of biodiversity conservation in the United States and beyond, while drawing on Indigenous scholarship and other historically marginalized standpoints to re-think the future of conservation practice. A second contribution on "rethinking infrastructure" presents a framework for moving beyond conventional infrastructure, which in its narrow focus on controlling natural capital has inadvertently degraded biodiversity while perpetuating social inequities. A third contribution focuses on "re-thinking food systems", bringing competing visions for sustainable food futures into dialogue with (i) professional experience across collaborative projects to consider the future of academic knowledge production and training and (ii) methods for envisioning pathways toward more sustainable and desirable food futures. The final paper attempts to "re-think fire" by integrating critical perspectives from the ecological and social sciences and using these critiques to posit key elements of sustainable fire futures. Ample time will be left for discussion to draw out insights across fields and collectively envision the "seeds" of life-affirming sustainability futures.

Re-thinking Fire
Speaker: Laura German

Fire looms large in the human imagination, yet in highly differentiated ways across space and time. At present, it looms largest as an existential threat to land and life. With records of acres burnt continuing to be exceeded and significant loss of human and nonhuman lives in the U.S. and beyond, there is good reason for this. Yet the tendency to view fire as a destructive force, and a disturbance to be eliminated and tamed, is a by-product of a distinctly Western imagination. And it is a core contributor to the hazardous conditions facing the western U.S. and to the loss of biodiversity and countless cultural and economic values in eastern forests. Further, as pointed out by a participant in the 2024 meeting of the Intertribal Timber Council, "fire suppression is cultural suppression." What fire is, and our relations to it, clearly need to be re-thought. This presentation attempts such a re-thinking by integrating critical perspectives from

the ecological and social sciences – from the legacies of colonialism, racism and capitalism that have shaped thought and obscured what fire is and does, to the ecological and institutional legacies of fire suppression and the role of fire within the cultural and political oppression of Native societies. We also posit various pathways forward – from recognizing the unconscious biases that continue to shape fire science and understandings of landscape, to the re-distribution of authority over prescribed burning, and forging new relations to fire in dialogue with those who have long seen fire as kin.

Re-thinking Conservation
Speaker: Cory Struthers

The concept of nature conservation has come under increased scrutiny as the embeddedness of oppressive practices and paradigms in related fields has gained wider societal and scholarly attention. As conservation practitioners and scholars continue to grapple with the foundational assumptions and practices of the field, there remains a pressing need to articulate a positive vision for what conservation grounded in an ethic of justice might look like. To help advance this conversation, we present a diagnosis of the problem based on four intersecting dimensions of oppression: 1) the physical or material manifestations of conservation interventions; 2) the knowledge practices and assumptions that inform and underpin conservation visions and decision-making; 3) the modes of governance associated with conservation practice; and 4) the forms of relational praxis implicitly and explicitly endorsed and/or imposed in diverse conservation arenas. The framework was developed through dialogue among a multidisciplinary group of conservation scholars who drew upon our own diverse experiences in the field as researchers and practitioners, and on our diverse identities (settler and Indigenous, global North and South) that informs what we "see". After presenting the framework, we briefly discuss how each dimension of oppression has shown up in biodiversity conservation and related fields, and how we are failing to learn from history. In recognition that these practices are not fixed, but rather moveable levers that can be repurposed towards anti-oppressive conservation futures, we then draw on a review of emergent practices to re-envision these four dimensions through an anti-oppressive lens.

Re-Envisioning Sustainable Food Futures
Speaker: Jennifer Jo Thompson

Across scales the food system presents a "super wicked problem": the need to meet the demand for healthy, affordable, and desirable food in ways that conserve natural resources, mitigate climate change, and sustain the communities that underpin our food and agricultural systems. A 2023 report from the Food and Agriculture Organization of the United Nations emphasizes that the global food system contributes between 23 – 42 percent of anthropogenic global greenhouse gas emissions, with agriculture accounting for approximately 11 percent. Extreme weather, drought, and flooding are heightening agricultural uncertainty, especially among the most marginalized. Urbanization is consuming farmland while increasing the demand for meat and other high carbon-footprint foods transported over greater distances. Food insecurity remains high, exacerbated by climate change, war, inflation, and economic inequality. In response to increased scholarly and public recognition that the current state of our food system is unsustainable, two competing visions have emerged for sustainable food futures: the first, a techno-optimistic future focused on "precision" agriculture as the route to efficient utilization of natural resources; and the second which imagines dismantling large-scale agriculture in favor of agroecological social movements. Drawing on experience within several collaborative projects, I consider the implications of these competing visions in the context of academic knowledge production and training. I further consider how participatory approaches—grounded in trusting and equitable relationships and centering local perspectives and priorities—can open critical space to transcend these divergent paradigms and support communities to re-envision pathways toward sustainable and desirable food futures.

Re-thinking Infrastructure
Speaker: Charles van Rees

Civil infrastructure will be essential to ensure a livable Anthropocene in the face of rising climate risks and growing resource demands. However, conventional infrastructure planning largely neglects the contributions and maintenance of Earth's ecological life support systems, which provide irreplaceable services supporting human well-being. Those services ultimately depend on biodiversity, but conventional infrastructure practices have inadvertently been a key driver of biodiversity loss. Here, we envision a new infrastructure paradigm wherein biodiversity and ecosystem services are recognized for their essential role in providing for human well-being, and constitute a central objective of civil engineering. In particular, we reimagine infrastructure practice such that 1) ecosystem integrity and biodiversity conservation are explicit objectives from the outset of project planning; 2) infrastructure practices leverage diverse project portfolios along a spectrum from conventional to nature-based solutions; 3) ecosystem functions reinforce and enhance the performance and lifespan of infrastructure assets; and 4) civil engineering promotes

environmental justice by counteracting legacies of social inequity from conventional infrastructure development and nature conservation. This vision calls for a fundamental rethinking of the standards, practices, and mission of infrastructure development agencies and a broadening of scope for conservation science. Here, we explain the historical precedent for this vision and highlight key steps toward its realization.

ACCOUNTABILITY IN SUSTAINABILITY PRACTICES

Sustainability priorities in university ranking submissions
Speaker: Brandon Dickson

We explore the influences on submissions to an international sustainability ranking organization by North American universities, to provide context on stakeholders' priorities and understand the sustainability implementation gap in universities. Universities are major sustainability actors because of their roles in advancing sustainability research and teaching and as large carbon emitters (Huising & Aron, 2023; Purcell, Henriksen & Spengler, 2019). In this space, Times Higher Education's Impact (THE-I) ranking, which scores universities along the 17 Sustainable Development Goals (SDGs), is widely acknowledged as a leader (Veidemane, 2022). Building from calls for future research on the factors that shape THE-I submissions (Bautista-Puig, Orduña-Malea & Perez-Esparrells, 2022) we focus on the research question: As reflected in THE-I's submissions, what sustainability agendas are North American universities prioritizing and are there patterns explaining this prioritization? Drawing data from web scraping on THE-I and university websites, across 97 universities (51 American, 26 Canadian, 20 Mexican) we compare the impact of institution ranking, size, region and funding-status. We find that across North America, universities prioritize 'People' SDGs like Health (n=80), with 'Planet' SDGs like Life Below Water (n=41) receiving less attention. We note that differences in sustainability priorities are nationality-based, with Canadian universities prioritizing Prosperity and Planet SDGs and People SDGs prioritized in Mexico and USA, with no differences by ranking, size, or funding-status. This research provides context on the sustainability implementation challenge by understanding how universities present sustainability actions and their responses to external sustainability agendas. It prompts questions on universities' strategic engagement with sustainability rankings.

Keeping up with the sustainability leaders: Foreign corporate accountability legislation in Canada
Speaker: Sophia Carodenuto

There is a growing recognition of the adverse human, social, and environmental impacts associated with the supply chains of globally traded agriculture commodities like coffee, cocoa, and palm oil. Traditionally, governments have relied on voluntary sustainability standards and corporate due-diligence pledges to address these issues. However, directives from the UN and OECD have spurred the implementation of mandatory supply chain due diligence laws in consumer countries such as France, Germany, and Norway. Canada is now among the nations contemplating policy measures to tackle the social and environmental challenges linked to commodity imports. Our research combines public policy analysis with an examination of corporate commitments, focusing on the Canadian coffee sector. Our dataset represents 80% of coffee imports into Canada and includes a diversity of companies of different sizes, processing capacity, and roles in the supply chain. We ask, what is the demonstrated capacity of the Canadian coffee sector to adhere to potential forthcoming due diligence legislation? Leveraging publicly available corporate social responsibility and sustainability reports, we catalog the specific commitments made by these companies to assess their robustness. We rank companies based on factors like report accessibility, adherence to established standards or internal policies, and the presence of external auditing or third-party verification mechanisms. Our analysis illuminates the nuanced spectrum of commitments made by companies, providing insights into their preparedness to comply with prospective supply chain due diligence regulations. Our findings underscore the limitations of voluntary commitments and advocate for the formulation and implementation of comprehensive mandatory due diligence legislation in Canada.

Evaluating mining MNC's social responsibility performance
Speaker: Cao Yu

In the context of increasing foreign mining activities and their impacts, and the growing number of social conflicts resulting from mining operations, this paper evaluates Chinese multinational corporations' (MNCs) performance. Broadly speaking, scholars paint a picture in which China's political regime together with its national culture and its economic development path influence Chinese extractive MNCs' activities abroad and might contribute to more social conflict. At the same time, scholars writing on extractive

conflicts have argued that conflicts result from companies' inadequate performances, especially regarding community engagement practices. That is, in this second view, social conflict is due to mistakes that any company could make; that is, there is no "Chinese way" of operating abroad. The paper thus engages the following research questions: How do Chinese firms affect socio-environmental conflict around extraction? Why? Through Geographical Information System (GIS) analysis and comparative case studies, this paper finds that firms with better social responsibility performance generate less conflict and Chinese firms do not confront more conflict than other foreign-owned firms. This finding has theoretical contributions as the results that Chinese mining MNCs do not perform worse threaten to falsify much of what has been discussed about Chinese mining firms, that they behave worse and cause conflict. Given the prominence of Chinese firms in mining globally, the study's focus on Chinese MNC mining projects contributes to our understanding of extractive conflict, with implications for the trajectory of extractive sectors and, in turn, alternative or sustainable development options.

Decoupling economic growth from resource consumption: How to implement the European Green Deal on corporate level
Speaker: Christoph Haag

The contributors will present a preliminary framework for a new sustainability management system for producing companies to reach the goal of growth decoupling from resource consumption.

Factors influencing sustainability practices in healthcare
Speaker: Stephanie A. Hanna

With climate change being named by the World Health Organization as the biggest public health threat, it is important to consider the role of healthcare in preventing and managing the health of populations. It is noteworthy, however, that if the global healthcare sector was a country, it would be the fifth largest polluter. As such, various health organizations are implementing environmentally-sustainable practices but little is known about the factors associated with successful implementation and maintenance. We conducted a scoping review to: 1) identify the barriers and enablers for implementing sustainable practices in healthcare, and 2) based on findings, propose a roadmap that supports successful implementation. The three concepts guiding the search were (1) environmental sustainability; (2) healthcare; and (3) barriers or enablers. The PRISMA checklist for scoping reviews was used to guide this search. A total of 16 articles were included and reviewed for data extraction. While most articles focused on healthcare in general, dentistry and surgery were the most recurring clinical areas of focus. Barriers and enablers were related to the individual (e.g. knowledge, skills, and attitude), institutional (e.g. budget, strategy, and readiness), geographical/infrastructural (e.g. infrastructure and public awareness), political (e.g. regulations and incentives), and other (e.g. patient awareness and knowledge). Based on the various factors identified, an eleven-step roadmap was developed with the first step being to understand the geography, infrastructure, and policies in which the organization operates and the final being to measure and refine progress towards sustainability objectives.

SUSTAINABILITY EDUCATION

Engineering for one planet: tools for change
Speaker: Cindy Anderson

Engineering for One Planet (EOP) is an initiative to transform engineering education and equip all future engineers across all disciplines with the fundamental skills and principles of social and environmental sustainability. Catalyzed by The Lemelson Foundation and VentureWell in collaboration with hundreds of sustainability advocates across sectors, the EOP initiative envisions a world in which all engineers play a critical role in ensuring that the solutions of today do not become the problems of tomorrow, restoring and regenerating our planet, and improving is accelerating curricular transformation by supporting faculty change efforts through the co-creation of open source teaching resources with a growing community of stakeholders and providing seed and institutionalization grants, as well as fostering collaboration among stakeholders across sectors. Experts from academia, civil society, and government co-developed the EOP Framework in 2020 that provides an adaptable and adoptable vetted menu of 93 core and advanced sustainability and leadership learning outcomes. Five universities pilot tested the framework in curricular changes over two years, and the EOP Framework was revised in 2022. In 2023, EOP launched three companion teaching guides with step-by-step guidance and free teaching resources for integrating learning outcomes from the EOP Framework. To date, EOP's 34 higher education grantees have integrated EOP learning outcomes into hundreds of courses reaching over 15,000 students. During this presentation, authors will share an overview of the EOP initiative, lessons learned for emulating in other domains, its freely available teaching resources, and ways to get involved.

Predictable obstacles to sustainability progress
Speaker: Peter Schulze

Sustainability efforts regularly falter on one or more of 18 obstacles. The various obstacles pertain to each of this conference's themes. They hinder both innovation and implementation, and lack of forewarning impairs career readiness. The obstacles fall into three groups: one set slows detection and understanding of problems, another set hinders deciding to respond, and the third set interferes with responding effectively. They apply to most if not all the specific topic areas of this year's conference. The obstacles affect issues large and small and often regardless of controversy, though several are subject to exaggeration by those opposed to sustainability progress. Some obstacles are obvious to the casual observer, but others may be less familiar. Sustainability texts and curricula do not typically address them. Thus, when the obstacles arise, responses are often ad hoc. I described each of the 18 in a 2022 open-access book (https://www.uclpress.co.uk/products/186377) written for those embarking on sustainability careers. Here I seek to attract others to their further study and thus foster more rapid sustainability progress.

Aligning sustainability academics with student interests and employer needs
Speaker: Meghann Jarchow

Sustainability can be understood as asking the questions, “What kind of world do we want?” and “How can we effect change to create that world?”, yet employers often seek to hire students with knowledge of specific tools or analytical methods. Aligning sustainability curricula and co-curricular opportunities, student interests, and employer needs can be challenging. At the University of South Dakota, we have undergraduate (since 2012) and graduate (since 2018) degrees in sustainability. In this session, we will describe our efforts at aligning opportunities, interests, and needs including student, faculty, and external stakeholder feedback of those efforts. We will also describe alternative curricular and co-curricular structures that we are exploring. This session will leverage the experiences from the Sustainability Program at USD to advance the conversation around sustainability education.

Interdisciplinary energy studies for the renewable energy transition
Speaker: Charles Barnhart

Navigating the transition to a renewable, low-carbon, and just energy system requires leaders who understand the science and technology as well as the economics and regulatory system. It demands practitioners who can pivot the spreadsheets, and others who can turn a wrench. Across the board, it requires agile thinkers who can synthesize a wide array of information and plot a course from where we are now to where we need to be, at the scale of the household, the firm, the state, or the country. In 2012, Western Washington University embarked on a bold initiative to build an interdisciplinary undergraduate energy program grounded equally in the science and technology aspects of energy as in the economics, policy, and managerial aspects. As of June 2024, we will have graduated over 100 students with the BA in Energy Policy and Management or BS in Energy Science and Technology, in addition to dozens more with minors, certificates, or concentrations in majors like electrical engineering and business. Many of our graduates find meaningful and impactful energy jobs right out of college, and in our second decade we are looking to broaden and strengthen connections with secondary schools, community and technical colleges, the military, and other universities. This talk highlights the structure of the energy studies programs at Western, the paths of our alumni, and the opportunities we see for future growth.

Sustainability leadership certificate that combines policy, business and environmental science
Speaker: Jessica Hellmann

The University of Minnesota public affairs (Humphrey School of Public Affairs) and business schools (Carlson School of Management) recently completed a collaboration with the Institute on the Environment to create an interdisciplinary certificate in sustainability leadership to be offered beginning fall 2024. This presentation will describe the challenges and benefits of inter-collegiate collaboration in a context that was designed to offer programs within schools or colleges. By combining the perspectives of policy and business, on a sustainability science foundation, the University aims to prepare change agents who can provide leadership in a wide range of organizations in the business, public and nonprofit sectors. In addition, combining the perspectives of public affairs and business enables students to imagine a broader range of action in working across the boundaries of those sectors. Prospective students are working professionals who are interested in building on their existing sustainability skills or retooling to shift into sustainability work in light of increasing employer demand, as well as current university graduate students. The certificate planners took a frugal approach to creating the certificate by relying primarily on existing courses. They incorporated the key sustainability competencies described in the sustainability literature. The certificate also incorporates experiential learning components that have been identified as

important in sustainability education.

SUPPLY CHAINS; PRODUCTION, INNOVATION, SUSTAINABILITY

Sustainable Technological Innovation of the Secondary Battery Industry
Speaker: Joosung Lee

Secondary batteries are a key technology to lead the sustainable transformation of various industries. Global companies have actively invested in research and development to increase the battery performance and reduce costs. For a sustainable energy sector, international governments provided policy incentives while the secondary battery market grew rapidly. This paper presents an industrial innovation strategy for the subsequent phase of this transition as the key players in the secondary battery industry are competing in the U.S., China and Korea. Among them, Korean companies have grown their market share significantly and are seeking ways to innovate next generation technologies as well as expand business opportunities with an integrated view of the geo-political economy. Given this business environment, this paper analyzes a case study of a secondary battery manufacturer in Korea and suggests a feasible innovation strategy to collaborate and compete with the U.S. and Chinese producers. This research contributes to understanding the industry's technological options and its complicated geo-political landscape in progressing toward global sustainability.

Living wage implementation gap in global supply chains: a study of global sustainable textile Manufacturers
Speaker: Ellen Holtmaat

This research focuses on closing the living wage implementation gap in global supply chains. Living wages are essential for human health and well-being, addressing governance issues to bridge the gap between aspirations and reality. Achieving living wages supports SDG 10 (reduced inequality), SDG 1 (no poverty), and SDG 8 (decent work and economic growth) by increasing incomes for low-income households and reducing the number of working poor. A living wage is a context-specific estimate of the income needed for a decent standard of living through a standard workweek, often higher than the legal minimum wage. Currently, over 20% of full-time workers do not earn a living wage, and at least 8% live in extreme poverty. In the past seven years, attention to living wages has increased significantly. Companies are making commitments, NGOs are verifying claims, multi-stakeholder groups are piloting programs, and, as of March 2024, the International Labor Organization has committed to more active promotion and oversight. However, these efforts have resulted in few actual transitions to living wages. This study aims to understand why organic textile manufacturers certified as ""sustainable"" still struggle with implementing living wages and identifies the conditions under which they succeed. By analyzing survey data and auditor reports from 448 manufacturers, it evaluates four sets of hypotheses derived from existing theory: cost, collaboration with buyers, intra-firm conflict, and technical capacity. This research provides a new theory on the persistence of the living wage gap and offers recommendations for supporting this critical sustainability transformation.

Pathways for the Indian steel sector: Realizing low carbon industrial clusters through a place-based approach in eastern India
Speaker: Alexandra Mallett

There is an increasing realization that current methods to produce materials which underpin modern society such as steel are unsustainable; a challenge particularly acute in India, a rapidly growing economy. However, strategies to decarbonize the steel sector being proposed in India – which often centre on breakthrough technologies - may not be as applicable for certain industrial clusters such as those with many smaller firms. Furthermore, there are growing calls for 'just transitions'; arguing that conventional ways of responding to change (e.g. opening/closing a mine or factory), which emphasize economic growth and profit maximization rather than people and places, exacerbate stressors faced by these industrial clusters. Opportunities and challenges around decarbonization will depend upon a cluster's specific resources, assets, and capacities, which will in turn affect their ability to adapt to change. So how can industrial clusters embark upon sustainability pathways including decarbonization in a just, equitable way? To tackle this question, we turn to the experiences of three industrial clusters in the 'steel belt' of India (Durgapur, West Bengal; Giridih, Jharkhand; Raipur, Chhattisgarh) using a place-based approach. In contrast to a technology-based or sectoral approach, a place-based approach acknowledges that industrial clusters are also places that many call home and that people develop emotional attachments to, providing a sense of identity and belonging. Through document analysis, along with field research in the clusters conducting surveys, interviews and focus group sessions, we found that history (influencing variation in workers' wellbeing by firms and level of awareness of rights), identity (such as place attachment to both

sacred places around the cluster and the cluster itself), and local socio-economic dynamics (such as which actors were deemed most legitimate) helped to explain differences between the clusters, as well as their potential towards decarbonization. These insights can help to develop appropriate – and hence more feasible - decarbonization pathways within respective clusters; ones in which people and places are at the core.

Supply Chains: Production, Innovation, Sustainability
Speaker: Alan Jacobsen

Developing novel decarbonation solutions for sectors such as materials (e.g. paper, plastics, concrete, steel) and fuels (e.g. drop-in fuels, hydrogen) is a critical part of addressing climate change. At Amazon, our team is focused on accelerating the invention, development, and adoption of new technologies and solutions that will help meet our collective sustainability goals in collaboration with partners. We take a multifaceted approach that combines building foundational science-based computational models to extract novel insights with forming strategic partnerships to advance the most promising emerging technologies. In this talk, we will discuss our firsthand experience of how a paper decarbonization model we developed generated actionable insights into decarbonization strategies, including the potential for implementing carbon capture and storage (CCS) technology at scale. Using these insights, we initiated a Multi-disciplinary collaboration with RTI International, SLB, and International Paper (IP) to design and construct a first-of-its-kind CCS demonstration plant at IP's paper mill in Vicksburg, Mississippi. This project was recently awarded funding by the US Department of Energy, and if we are able to successfully complete all stages of this project (target date 2029), this large-scale demonstration facility will capture up to 120,000 metric tons of CO2 per year, and enable over 100,000 metric tons of decarbonized paper per year for Amazon packaging.

Co-designing innovation pathways for transition to circular economy
Speaker: Tripti Basant

The Indian textiles sector is one of the largest job providers in India, employing over 45 million people and contributing to 4% of the country's Gross Domestic Product. However, various concerns have been raised regarding the sustainability of the textiles supply chain. This includes excessive use of water and pesticides in cotton production, the wet processing of textiles, which generates an enormous waste sludge and chemically polluted waters unfit for agricultural and potable use. The situation is reported to be approaching crisis proportions, with court order closure of several small and micro producers, leading to loss of livelihood of millions of workers. The objective of this research is to show how the current crisis can be leveraged as an opportunity for transformation, through exploring the viability of circular business models and codesigning of innovative pathways for transition to a circular economy. Based on data collected through semi-structured interviews, focus groups, and stakeholder workshops in one of the major textile clusters in South India (Tirupur Knitwear Cluster, TKC), we will present results on: a) Mapping of current linear value chains in TKC; b) Evaluation of the sustainability of TKC from the economic, social and environmental perspectives, using the U.N. Sustainable Development Goals framework; and c) Co-design of innovative circular practices and business models in TKC through stakeholder engagement. This research will help to promote awareness of and catalyze the scaling of innovative circular economy business models to textiles and related industries.

SUSTAINABLE TRANSPORTATION

Vessel speed reduction to protect blue whales & blue skies
Speaker: Sean Hastings

Protecting Blue Whales and Blue Skies is an incentive based voluntary ocean Vessel Speed Reduction (VSR) Program along the coast of California. In seasonal and predictable VSR zones, ocean shipping companies calling on California ports can reduce impacts on endangered whales, air quality and regional greenhouse gas emissions, and ocean noise. The Protecting Blue Whales and Blue Skies (BWBS) team independently verifies cooperation rates, quantifies the benefits of participation, and provides positive public relations for program participants to incentive sustainable shipping practices. The 2023 season marked the highest enrollment and cooperation rate in the program's history. Collectively, 33 global shipping fleets traveled ~375,000 nautical miles at 10 knots in the VSR zones and achieved an overall cooperation rate of 81%. Environmental benefits included a reduction in NOx emissions by 1,250 tons and regional GHG emissions by 45,000 metric tons. The reduced risk of fatal ship strikes to endangered whales was 58% and underwater noise was reduced by 5.4 decibels per transit. Motivating shipping companies was a robust positive public relation campaign including 900+ features with 25 million news impressions and 30 million advertisement impressions. The BWBS program is also working with consumer goods brands, retailers, ports, freight forwarders and logistics companies as Ambassadors to further support their ocean carriers'

participation. The BWBS incentive program cooperation matches compliance with regulated VSR zones on the U.S. East Coast, demonstrating incentive based voluntary program can achieve significant conservation success.

Let's get to work - Electric vehicle adoption leadership
Speaker: Brittney Breen

Forth is a nonprofit organization based in Portland, Oregon. Our mission is to electrify transportation by bringing people together to create solutions that reduce pollution and barriers to access. Forth envisions a world where clean and equitable transportation systems move everyone and everything. We work in partnership to build lasting program and policy models that significantly expand equitable access to electric transportation in the U.S. and beyond. Why are we focused on these areas? Because transportation is the largest source of greenhouse gas emissions. It is also the only sector with rising emissions. Greenhouse gas emissions from transportation account for about 29 percent of total U.S. emissions. An employer's commitment to sustainability is critical in employee retention. A survey of 20,000 HP employees globally found that 61% of survey participants believe that business sustainability is mandatory; and 58% said that environmentally conscious practices are key to engaging the future workforce. Forth, along with partners, developed a scalable workplace charging model with practical support for employers: the Electric Vehicle Adoption Leadership Certification Platform. Funded by the Department of Energy, Forth in collaboration with our partners, developed a nationwide platform that provides motivation, information, and support for businesses of all kinds. EVAL is a national workplace electric vehicle charging certification program that provides recognition and technical assistance to organizations supporting the adoption of clean transportation. Thus far, organizations such as Hawaiian Electric, Mastercard, and Cal Poly are among some of the first to certify.

Transportation decarbonization strategies: Evaluation of sustainable aviation fuels using life cycle assessment
Speaker: Marco Ruggeri

According to the International Energy Agency, the transport sector was responsible for about 8.8 GT CO2 eq in 2022, 40% of global CO2 emissions related to the energy sector, contributing significantly to climate change and its associated impacts. Therefore, recently, the global community has intensified its efforts to address the pressing challenges posed by climate change and the need for sustainable energy sources. As part of this effort, much attention has been paid to the development of alternative fuels that can mitigate GHG emissions while ensuring energy security and compatibility with existing infrastructure. This could be particularly useful in the aviation sector, which, while accounting for a relatively small percentage of global GHG emissions (800 Mt CO2 eq in 2022), is one of the most complex sectors to decarbonize. It is considered a so-called "hard-to-abate" sector, i.e., those sectors difficult to decarbonize through conventional methods such as, for example, direct electrification. Sustainable aviation fuels (SAFs), which are fuels that are chemically the same as their fossil counterparts but produced from biomass, fit into this context. Although their diffusion is still low due to their relative newness, it might be important to verify their sustainability through quantitative tools such as Life Cycle Assessment. Therefore, the objective of this research is to study the sustainability of different types of precursors used for the production of SAFs, considering different biomasses. Specifically, from food feedstocks (Soybean, Palm, Rapeseed, and Camelina), non-food feedstocks (Jatropha), and organic waste (tallow and waste cooking oil).

Water transportation using a periodic temperature gradient
Speaker: Hideyuki Sugioka

Shortage of water and energy problems are urgent matters to solve for a sustainable society. For these problems, the control of convection might be a clue to the solution because convection flow exists everywhere. Here, we will review the recent findings of our group concerning sustainable water transportation methods in a convection flow region from the viewpoint of the forefront of fluid physics. That is, we introduce a new method of water transportation using convection control technology with renewable energy such as sunlight, and unused heat such as industrial waste heat. Specifically, we propose a method of extracting mechanical energy (flow energy) directly from periodic temperature gradients, thereby making it possible to use low-grade energy that exists widely and thinly without incurring costs. In particular, we will demonstrate the possibility of creating a flow using sunlight by placing black and white logs [Appl. Phys. Lett.120, 123901 (2022)] or black triangular prism structures [Journal of the Physical Society of Japan 92, 114401(2023)] in a fluidic channel. Furthermore, we will demonstrate the possibility of elevating water to a high place using sunlight with a spiral tube [Physics of Fluids 34, 114121(2022)]. Our technology may help to achieve sustainable transport of water and contribute to a water shortage problem in the world.

The Challenges of Reducing Maritime Emissions
Speaker: Anil (Andy) Hira

Maritime shipping delivers approximately 80% of global trade of physical goods. The sector consumed approximately 9.1 EJ in 2018, relying primarily on heavy fuel oil and marine diesel. Shipping creates 3% of global greenhouse gas emissions, an estimated 1076 Mt in 2018. The International Maritime Organization has set ambitious targets for emissions reductions, aiming to cut them by 40% by 2030 and net zero by 2050. The challenges of transforming an entire sector are daunting. Electric batteries do not have the range to handle the long distances of global trade. Using natural gas, ammonia, or methanol might reduce emissions, but not so significantly. Alternative clean fuels such as hydrogen, are nascent. On top of this is the extreme challenge of coordinating and enforcing norms across global shipping. This paper begins to explore options for maritime shipping, including energy efficiency, alternative fuels, and constructing a global regime that would move us closer to net zero.

STAKEHOLDER INCLUSION

(De)Centering power dynamics for innovative risk management processes
Speaker: Khampha Stempel

Risk management is central to processes of sustainable innovation. Risk management itself is often a site of sustainable innovation. However, the intended outcomes of innovative risk management processes do not match resulting impacts. This oral presentation presents findings from examinations of risk management processes facilitating the permitting process of the Stibnite Gold Project - a mine site located in the northwest United States seeking a permit to mine minerals necessary for solar storage and military technologies. Multiple stakeholders shape the knowledge networks that inform the decisions crucial to the permitting process. This research reveals how misunderstandings of social and political power relations contribute to the incongruency of intended outcomes and impacts of Stibnite risk management processes. Understandings of how social and political power is organized has deep implications for functions of systemic/institutional oppression, spatial and temporal mobility, and, ultimately, who/what is sustained. To address questions of what and who is being sustained - a larger question throughout sustainability scholarly and public discourse - this research communicates how stakeholders involved in Stibnite risk management processes might better engage with issues of power. Stakeholder, or community, engagement has become a crucial innovation in response to more traditional risk management processes. However, it remains unclear which innovations in stakeholder engagement should be sustained and which should not. Additionally, who and what is being sustained as a result of risk management processes? To effectively carry out stakeholder engagement - it is essential to consider all that is at stake. Analyzing social and political power relations offer greater clarity to why certain risks are (de)centered in stakeholder engagement processes and how sustainability risk management processes might become more socially and politically just.

Explaining empowerment: Clean energy, development and gender
Speaker: Deepti Chatti

Gender empowerment is one of the stated goals of expanding clean energy access and achieving sustainable development, but its meaning and the nature of its relationship to energy access is nebulous. Extant sustainability research has promulgated a limited idea of gender empowerment, limiting it to purchasing power, participation in wage work, and time savings. Based on ethnographic research in India, I analyze the ways in which a rural community in Himachal Pradesh engages with the world's largest clean cooking energy program, the Pradhan Mantri Ujjwala Yojana. The program's discourse suggests that clean energy empowers participants by providing comfort from drudgery and freeing up time for rest. I analyze household energy decisions together with agrarian cycles and their labor demands and find that liquefied petroleum gas (LPG) enables more work rather than rest. Here, clean energy allows for participants to increase a desired busy-ness rather than providing more comfort or rest. How does this counterintuitive outcome affect the empowerment goals and impacts of the program? I argue that the empowerment potential in energy programs lies not necessarily in the grand imaginaries articulated by external development actors, but in the myriad ways in which they are heterogeneously embraced by the targets of sustainable development to meet specific local needs. I conclude the paper with a section on how ethnographic research, although very specific in place, context, and time, can yield broader insights for designing future energy programs with progressive gender goals in mind.

Gender inclusivity of the United States biosphere regions
Speaker: Alaina Smith (She/Her)

Masculine language is pervasive through socio-economic development and its vernacular, leading feminists to argue that sexist language can skew gender roles and identities in favor of male hegemony (Boroditsky 2009). An increase in the visibility of women's rights issues in the fields of conservation and land use change has led to positive reflection on gender inclusivity and a realization that amending practices to include women without a commitment to include all genders is not enough. This study analyzes the inherent gender bias of the language used in the United States Biosphere Network and the UNESCO Man in the Biosphere programme at large. UNESCO's Man in the Biosphere programme provides an opportunity to support conservation and sustainable development with logistical support in key large landscapes across the United States. Periodic reviews assess a Biosphere region's success in reaching these goals, including a specific question on gender inclusivity efforts, called "2.4.4 Women's Roles." This alone demonstrates the exclusionary language prevalent in the global network, despite UNESCO's commitment to gender-neutral language. This study employs document analyses to evaluate the gendered nature of the language used in the submitted periodic reviews of the United States Biosphere Network in comparison to the language used in the UNESCO technical guidelines. The results describe the current landscape of implicit bias in the program, highlighting a key area for intervention to bring intentionally inclusive language and practice to the United States Biosphere Network.

Building First Nations capacities for climate action
Speaker: Brennan Vogel

Historically marginalized through processes of colonialization, First Nations Indigenous communities in Canada, like those around the world, face a range of immediate challenges and future opportunities in building capacity for responding to the impacts of climate change and reciprocal needs for greenhouse gas (GHG) reductions. While constituting less than 6% of the global population, Indigenous peoples also steward over 80% of the planet's remaining biodiversity. Deshkan Ziibiing, or Chippewas of the Thames First Nation, is an Anishinaabeg community of 1002 people located 30km southwest of London Ontario Canada. Located on Deshkan Ziibi (Antler River, Thames River), the community faces an array of climate change mitigation challenges and adaptation opportunities. Reducing GHGs from home heating through net zero retrofitting, inventorying terrestrial and aquatic carbon, improving regional collaboration on River pollution and initiating nature based solutions and climate actions provide good opportunities for creating new jobs in energy efficiency and conservation and through Indigenous Guardians programs which in turn provide opportunities for climate action, decolonialization and reconciliation. In this presentation, non-Indigenous ally and Climate Change Liaison Brennan Vogel will share key insights from case stories and four years of work experience with the Department of Treaties Lands and Environment at Chippewas of the Thames First Nation, including project highlights on topics such as: two-eyed seeing approaches to flood risk mapping; Indigenous housing and net zero retrofitting; conservation social impact bonds; Indigenous Guardians capacity building; regional integrated watershed management; carbon sinks, biodiversity, species at risk and Indigenous land stewardship and nature based solutions.

Environmental justice and indigeneity: a Māori view.
Speaker: Suzanne Phibbs

Environmental hazard and climate change impacts are patterned along lines of social inequality, with Indigenous peoples more likely to be impacted, raising important concerns for the environmental justice movement. The under-representation of Indigenous people in environmental justice policymaking also impacts upon the acceptability and relevance of sustainability initiatives to first nations peoples. Indigenous concepts, values and understandings of environmental justice are pertinent to climate change mitigation, transformative practice and sustainable futures. This collaborative presentation, by Māori academics and Māori community members, focuses upon local indigenous understandings of environmental justice which emphasise the need to maintain harmony and balance among humans and in relation to the natural world. Research Question: How does local Indigenous knowledge ensure environmental and community sustainability? Methods: Qualitative interviews with key knowledge holders and community-led Indigenous workshops in the Rangitikei region of New Zealand. Findings: Māori participants drew upon ancient spiritual customs as well as traditional knowledges and practices to adapt and respond to environmental challenges, such as the degradation of ancestral lands, variations in biodiversity and the increasing frequency and severity of flood events. Significance: This research contributes to an emerging evidence-based body of literature by Indigenous scholars that documents Indigenous cultural strengths in relation to climate resilience and environmental sustainability. Global Indigenous heterogeneity, and the diversity of local Indigenous knowledges, values, principles, and practices are assets to environmental justice agendas.

THE EQUITY OF GOVERNANCE IMPLICATION OF GEOENGINEERING

Advancing an Ethical Framework for Climate Intervention Research – Issues and Opportunities
Speaker: Billy Williams

Climate change requires urgent action. Increasingly, the world is considering technology-based climate intervention approaches—often called geoengineering. Many of these approaches are untested and the consequences are not well understood. While climate intervention research has been justified as being necessary in order to expand the range of options available to policy makers in the future, some public opposition to geoengineering exists, whether to research or implementation. In 2022, AGU launched its plan to develop an Ethical Framework for Climate Intervention Research —a code of conduct to guide climate intervention measures that may be needed in addition to emissions reduction. The proposed ethical framework principles have undergone a public comment period, and an updated set of principles is being prepared for public release in 4th Q 2024. The foundations for these updated principles and associated recommendations, the process by which they were developed, their implications, and the proposal for global dissemination and engagement will be discussed

Dangerous distraction or climate savior? Geoengineering and global sustainability.
Speaker: Duncan McLaren

The term 'geoengineering' embraces two broad categories of interventions in global climate systems – large scale carbon removal and solar radiation modification (SRM). These categories differ both practically and politically, with carbon removal increasingly accepted and pursued, but SRM still speculative and widely resisted. However both forms of geoengineering share an ethical similarity: that they are interventions undertaken after the fact of excess emissions, and their pursuit might as a result serve to discourage or deter timely emissions reductions. This presentation examines the risks of such 'mitigation deterrence', identifies potential and actual pathways through which it emerges, and outlines the implications. It highlights the ways in which discourses around both carbon removal and SRM promise a slower and more orderly energy transition as a desirable outcome of the deployment of geoengineering, rather than as a failure to deliver the social and economic transformation needed for justice and sustainability. It concludes with some reflections on how geoengineering might be governed to as to reduce the risk that it serves to preserve an unjust social order and unsustainable economic system.

The sociotechnical dynamics of negative emissions, carbon removal, and solar geoengineering
Speaker: Benjamin Sovacool

Despite a long history of climate agreements since the Rio Earth Summit in 1992, greenhouse gas emissions have continued to grow over time, only temporarily slowed down by the first year of the COVID-19 pandemic in 2020. Negative emissions technologies (also known as carbon removal), including soil carbon sequestration, afforestation and reforestation, direct air capture, and bioenergy with carbon capture and storage, may be employed to remove carbon dioxide from the Earth's atmosphere. Solar geoengineering technologies (also known as solar radiation management) such as stratospheric aerosol injection, aimed at reflecting a portion of incoming sunlight back into space before it reaches the Earth's surface, could serve as an emergency measure to slow the risk of global warming, or create a stop-gap period of adjustment that gives countries time to adapt to the impacts of climate change. Both sets of negative emissions and geoengineering options could become widely deployed by mid-century. But their emergent benefits, risks, and impacts on justice, equity, and future climate pathways are uncertain. Drawn from a rich collection of original data as a part of the GENIE project, this presentation offers a meta-analytical framework where social science, engineering, and physical science disciplines merge for a comprehensive mapping of these prospective energy and climate transitions. It explores the environmental, technical, social, legal, ethical and policy dimensions of greenhouse gas removal and solar radiation management. It offers a critical scientific assessment of deployment options, controversies, and patterns of social acceptance and opposition for evidence-based policymaking to address climate change and a zero-emissions future.

SUSTAINABLE BIOECONOMIES

Ocean-based micro-macroalgae cultivation: New approach for CO2 sequestration and biofuel production
Speaker: Bao Nguyen Quoc

Freshwater and areal land use are two major limitations in growing feedstock for a carbon negative

bioeconomy. The ocean offers seawater and unused surface area that can be utilized to grow microalgae and macroalgae for CO2 sequestration, which can provide valuable biomass for biofuel production. Microalgae and macroalgae are known for their rapid growth and ability to sequester CO2 through photosynthesis by which they reduce greenhouse gasses hence unlocking a carbon negative economy. However, microalgae are too small to be harvested from the ocean. To address this challenge, we propose farming microalgae and macroalgae as a consortia together with beneficial bacteria in eco-friendly hydrogel constructs, which can be deployed on mobile platforms in the ocean. Micro and macronutrients such as iron, phosphate, and nitrogen will be encapsulated in hydrogel hence making them readily available for microalgae and macroalgae to grow in areas lacking essential nutrients – a common limitation of the oceans. In our research, we were able to grow the consortia in hydrogels within 30 days, and the biomass saturated the hydrogel, reaching 2-3 times the initial biomass. The presentation will discuss the scientific principles behind microalgae cultivation, including the selection of suitable species and cultivation methods. This research provides a stepping stone to a new field employing the ocean's surface for carbon sequestration and to potentially producing beneficial value-added products.

Biochar biofertilizers: Carbon storage from the ground up
Speaker: Rosemary Randall

There is a pressing need for sustainable practices in the agricultural sector that promote crop growth and soil health. This is in part due to the sourcing and production of conventional fertilizers being unsustainable, and also because they have cascading negative impacts on the environment. For example, they pollute water sources and increase emissions of the potent greenhouse gas N2O. Additionally, agricultural soils are often contaminated with toxic substances that accumulate over time, decreasing soil fertility. Innovations that mitigate these impacts are greatly needed for a sustainable future, and biotechnological advancements hold promise. Here, we present our research that harnesses the tripartite interactions among plants, fungi, and bacteria to promote carbon stabilization, soil health, and plant growth. Our biotechnology encases highly-functional mixed-microbial consortia in biodegradable hydrogel beads with C-capturing substances (e.g., biochar) that can be applied to soils. We hypothesize that synergistic interactions among bacteria, fungi, and biochar in hydrogels will promote the plant and soil communities' ability to uptake nutrients while removing pollutants and facilitating C storage. Data from current studies demonstrate that our biotechnology can maintain grain yield in wheat by promoting closed-loop nutrient cycles and plant nutrient uptake. Further, we found that when we encased various consortia with biochars and applied them to highly contaminated soils with sorghum and sunflower as host plants, there was an increase in soil organic matter and a decrease in the concentration of several pollutants. These results demonstrate that our hydrogel biotechnology has potential to be optimized for sustainable practices.

Spatial Greenhouse Gas Emissions of US Soybean Products
Speaker: Rylie Pelton

The US is a leading producer and exporter of soybeans, accounting for 28% of global production. Soybeans and their derivative products are critical to various downstream sectors, including biofuels and livestock products. However, the environmental impacts of US soybean production and processing are typically based on national-scale estimates, overlooking regional variations in practices, grids, and environmental conditions. Understanding how supply chains aggregate impacts in different regions will help identify opportunities for mitigating emissions in downstream supply chains to meet climate action targets. This study estimates the life cycle greenhouse gas (GHG) impacts of US soybeans, soybean meals, and oils, considering spatial differentiation in production and processing. By leveraging a least-cost optimization model, we provide transparency to US crop commodity supply chains, enabling consumption-based estimates of emissions. We connect the estimated commodity flows to county-scale, nationwide life cycle inventories (LCI) of soybean production, considering differences in nitrogen fertilization, N2O emissions, land use changes, irrigation, and fuel use. Processing-related emissions from solvent extraction processes are estimated, considering differences across each processing step, grid regions and soybean protein qualities, together capturing spatial variability in GHG hotspots. Our findings highlight significant regional variations in GHG emissions, driven by differences in agricultural practices, supply chain sourcing, and processing regions. This spatial differentiation is crucial for accurately estimating the GHG footprints of downstream products and identifying priority areas for targeted climate action, underscoring the importance of region-specific life cycle assessments in developing effective sustainability strategies and supporting various industries' goals to reduce GHG emissions.

Sustainable food waste treatment and the resource recovery
Speaker: Abdulmoseen Segun Giwa

In 2022, approximately 1.05 billion tonnes of food waste were generated globally, according to the UNEP Food Waste Index 2024. This highlights the extensive issue of food waste, with households contributing 60%, food services 28%, and retail 12%. Food waste occurs during storage, processing, and consumption in various settings, including homes and restaurants. It is estimated that about one-third of all food produced for human consumption is lost or wasted, totaling around 1.3 billion tonnes annually. These figures highlight the urgent need for addressing food waste on a global scale. Some FW treatment approaches generate Recalcitrant Organic Residues (RORs)
from the biological treatment of FW, which also account for approximately 30% of the actual waste. These wastes are difficult to degrade and are considered indigestible residues from aerobic and anaerobic fermentation treatments at FW treatment facilities.The currently applied disposal routes for FW and RORs are not sustainable. They exert environmental pressure and are underutilized as resources. Therefore, these challenges must be addressed. This project proposes an innovative strategy to enhance the energy value and beneficial
products derived from FW and associated RORs. We propose conceptual future optimization routes for FW and RORs via two types of sustainable technology integration. Pyrolysis techniques will thoroughly treat RORs to produce various value added bio-energy products, such as pyrogenic biochar, syngas, and bio-oil. Anaerobic digestion will treat FW while utilizing pyrolysis products to enhance performance and upgrade biomethane and nutrient rich digestates for agronomy. The tar challenges associated with conventional pyrolysis will be mitigated by employing two-stage pyrolysis, which will prevent device pipe blockages and promote the production of adequate oil and gas products. This holistic proposal will offer sustainable real-life applications to harness the inherent resources of FW streams generated from FW
treatment facilities. .

Sustainability-informed design for A carbon negative bioeconomy
Speaker: Yuan Yao The bioeconomy harnesses biological resources and processes to replace fossil-based, non-renewable products. Various bioeconomy pathways integrate natural and engineered carbon dioxide removal (CDR) solutions, such as biochar and bioenergy with carbon capture and storage, presenting significant potential for climate change mitigation and addressing global resource challenges. Establishing a sustainable, carbon-negative bioeconomy requires a comprehensive understanding of the environmental, economic, and social impacts of diverse biomass pathways and their CDR efficacy across different technologies, locations, and timelines. However, gaining these understandings is challenging due to the limited knowledge of system-wide effects and the absence of comprehensive assessment methods across various spatial and temporal scales. This presentation will introduce multi-scale life cycle frameworks developed by Yao's research lab to tackle these challenges. By coupling industrial ecology methods such as life cycle assessment with techniques from other disciplines—including machine learning, engineering process modeling, techno-economic analysis, and ecosystem modeling—these frameworks offer a dynamic approach to understanding the complexities of biomass systems. Through several practical case studies, the talk will demonstrate how these integrated frameworks enhance our understanding of interconnected biomass and engineered systems across different scales. Additionally, the presentation will explore policy implications and illustrate how insights from these case studies can guide system-level design toward a resource-efficient, climate-beneficial bioeconomy that supports global sustainability goals.

BIO-BASED FUELS AND CHEMICALS FOR A LOW-CARBON ECONOMY

Industrial decarbonization in the U.S. – a perspective
Speaker: Corinne Fuller

Industrial GHG emissions are an increasing fraction of U.S. emissions. Achieving carbon neutrality requires decarbonizing U.S. industry. Industrial GHG emissions come from electricity and fossil energy inputs, feedstocks/raw materials, and product usage and end of life. How do we enable implementation of the highest impact approaches? This question will be addressed in the talk.

An Inconvenient Truth: Why the economics of making jet fuel from biomass is so awful
Speaker: Richard Gustafson

A lot of outstanding research has been done on production of aviation fuel (SAF) from cellulosic biomass, but we still are awaiting commercialization of this process. In this presentation I will go over the economics of producing fuels from cellulosic biomass to show how challenging it is to build a commercial cellulosic biorefinery. I will make some comparisons with the petroleum industry – the competition – and the pulp and paper industry – the biorefinery's closest cousin. Finally, I will make some suggestions on what might

help the economic situation and what probably won't – but there will be no "silver bullets." The talk is designed to stimulate a lively conversation in the discussion period.

Drivers of Current Biofuels Development and Opportunities for the Future
Speaker: Dane Camenzind

Over the last 5 years, we've witnessed a rapid rise in consumption of hydrocarbon renewable fuels, primarily renewable diesel produced from lipids. But recent announcements from several companies may be signaling an end to the "renewable diesel boom" as credit prices have fallen and feedstock prices have risen. Comparisons of economics and feedstock inventories applicable for other fuel pathways are explored and additional attention is given to sustainable aviation fuel (SAF).

Advancing towards scale-up, developments in hydrothermal liquefaction of biomass at Pacific Northwest National Laboratory
Speaker: Peter Valdez H

Hydrothermal liquefaction (HTL) is an emerging technology for converting wet biomass and wastes to fuel intermediates. Using hot (350 °C) and compressed (2,400 psig) water as the reaction medium, biomolecules in the feedstock material decompose, producing a biocrude and other carbon-rich co-products. The biocrude can be upgraded to finished fuel products, including gasoline, diesel, and jet fuel fractions. We will highlight key advancements made in recent years to improve the technical and economic viability of HTL. Key technical advances include strategies for formatting feedstocks, optimizing heat exchange, and managing solids during processing. Key economic opportunities were identified, such as sourcing regional feedstocks, blending seasonal feedstocks, and making use of cost-advantaged feedstocks. The cumulative results of the research advancements are incorporated into process and economic models for the design of a commercial-scale HTL facility. The proposed HTL facility has the potential to produce biofuels at commercially competitive prices.

Transitions from fossil energy to bioenergy: Evaluating socio-economic impacts to avoid burdens on disadvantaged and rural communities
Speaker: Esther Parish

The US Department of Energy's BioEnergy Technologies Office (BETO) has been funding research to inform the process of siting renewable bioenergy facilities so that they do not perpetuate or increase the socioeconomic disparities associated with fossil fuel industries. Our research team has worked with a cross-section of stakeholders to develop a list of practical indicators of procedural and distributional justice that can be used to site new and repurposed facilities in ways that increase benefits and decrease adverse effects to underserved communities. This list of energy and environmental justice (EEJ) indicators can be modified with communities to guide siting and permitting decisions by drawing early attention to key problems, concerns, or priorities and then tracking progress toward justice-related targets. We participated in a January 2024 BETO listening session in California and will be participating in a Gulf Coast listening session in January 2025 to hear directly from affected communities about their key concerns during this time of energy transition. We will be using these findings along with case study results to develop a set of recommended practices that can guide an equitable and sustainable energy transition.

TRANSLATING SCIENCE INTO IMPACT FOR SUSTAINABILITY

Bridging Science to Impact: SEI-US Water Program's Journey from Research to Action
Speaker: Laura Forni

Water is the essence of life and while that simple concept will always hold true, the way water is managed, and the strategies researchers use to support decisions around water are continuously changing. Particularly, as watershed management often consists of multiple trade-offs where people and ecosystems are affected by local and global changes, the solutions to local water challenges are influenced by the social and political context, national economic objectives, and native ecosystems. At the SEI-US Water Program, we embrace the complexity and diversity of these issues as we strive to translate our research into tangible, sustainable impacts around the world. Our projects span a spectrum of technical complexity, working at different scales, responding to the objectives of a range of stakeholders in projects funded by diverse sources, ranging from water utilities to national-level initiatives. In navigating the challenges inherent in each water project, we grapple with the reality that challenges at the local levels are influenced by both local and global dynamics. Our journey from research to impact involves applying sophisticated frameworks and technical tools to identify solutions, which are then integrated into policy instruments for implementation. Furthermore, by integrating education and capacity building into our projects, we work to

ensure the long-term sustainability of these efforts and empower local communities to implement effective water resources management. In this presentation, we will highlight three emblematic projects that illustrate our evolution over the years and our transition from research to impact in California, Africa, and Latin America.

Shaping Sustainable Energy Policy through a Dual Focus on Cutting Edge Research and Stakeholder Engagement
Speaker: Charlotte Wagner

The Energy Modeling Program at the Stockholm Environment Institute (SEI) spearheads transformative research at the intersection of energy, environment, and sustainable development to support science-based decision making in lower- and middle-income (LMI) countries. Over the past 40 years, SEI has offered an openly accessible, user friendly energy systems modeling software called Low Emissions Analysis Platform (LEAP) to support LMI countries in drafting science-based climate mitigation and sustainability pathways. As stakeholders' needs have become more complex, SEI has continuously evolved the platform to allow for more detailed assessment of national energy systems, such as cost-optimization and transmission modeling, but also broadened the scope of LEAP to consider the intersection of climate mitigation with other development challenges. In its recent work, SEI has supported countries in assessing integrated water-energy-food systems, impacts of climate change on hydropower, air pollution co-benefits, and climate mitigation and sustainable development goals intersections. Central to SEI's success in this area is capacity training and fostering enduring partnerships with environmental and government agencies. By transferring knowledge and building local expertise, SEI empowers communities to navigate complex energy transitions, fostering inclusive and sustainable development pathways. Through its multifaceted, global approach, the Energy Modeling Program at SEI has been a force in shaping a more equitable, resilient, and sustainable energy future in numerous regions. The ASEAN Energy Outlook, which was co-developed by SEI and the ASEAN Center for Energy, is a key example of such long-term engagement and has allowed SEI to push towards net-zero planning in South-east Asia. Currently, over 60 countries currently employ LEAP for their Nationally Determined Contributions, testimony to both success and need for science-policy engagement around climate mitigation and sustainable development.

Influencing UNFCCC negotiations through research on fossil fuel supply and transitions
Speaker: Derik Broekhoff

SEI's Initiative on Fossil Fuels and Climate Change helped to advance knowledge on the role of policy in driving fossil fuel supply, and the potential for supply-side policy interventions to reduce greenhouse gas emissions and promote sustainable development. The initiative built on SEI's partnerships and capacity-building activities around the world, engaging recognized leaders on climate change mitigation, energy modelling, political economy, equity and the climate change negotiations. In this presentation, we discuss how SEI's core research, framed around issues such as the emissions implications of new fossil fuel production, the risks and benefits of policies that might curtail emissions, and the role of political economy in shaping decisions about fossil fuel development in individual countries, moved through networks of stakeholders and decision-makers, playing a key role in advancing consideration of fossil fuel supply within UNFCCC negotiations.

Using research to support the co-development of effective policy instruments to foster clean cooking technologies
Speaker: Robert Bailis

Roughly one billion people in sub-Saharan Africa lack access to clean cooking fuels and rely on fuelwood, charcoal, and other biomass burned in open fires or simple devices. Resulting pollution contributes to nearly one million avoidable deaths each year. The same pollutants worsen ambient air quality and contribute to climate change. Harvesting degrades landscapes and the burden of collection often falls on women and young children. Despite countless policies attempting to induce a transition to cleaner, healthier options, woodfuels remain entrenched in the regional energy mix. Further, the WHO projects that 400 million more people will use woodfuels by 2050. Uganda exemplifies this trend, with very little uptake of cleaner fuels and no change expected under current policies. However, the Ugandan government would like to act. In this presentation, we explain how SEI is supporting the Ugandan government's development of a new "clean cooking strategy". We are co-developing new policy instruments including standards for novel cooking technologies, verifiable targets for adoption of those technologies, financial instruments to address affordability gaps for businesses and end-users, and, most relevant for forests and livelihoods, regulations that seek to limit access to woodfuels like charcoal. Lessons from this work will be broadly applicable as dozens of African countries seek to induce similar energy transitions.

LINKING ENVIRONMENTAL AND HUMAN WELLBEING

From Silos to Synergy: Uniting Climate Action, Biodiversity Conservation, and Human Well-Being for a Resilient Future
Speaker: Yusuf Jameel

Addressing climate change and improving the health and well-being of those in poverty are some of the biggest challenege we are facing today. We analyzed 80 climate solutions and identified 28 solutions that offer co-benefits for human well-being in rural and underserved areas of South Asia and sub-Saharan Africa. We evaluated how these solutions impact the twelve dimensions of human well-being. Our review of over 450 articles and reports found strong evidence that implementing these climate solutions can significantly improve aspects of life such as income, health, food security, education, and gender equality. For instance, implementing clean energy practices can alleviate poverty, and enhance health, gender equality, and education. Similarly, agriculture and agroforestry focused climate solutions can improve food and water security for billions of people in low-and middle-income countries. Our analysis highlights that the dual challenge of climate and well-being can be addressed simultaneously. There is a remarkable opportunity for climate funders, policy-makers, and businesses to alleviate poverty and improve well-being by investing in these solutions. We must urgently prioritize them for the well-being of the people and the planet.

Forests, global change, and children's health
Speaker: Taylor Ricketts

Ecosystems support human well-being, but specific health consequences of ecosystem change remain rarely quantified. Here we report on several collaborative studies to understand general relationships between forests and children's health. We compiled a unique dataset covering ~900,000 children from 49 countries, by combining Demographic and Health Surveys (DHS) with spatial information on climatic and environmental factors. Using these data, we find that children living near to or downstream from forests tend to face reduced risks of diarrhea, malaria, low diet diversity, and stunting. We repeatedly find stronger effects of forests for poorer and more rural communities, indicating that forest conservation could benefit vulnerable households most. Finally, we find evidence that deforestation can undermine the effectiveness of common public health interventions such as water treatment and bed nets. These and other studies indicate broad and general links between ecosystems and human health. Together, they indicate that forest conservation can be an effective and equitable public health investment.

Global Interactive Tool Communicating Health Impact of PM2.5
Speaker: Nishka Sharma

Air Pollution is one of the greatest health threats facing humanity today. But, how can we effectively communicate its impact on human health to the public, specifically the implications it has on our life spans? How do we effectively nudge people to take action on air pollution? Air Quality Life Index (AQLI), an interactive map tool, fills this gap by estimating the relationship between PM2.5 pollution and Life Expectancy, allowing users to visualize the gain in Life Expectancy they could experience if their community met the latest World Health Organization (WHO) Annual PM2.5 guideline, national standards, or another standard. It does so by leveraging results from a pair of large cohort quasi-experimental studies set in China. The results of the studies are combined with detailed global population and satellite derived PM2.5 data to estimate the impact of particulate matter on life expectancy across the globe. This presentation will share the latest findings of global air quality and its impact on human health, as calculated by AQLI. It will also discuss methods AQLI uses to communicate about air pollution to the public, including AQLI's interactive map tool, providing a hyperlocal view of air pollution in a given region and how it compares to other regions and across time. The presentation will also discuss how various public stakeholders have used this information to nudge their communities, cities, and countries to action.

Linking SDGs and LCSA to evaluate technologies and products
Speaker: Alexander Barke

Using new technologies and products is directly linked to a contribution to more sustainability. To demonstrate this, companies usually highlight their contribution to the 17 Sustainable Development Goals (SDGs). However, these are often subjective forecasts that focus only on using the technologies or products, neglecting the entire life cycle. Furthermore, such forecasts are made after the technology and product development, and the question remains how exactly the contribution to achieving the SDGs can be quantified. Precisely these aspects can provide important impetus in the early stages of technology and

product development to make them truly sustainable. For this reason, we have developed a method that enables the quantification of the contribution of technologies and products to SDG achievement. The method is based on linking the prospective Life Cycle Sustainability Assessment (LCSA) to the SDGs. The prospective LCSA is used to determine the environmental and socio-economic impacts of technologies and products along their entire life cycle. Subsequently, the 17 SDGs are characterized via the previously determined environmental and socio-economic impacts. Finally, the contribution to SDG achievement is quantified. The applicability of the method is demonstrated by analyzing next-generation lithium-sulfur all-solid-state batteries (LiS-ASSBs) for electric aircraft. Different configurations of LiS-ASSBs are modeled and our method is used to quantify their contribution to SDG achievement. It is shown that LiS-ASSBs make significant contributions to SDG achievement, and thus to a more sustainable development. In summary, the developed method can be used in science and industry to provide important impulses in early development phases.

How poverty is measured impacts who gets classified as poor
Speaker: Christine Pu

Background: A wide array of organizations measure poverty to inform their operations. They use a correspondingly diverse set of indicators to do so. We test whether the classification of households into poverty categories is meaningfully influenced by the poverty measurement approach that is employed. Methods: We conducted 16,150 household surveys across Ethiopia, Ghana, and Uganda to measure households' wellbeing status using four commonly used poverty measurement approaches. Households were selected using a stratified random sampling approach to ensure representativeness at the district level. Spearman's rank correlation coefficients (Rs) were used to compare poverty classifications at the household level. Results: We find almost no agreement in how four commonly used approaches rank 16,150 households in terms of poverty status. Pairwise comparisons of the tools demonstrate weak associations for the full sample; correlation coefficients range from Rs = 0 (95% CI [0, 0.02]) to Rs = 0.2 (95% CI [0.19, 0.22]). Correlations are just as weak for each district, for urban and rural households, and across the entire socio-economic distribution. Households' poverty rankings differ by an entire quartile on average. Conclusions: Conclusions drawn by researchers and practitioners about how much their water and health programs are reaching the impoverished may in large part be an artifact of how they are measuring poverty. Given the considerable amounts of funding, time, and energy invested into these programs with the deliberate aim of alleviating poverty, our findings are cause for concern. They also underscore the importance of clearly conveying how organizations are defining 'poverty'.

SUSTAINABILITY ON FARMS AND ACROSS LANDSCAPES

Lessons for sustainability innovation from Scotland
Speaker: Jack L. Harris

Scotland provides a unique case for understanding tensions between global solutions and hyperlocal realities across dense, remote, urban, rural, and island communities. This topic explores the delicate balancing act between global and transnational solutions, community agency, and local governance and highlights Scottish innovations in governance and solutions building. The presentation combines cases from our developing Rutgers University Scottish Sustainability Study abroad course (May 2025 estimated launch and June 2024 planning trip) and findings from research on Scottish institutional frameworks that foster community sustainability. Connections between community agency and institutional actions in specific contexts such as community energy and regional foodsheds, depopulation and migration, transport, and the impact of large-scale renewable energy development and rewilding projects on local communities and remote regions are considered. Scotland provides a unique, bounded case study through which to explore sustainability practices and policies rooted in culture, identity, institutions, and history. Since 1999 Scottish law and policy (independent of United Kingdom laws and policies) have focused on empowering people and communities to engage in sustainable activities that increase economic and social wellbeing at neighborhood, community, and regional levels. These laws foster community agency which in turn drives hyperlocal efforts to increase sustainability and wellbeing through community-based approaches to energy, housing, workforce development, and sustainable food systems. However, national and international priorities, laws, treaties, and compacts sometimes impinge upon community agency in solving sustainability challenges. Scotland provides some instructive lessons in how to address these conflicts.

Agricultural land utilization efficiency evaluation in China
Speaker: Wasi Ul Hassan Shah

With the declining agricultural land availability and increasing need for food production in China's

agricultural sector, it is significantly important to evaluate the efficiency of land usage and its causes in order to achieve sustainable agricultural development. Further, heterogeneity in production technology across different regions affects agricultural land utilization and sustainable total factor agricultural productivity. To this end, this study aims to evaluate the agricultural land utilization efficiency, regional technical heterogeneity, and total factor productivity (TFP) change in 31 Chinese mainland provinces and 4 agricultural regions. The study employed DEA-SBM, Meta-frontier analysis, and Malmquist productivity index to gauge the agricultural Land utilization efficiency, technological gap ratio, and TFPC in 31 mainland provinces and 4 different agricultural regions for the study period of 2000-2022. The results of the study demonstrate significant disparities in the efficiency of agricultural land utilization among different regions and provinces. The average efficiency score for China's agricultural land utilization is 0.7822, indicating 21. 78 % growth potential. The eastern region was found to be more advanced in agricultural production technologies, with a higher technological gap ratio of 0.9733. The Malmquist index value of 1.0923 indicates the growth in TFPC over the study period. The total factor productivity Results further reveal that technological change is the main determinant in the total factor of agricultural productivity change.

Trees Outside Forests: What We Know, What We Think We Know and What We Don't Know
Speaker: Pooja Choksi

Over the past decade, land restoration has emerged as the leading natural climate solution to mitigate climate change, with potential to produce co-benefits to biodiversity and people's livelihoods. A plethora of tree planting programs aim to increase tree cover outside natural and protected ecosystems by planting trees in farms, savannas, roadsides etc. However, the evidence on the production of co-benefits is sparse and at times, conflicting. We carried out a systematic literature review on the human wellbeing outcomes of 20 trees outside forests (ToF) practices, such as agroforestry, silvopastoralism, the use of live fences etc in South Asia. In order to quantify the lesser studied wellbeing outcomes of trees outside forests in South Asia, we screened 6000 articles and filtered 375 articles that met our eligibility criteria. We found that most studies focus on the material and economic outcomes, which are positively influenced when trees are planted outside forests. Trees planted outside forests can increase conflict within local communities and negatively impact people's sense of agency. However, close to 80% of the studies reviewed were observational and without a comparator and 15% of the articles reviewed had conflicts of interest. Further, more local and less expansive ToF practices such as home gardens and alley cropping are important to promote tree species diversity in comparison with practices such as afforestation. Our review shows that ToF may not always produce win-win outcomes for climate and people. This research is crucial to guide restoration efforts in this UN Decade on Restoration.

Implementing the Transition to Organic Partnership Program
Speaker: Esteve Giraud

The organic food sector accounts for six percent of all food purchased in the US, and contributes to human health, economic development, and climate change mitigation. Yet, it has traditionally received less in federal support than its market share. In 2022, the US Department of Agriculture launched the Organic Transition Initiative (OTI), a historic $300 million investment in organic agriculture to support transition to organic agriculture. A pillar of this initiative, the Transition to Organic Partnership Program (TOPP) aims to provide direct support to farmers, ranchers and processors through technical assistance, workforce development, community building, and mentorship opportunities. TOPP is a collaborative effort involving more than 250 organizations and hundreds of farmers across the United States, divided across six regions: the Mid-Atlantic/Northeast, Southeast, Midwest, Plains, Northwest, and West/Southwest. In this context, our research team was entrusted with building a data collection and reporting system to ensure efficient and comparable data collection throughout the country for the duration of the program. In this presentation, we (1) describe the process in developing a coherent, cohesive, and collaborative data collection system for all the project partners, (2) present results after one year of program implementation, and (3) discuss current implications and challenges for organic workforce development and community building, and how these relates to larger workforce development in sustainable food systems.

SUSTAINABILITY TRANSFORMATIONS - SUPPORTING HUMAN WELLBEING

Measuring Sustainable Human Wellbeing
Speaker: Uma Baysal

Achieving sustainable well-being requires measuring multiple dimensions of human development beyond economic metrics, focusing on ecosystem changes to ensure long-term environmental health. Traditional measurement methods focus on economic development, often neglecting the ecological determinants

essential for the sustainability of human well-being. The tension between sustainability and development becomes apparent as the recognition of the dependence of human well-being on ecosystem services is crucial for safeguarding the environment. This highlights the necessity for indicators that capture the intricate relationship between human well-being and environmental changes while addressing the challenges posed by the tension between sustainable practices and traditional models. Higher GDP scores may enhance human well-being yet conflict with sustainability. Our objective is to develop a Human Well-being Index tailored to assess the sustainability of local human well-being in the counties of Colorado. With the recognition of the multidisciplinary nature of human well-being, this study adopts an integrated approach combining indicators of human well-being and environmental consumption to provide a holistic evaluation of sustainable well-being at the county level. By evaluating counties, we identify areas needing sustainable transformation and prioritize policy interventions. This tool enhances understanding of local challenges and provides a framework for informed decision-making and investment. This study contributes to the conference theme by bridging the gap between human development and environmental sustainability. It offers a practical application for policymakers, researchers, and stakeholders interested in promoting sustainability. By highlighting the trade-offs between development and sustainability, our approach supports the effort to find areas where a transition towards sustainable models is needed.

Detroit Therapy Forest: Fostering environmental and social resilience in a post industrial city
Speaker: Zachary Pousak

This presentation focuses on a therapy forest project initiated by a small nongovernmental organization based in Detroit, Michigan with support from the National Fish and Wildlife Foundation (NFWF), and in partnership with US Forest Service and faculty and students from the University of Michigan-Dearborn and other academic institutions. Rescue MI Nature Now (RMNN) is a community-based organization whose "mission is to acquire underutilized plots of land and revamp them into communal green spaces, populated with trees, flowers, and native flora." In 2022, RMNN received support from NFWF's Southeast Michigan Resilience Fund to transform an area characterized by neighborhood blight into an approximately 2-acre, accessible therapeutic forest through a participatory planning design and construction process that also provides a hands-on learning component for grade-school students. We provide background on the ecology and history of Detroit and the origins and evolution of RMNN, while documenting the first two years of this project, through the summer of 2024. We include geographic and ethnographic data on the community context as well as tree baseline tree inventory and tree canopy assessment. Based on pilot data, we consider the following questions: can small scale or "pocket" forests that are intentionally designed achieve similar restorative goals as larger forests that are naturally occurring? How can a forest alter or reverse the relationship between human residents and wild growth, shifting from threat to benefit? Finally, how does the development of local urban forests add to other efforts to revitalize local communities and economies and enhance progress towards broader sustainability goals?

Health benefits of exposure to urban greenery: an interdisciplinary study
Speaker: Rajasekhar Balasubramanian

Population growth and rapid urbanization have led to many negative impacts on urban areas, including decreased air quality, urban heat islands (UHI) effects, increased energy consumption, and deterioration of urban dwellers' health. Expanding urban greenery (UG) with mixed configurations and compositions is one of the strategies that we can consider helping urban planners to develop a sustainable city. Extensive UG can help to reduce ambient temperature, improve outdoor as well as indoor air quality and increase biodiversity. UG can also be used to combat climate change and UHI effects. However, the influence of different attributes of UG on human health and well-being remains unclear due to a lack of empirical evidence. In the interest of filling this knowledge gap, we conducted a comprehensive, interdisciplinary research program to create practical knowledge and provide relevant data with specific reference to improvement of urban air quality and related health benefits. This work included the investigation of air quality at 16 strategic locations with different types of roadside vegetation as well as computational fluid dynamics-based simulations of on-road vehicular emissions across porous vegetation layers with various heights and depth. Our research findings indicate that vegetation installed on roadsides with different configurations has different impacts on the exposure of city dwellers to traffic-related air pollution (TRAP). Among these configurations, 3-layered hedges are effective in reducing human exposure to TRAP and provide multiple health benefits. Our study outcome will enable city planners and environmental professionals to install appropriate UG systems in cities to promote human health.

Just and Equitable Transformations in the Northeast U.S.: a future for whom?
Speaker: Manasa Bollempalli

Over the next few years, flooding and heatwave exposure will increase in coastal Northeast U.S. due to

compound climate and man-made threats. Living in a highly developed, ethnically diverse, and urbanized region that includes Philadelphia and Camden, local migrant and underserved communities are facing the brunt of these impacts with critical losses of life and property. Not always included in the conversations about adaptation, migrant, black, Hispanic, and Asian communities are also understudied in the risk and emergency fields. Given that decision-makers are facing the need to develop equitable and just transformative solutions for adaptation, it has become essential that we listen to these voices. Furthermore, much remains to be explored regarding what a sustainable transformation might mean to these populations in the context of rapid economic and climatic change that may not hinder their capacity to adapt. This presentation discusses findings from over 200 interviews conducted among underserved communities and local decision-makers in South Philadelphia and Camden. As part of a larger project on climate knowledge co-production, we discuss how the notion of equitable transformation has gained preeminence in public policy and research. We also delve into how concepts, such as climate mobility, become integral to societal discourses about change and influence policy priorities. As the region grapples with the dual threats of urban flooding and heatwaves, the notion of transformation moves from a theoretical construct to a pragmatic imperative, delineating a vision of a legitimate, sustainable future and who gets to participate in it.

Preliminary Findings from Accelerating Source Separation for Equitable Transitions (ASSETs)
Speakers: Marisa Manheim, Hayley Joyell Smith

In the United States, where over 65% of the nutrients in the food supply end up as environmental pollutants, source separation of wastewater can create a circular nutrient economy, reducing water pollution and utilities' treatment costs. Yet, implementing source separation requires coordination across a complex system-of-systems that includes municipalities, property owners, regulators, and workforce professionals, and necessitates changes to toilet users' sanitation practices and imaginaries. This paper empirically analyzes an ongoing transitions management project, Accelerating Source Separation for Equitable Transitions (ASSETs), led by academic, private sector, and nonprofit researchers. Funded by the National Science Foundation's Convergence Accelerator program, ASSETs applies design research methods to foster emergence of local source separation initiatives by involving a diverse array of stakeholders and users in iterative learning cycles. Early feedback from regulators narrowed the project's scope to separating urine, which contains 70% of nutrients in human waste. Feedback from utility and municipal professionals informed the near-term goal: piloting circular sanitation systems through a mobile collection unit. Collaboratively designed with local stakeholders in Ann Arbor, MI, this unit will reduce the impact of large public events, like Big 10 football games, on the wastewater utility and divert urine to fertilize local landscapes. Design principles co-created with sanitation justice activists ensure ongoing planning accounts for equity and justice considerations. This transdisciplinary action research project provides an empirical example of transitions management of sociotechnical systems, demonstrates how design research methodologies can aid transformations research, and addresses a need for more discourse on sanitation in the sustainability literature.

DATA FOR SUSTAINABILITY: LIMITATIONS AND CHALLENGES

The AI elephant in the room: Energy & resource use
Speaker: Jeremy Tamanini

Generative AI is both energy and resource intensive, consuming large amounts of electricity, as well as water to cool data centers. Estimates suggest that by 2027, global AI could consume the same amount of energy as the Netherlands, and produce scope 1 & 2 water withdrawals 4-6x greater than Denmark. These environmental costs to AI systems exist alongside clear benefits: improved country and sector-level sustainability measurement; energy and resource optimization within enterprise operations; superior forecasting and early warning systems related to severe weather events or agricultural disruptions; and streamlined sustainability reporting. Sustainability innovation must ensure that we accelerate these benefits while the associated costs recede through being managed responsibly. This oral presentation will be structured as follows: 1) define AI energy & resource consumption in simple terms accessible to a broad audience; 2) share emerging best practices for mitigating the environmental footprint; 3) provide latest updates on standards from both national governments and non-governmental organizations to promote data transparency and responsible management around these proliferating AI systems. The presentation aims to inform conference participants from different backgrounds. It will include footnotes and references useful to diverse stakeholders, including: 1) academics looking to deepen the research associated with this topic; 2) private sector entities interested in how to best monitor and optimize their integration of AI systems to enterprise operations; and 3) public sector officials tasked with considering these emerging environmental concerns in the context of overall AI regulatory frameworks.

Mapping finer scale wealth inequality using machine learning and remotely sensed data
Speaker: Nabin Pradhan

Limited and missing socioeconomic data have made it nearly impossible to measure or estimate wealth inequality consistently at fine spatial or jurisdictional scales, let alone to track changes in it, for lower- and middle-income countries (L&MICs). We demonstrate a novel data harmonization method that combines existing household survey data with freely available remotely sensed data employing machine learning to generate finer-scale wealth inequality measures across spatial and temporal scales. Our analytical approach involves harmonizing socioeconomic information from two recent nationally representative Demographic and Health Surveys (DHS) in India. Our analysis provides three significant contributions to addressing wealth inequality data gaps. First, drawing data from 84 countries, our study demonstrated that Gini coefficients derived from nighttime lights tend to overestimate wealth inequality compared to survey-based estimates. Second, we developed an analytic method to integrate socioeconomic survey data with various layers of remotely sensed data, approximately at the village or ward level to develop a reliable proxy of wealth inequality. Finally, leveraging a cross-validated machine learning model with training and test datasets spanning a five-year gap, we successfully filled data gaps at the subnational levels comprising Block and District in India from 2016 to 2020. The study contributes novel methods to generate socioeconomic measures of inequality globally and their application to address other Sustainable Development Goals (SDGs) related to equity.

Measuring and mitigating the carbon impact of data
Speaker: Alisa Bonsignore

Data has a carbon footprint. The world is using twice as much energy as in 1980, driven largely by digital technologies. Yet most sustainability solutions are digital. Those who came of age alongside the internet believed digital content and tools to be a shiny, sci-fi utopia. It was invisible, therefore it was harmless. That underlying mindset has pervaded technological and sustainability developments for the last three decades. There's always a technological solution. We'll tech our way out of this mess! The IPCC reports that we need to take drastic and immediate steps to reduce our carbon emissions. We've already seen that the existing and widespread effects of anthropogenic climate change are already being unevenly felt, with more dramatic consequences experienced by women, people with disabilities, those experiencing poverty, and BIPOC communities. Whether we're talking about apps or AI, we have an ethical obligation to educate the emerging workforce about the need to balance any solution's benefits with the planetary harm of the digital format.

WHAT MAKES A DIFFERENCE? TEACHING COMMUNITY ENGAGEMENT

Teaching community engagement for sustainability presents a central challenge: how can educators provide students with a substantive experience while also advancing the goals of a community partner. Or, put more colloquially, how can educators cultivate student-community partnerships without wasting anyone's time? This symposium features presentations from five faculty members in degree-granting Community Sustainability programs at two public universities. Drawing on lessons learned and best practices for teaching community engagement, the presentations showcase multiple models of and methods for engaging students, communities, and building partnerships with community institutions. Acknowledging the diversity of student backgrounds and class sizes, this symposium recognizes the need for adaptable teaching approaches. It also explores the interdisciplinary nature of community engagement, highlighting the importance of collaboration across fields and communities of expertise – including residents of the communities where we work. Presenters will share experiences of addressing common challenges encountered when teaching community engagement for sustainability and offer innovative solutions for overcoming them. By incorporating perspectives from various fields – including theories of "the social" – this symposium also underscores the importance of contemplative practice and faculty mentorship for advancing students' efforts in community towards a more sustainable future.

Community Partnerships as Pedagogy: Best Practices for Navigating Tensions in Needs, Power, Time, and Purpose
Speakers: Leah Mundell, Lindsey Falkenburg, Nora Timmerman

This session shares the work of two undergraduate programs at Northern Arizona University that teach community engagement. The Community Engagement Minor connects undergraduates directly with community partners to organize around issues that affect them and their communities, while developing skills of relationship building, power analysis, and action planning. Community and University Public Inquiry pairs advanced undergraduates with regional organizations to conduct just and sustainability-focused community-based research in Northern Arizona. In both programs, substantive

partnerships with community organizations are central to the learning experience. Yet, incorporating undergraduates into an organization or community group takes significant time and resources. How do we ensure students have meaningful learning experiences while advancing the goals of community partners? While there are no silver bullets, we share best practices from nine years of experience in community-based research and action education. In particular, we address relationship-building and clear needs assessment for all partners involved; scaffolded mentoring for students, graduate facilitators, and faculty; modeling and teaching democratic, decentralized power and agency; and selecting community partners that value (and have capacity for) education. We also discuss navigating the unexpected within dynamic community partner-based learning. Finally, we consider how partnerships help us bridge deep critiques of our current systems and the need for immediate action within the imperfect world in which we live.

A "Bite-Sized-Chunk" vs. "Seeing the System": Teaching social theory for community engagement
Speaker: Alder Keleman Saxena

How does teaching social theory aid in community engagement? This presentation explores how social science and humanities teaching gives students tools for engaging with community partners to address real-world sustainability challenges. The social sciences - ranging from anthropology to economics to psychology - have a long history of thinking about what makes a community, and what drives social change. Critically examining a range of different perspectives on what makes "the social" allows students to identify, compare, and contrast ideas about what motivates people to action, which unstated assumptions and principles undergird decision-making, and how best to apply the concepts they learn to what they encounter in real-world work. Crucial to this is tacking back and forth between structure and agency - so students appreciate the complex interplay between phenomena that constrain and enable change. The arts and humanities can complement this by helping students think through the kinds of stories and histories that shape collective meaning-making. Resonating with other approaches that encourage taking a "bite sized chunk" of sustainability problems, teaching humanistic and social theory can help students to "see the system" - and in that way, be better prepared to take strategic action to advocate for sustainable futures.

Student activist spaces as sites for community collaboration and strategic action
Speaker: Nora Timmerman

Student activism has always been a vibrant part of college and university life. As we consider how to address implementation gaps and develop a sustainability workforce, the skills students learn through mentored, community-engaged campus activism become crucial. Institutional gaps between professed values and on-the-ground action often don't close without a push, and the people who have learned how to push strategically and in collaboration with community groups become important leaders in any sustainability movement. In this paper, I share scholarly case studies of historical and contemporary student activist movements, each of which found success through community partnership and/or engagement. The presentation showcases a diversity of student-community collaborations within student activist work, ranging from regular consultations to co-planning actions, to co-authoring demands and striking in solidarity with one another. It also discusses the skills and conditions necessary for mentoring student activists toward community engagement. These include teaching history and the arc of social transformation, building conflict management and relational skills to work together across difference, and navigating decision-making structures and entrenched power. Ultimately, this paper shows how student activism is not only a location for teaching community engagement, but is itself enhanced and strengthened by community engagement.

Contemplative Practice and Resilience: Pedagogies to Support Sustainable Sustainability Practice
Speaker: Lissy Goralnik

Our social world is characterized by speed, driven by a focus on progress and productivity. This worldview is reflected in higher education. But social-ecological problems like climate change are value-laden and socially-bound, ill-fitted for the science-forward problem-solving that befits a progress-minded worldview. Speeding through these types of issues - where solutions are better or worse, or good enough - can cause deeper entrenchment, rather than repair. Wicked problem solving instead requires skills like slowing down, being with uncertainty, working collaboratively, and facilitation. These community engagement skills depend on participatory virtues, character traits like patience, humility, persistence, and empathy that support challenging conversations across diverse stakeholders and values, which can be facilitated by contemplative practices. With the nested goals of supporting sustainability change agency and student wellbeing, we developed a 2-credit undergraduate course on contemplative practice and resilience. We hoped that exposure to contemplative practices would provide learners the tools to cultivate a sustainable sustainability practice and prevent burnout. Teaching this course illuminated the value of contemplative practice in the undergraduate classroom. It also revealed that student wellbeing was so

compromised that the expectation for increased agency was unrealistic. Our students needed tools to build day-to-day resilience before they could contribute to community wellbeing and sustainability problem solving. This presentation will discuss course framing, assessment methods, and results to frame the implications for community engagement learning and sustainability.

Teaching and doing community engagement without leaving the classroom
Speaker: Jennifer Lee Johnson

This contribution details an approach I developed for teaching – and doing – community engagement in a large advanced undergraduate course. This course, entitled: Community Engagement for Sustainability, is part of the core curriculum of undergraduate programing in the Department of Community Sustainability at Michigan State University, enrolls at least sixty students, and fulfills a university-level writing requirement. Concerned with 'unleashing hoards of undergrads' onto the greater Lansing area, I instead centered our course around an ongoing collaboration between my research group – the Toxic Action Lab – and a highly engaged community partner from Kokomo, IN. In addition to regular reading, writing, and current event presentation assignments, students in the course complete a group research project on a specific topic or a site identified by residents of Kokomo. Together, for the students' final projects, we design, compile, and circulate a collective StoryMap, distilling their findings and including links to their detailed reports. Students who elect to be included as a co-author of this work are credited by name for their contributions. In the process, students: 1) learn portable tools for effective teamwork; 2) how to access and analyze documents found in the archives of state and federal environmental management agencies; and 3) how to organize and cite this information using Zotero, a collaborative research management tool. In addition to producing actual research products requested by and shared with residents, students become more confident, competent, and curious – all without leaving the classroom.

SUSTAINABLE CITIES

15 Minute City
Speaker: Anthony Larsson

The concept of the "15-minute city," aiming to create vibrant, sustainable, and resilient urban areas by ensuring essential amenities, services, and activities are within a 15-minute walking or cycling distance from residences, has recently emerged as an urban catchphrase. Using Sweden as a case study, this presentation aims to examine, model, and visualise data geographically with spatial components to identify patterns, trends, and relationships related to geographic location. This presentation will reveal that 15-minute cities are predominantly found in city centres but also exhibit a slight inclination towards the western sides of cities. The emergence of 15-minute cities is linked to the growing phenomenon of gentrification, viewed as a driving force behind the 15-minute city concept, as the notion of the 15-minute city evolves in tandem with gentrification.

Community capital dashboards and digital twins for sustainable cities
Speaker: Mark Roseland

Community capital frameworks have been used with resounding success in various community types around the world — large, small, rural, urban, developed, developing. These frameworks resonate with very different communities because they encourage people to think strategically and systemically about values, existing capacity, and potential long-term impacts of specific policies, programs, and projects – a critical advance in sustainability innovation. Furthermore, they help communities with few financial resources to recognize their wealth in other forms and become inspired to organize for community change. Roseland et al (2024) have introduced the Community Capital Compass as a guide to navigating community change. Focused on sustainable community development, our Community Capital Lab is operationalizing the Compass as a decision-support dashboard available for every US state and county. Recent innovations in digital twin technologies add exciting new possibilities for the Community Capital Compass. However, there is a growing digital divide between a relatively few larger, well-resourced cities and the more numerous smaller cities, towns, villages and tribes that cannot afford to access these technologies. How can we use these tools to promote sustainable community development for all? We are incorporating pilot digital twin initiatives in Arizona and in Florida, with the aim of democratizing access to these digital technologies and thus greatly expanding access to civic tech solutions that help communities address pressing community sustainability challenges. Our efforts are designed to result in outcomes that amplify digital proficiency and inventive solutions, heighten community involvement, and bring about enduring sustainability initiatives.

Cognizing urban land change dynamics for sustainability
Speaker: Yichun Xie

Urban shrinking has a spatial extent and a temporal dynamic. For example, Detroit has declined for decades, but its suburbs have continued growing. Policies curbing urban vacant lands tend to be implemented on a municipal scale but fail to achieve sustainable outcomes. The paper argues that strategies curtailing urban decline should be coordinated over a much larger region, and geography-based artificial intelligence (Geo-AI) can help determine the spatial extent of such a region. The paper collects data on land use, demographics, housing, and socioeconomic factors in 210 towns at five decennials, 1980, 1990, 2000, 2010, and 2020 in Southeastern Michigan. The paper computes the gravity-type population, employment, and residential suitability interaction terms based on the regional transportation network. Then, the paper develops a spatial panel data model fitted with these interaction terms and the factors above based on the spatial adjacency relationships between the 210 towns to explore how urban shrinkages in Detroit have expanded over time and affected urban land changes in those towns. The paper examines how the interaction terms and shrinkage driving factors have interacted over space and time and created spatial spillover effects. The spatial interactions and spillover effects can reveal spatial patterns and dynamics of consequent urban land use changes in Southeastern Michigan, recommending how curbing urban shrinking efforts by individual towns should be cooperated by different regional clusters. Using cross-town and over-time spatial panel data models to explore how curbing urban shrinking shall cooperate over a larger region is missing in current literature.

Reconciling housing and agriculture in expanding metro areas
Speaker: Amy Lerner

Metropolitan areas across the United States, and particularly in California, face soaring land values and subsequent housing precarity. At the same time, agricultural metro areas, such as San Diego County, promote food production for both local and regional consumption while costs for land, water, labor, and housing undermine its ability to thrive. Traditional approaches to solving both housing and agricultural land-uses in expanding urban areas reflect the standard dichotomous property rights regime in the U.S.: public and private. But it is necessary to think through other ownership schemes in order to simultaneously accommodate affordable housing and food production into a landscape that is too costly for both. Using the San Diego metropolitan region as a case study, this paper explores the struggles facing many metropolitan areas that are battling the need for food and shelter amidst skyrocketing land values and offers suggestions on how to move beyond standard property schemes to resolve it, through third sector approaches such as community titling and communal land trusts, to secure basic needs for social and environmental sustainability. Using a mixed-methods approach, we present a combination of data on housing and land values over time, geospatial analysis and interviews with farmers and regional planners and policymakers. The data analysis enables us to counter the idea that we can solve agricultural conservation and affordable housing through traditional means, and offer avenues to pursue alternative ownership options through a commons approach.

TECHNOLOGIES FOR SUSTAINABILITY

Sustainable water transportation using blinking light
Speaker: Kazuma Matsuo

Obtaining water on high ground in remote areas may require significant effort. Therefore, if we can use sunlight to pump water to high ground like trees do, it may lead to the alleviation of water shortage problems, which is important for a sustainable society. In addition, in the field of sustainability, the conversion of light energy such as sunlight into mechanical energy is important. Here, we demonstrate that a bioinspired water pump using a thermo-pneumatic phenomenon by blinking light can pump water to the high ground [Applied Physics Letters 123, 193902 (2023)]. Specifically, a Y-shaped bioinspired pump with three chambers with two check valves can suck up water from a water source and discharge it from an outlet at a height of 30 cm. In this study, we used incandescent lamps instead of sunlight to irradiate the device with light. The pumping ability of our pump is 20.4 times higher than that of the recent high-performance artificial tree in a simple comparison. We also believe that by connecting these devices in multiple stages, it will be possible to pump water to very high places under the sun. Our research results should contribute to sustainable water transportation in the future.

Artificial floating islands for water quality improvement
Speaker: Zhaozhe Chen

Microcystin (MC) stands as the most prevalent cyanotoxin associated with freshwater harmful algal blooms (HABs), posing substantial health risks to both humans and aquatic ecosystems. Artificial floating islands (AFIs) present a promising solution to MC reduction. In this study, we implemented AFIs with two native aquatic plants, Carex comosa (bristly sedge) and Eleocharis obtusa (blunt spike-rush), in the equalization basin of a wastewater treatment plant for preliminary treatment of residential raw sewage. Over three months in late summer and fall, we monitored MC concentrations, physico-chemical parameters, nutrient levels, and plant biomass. Results indicated that the AFI system reached the highest of 77.9% reduction in MC levels during the active plant growth period. Precipitation emerged as a critical factor affecting MC reduction rate in natural settings. Plant assimilation was identified as the primary contributor to MC reduction under natural conditions, given the low susceptibility to temperature fluctuations. While temperature and nutrient levels did not directly influence MC reduction rates, they impacted plant growth, thereby indirectly affecting AFI performance. Notably, C. comosa exhibited higher potential for MC reduction than E. obtusa, attributed to its rapid growth and greater biomass yields. This study is the first exploration of field-scale AFI applications targeting MC as the primary pollutant, emphasizing the viability of field-scale AFIs as a sustainable and effective strategy for cyanotoxin management.

Ethical issues in sustainable bioinspired technologies
Speaker: Philipp Hoefele

My work deals with the ethical aspects of sustainable bioinspired technologies. Under what circumstances are these technologies sustainable and how can it be ensured that they contribute to values such as biodiversity, environmental justice, human health and wellbeing? Bioinspired technologies are often accompanied by a normative 'biomimetic promise' of better, namely ecologically sustainable and socially accepted technologies (e.g. Janine Benyus, Arnim von Gleich). From an ethical perspective, this raises numerous questions. For the imitation of natural principles and functions can by no means be described as good per se, nor can it be attested an ethical value, without a naturalistic fallacy from what is in nature to what ought to be produced technically in a sustainable and socially acceptable manner. Firstly, it is questionable whether anything in nature can be identified as good and valuable, and secondly, if so, this does not necessarily mean that the predicate good or valuable can be ascribed to it in a technical context. To this end, the transfer process from the natural product to the technical product must be analyzed: How do values attributed to natural principles and functions in environmentalism change when they are transferred to a technical milieu? To what extent can such values derived from nature also contribute to societal values such as environmental justice, human health and wellbeing? These ethical analyses should help to ensure that the development of sustainable bioinspired technologies is ethically unproblematic and socially acceptable right from the beginning of the development process.

Exploring renewable energy solutions in the Democratic Republic of the Congo
Speaker: Joshua Thompson

Reliable electricity is essential for small enterprise operations and economic development in low-income countries. The Democratic Republic of the Congo (DRC) has one of the lowest electrification rates globally, placing undue constraints on the country's small enterprises. Recent market liberalization of the DRC's energy sector has spurred innovative solutions to generate and distribute renewable energy, including the widespread development of decentralized solar mini grids with battery storage. We conduct an exploratory study to understand several early outcomes of small enterprises transitioning to solar grid-based energy in the eastern Congolese city of Goma. Using a case-control study design, we examine a sample of 128 qualitatively similar small enterprises connected to renewable solar and the long-standing parastatal utility network. We assess energy access using a multi-dimensional lens, going beyond operational indicators such as availability, usage, and reliability to understand enterprise owner well-being and energy-related decision-making ability. To do this, we look at indicators of perceived affordability, peace-of-mind satisfaction, and service value to construct a detailed profile of electricity access and supply characteristics across the two groups. In the economic and geographic context of our study, we find that decentralized solar energy provides significantly more reliable electricity. Additionally, we find improved customer well-being evidenced through less energy stacking and a better ability for enterprise owners to set their own boundaries for energy consumption. Our results show that alternative modes of renewable energy provision are feasible and far improved, suggesting new priorities for energy development funding and sector liberalization in other energy-sparse nations.

Potential acceleration of scaling up enhanced rock weathering due to climate change based on historical and regional analogs
Speaker: Chuan Liao

This study explores the scaling up of Enhanced Rock Weathering (ERW) as a viable carbon dioxide removal (CDR) strategy, essential for stabilizing the climate below 2°C by the second half of the century. Despite ERW's current limited capacity—substantially below the gigaton per year scale required for meaningful climate impact—this nature-based solution holds considerable potential for atmospheric CO2 removal. Our analysis, rooted in historical analogies, projects the global diffusion of ERW, taking into account regional discrepancies in technology adoption rates and potential nature-human feedback mechanisms that could accelerate climate mitigation efforts. By employing macroeconomic tools and observed adoption behaviors, such as metrics on fertilizer use and agricultural machinery, we refine traditional S-curve diffusion models. We incorporate country-specific per-capita incomes and develop new metrics to capture region-dependent adoption lags and future climate-dependent diffusion curves. These metrics help quantify the challenges and momentum behind ERW adoption, with longer adoption lags indicating substantial regional adoption costs, and curvature adjustments responding to regional variations in productivity and climatic conditions. This approach aims to enhance understanding of the barriers and drivers affecting ERW deployment, thereby informing effective integration into global climate strategies.

FINANCING SUSTAINABILITY

Economics of insetting
Speaker: Sean Chu

Carbon accounting rules currently prevent firms from taking full credit for decarbonization investments in their supply chains. This creates a public goods problem, leading to uninderinvestment in many cost-effective abatement measures. “Insets” are a proposed mechanism for fungible, tradable, and exclusive claims to emission-factor reductions resulting from abatement projects, resolving the public goods problem. Using an economic model, we show how the impact of insetting depends on specific rules governing insetting and on the nature of demand for carbon abatement from market participants. A specific concept we introduce is “sunsetting” — a time limit on the exclusive claim — which plays an analogous role to patents in terms of balancing the competing objectives of resolving the public goods problem and incentivizing adoption. We also show that: (1) Additionality is a concern, as in the case of offsets. The true impact of insetting should be evaluated relative to counterfactual firm behavior in the absence of insetting; (2) Insetting leads to economically efficient outcomes and to more abatement in the supply chain than in a regime with no insetting. The equilibrium price per ton of abatement may be greater than without insetting, assuming increasing marginal costs of abatement. Relative to the literature, the significance of this analysis is that it is, to the author’s knowledge, the first application of formal economic modeling to analyzing the impact of insets, as well as the first discussion to highlight the parallels between patents and insetting.

Bridging divides for a just future: Advancing low carbon transition while reducing Inequality
Speaker: Kuishuang Feng

Wealth and income are disproportionately distributed across countries and income groups resulting in carbon inequality. UNFCCC aims to keep warming well below 2 degrees Celsius while recognizing developing countries’ right to eradicate extreme poverty. Carbon pricing is regarded as an essential tool for curbing carbon emissions and ensuring low carbon transition but can be regressive, in the worst-case increases poverty and moreover lacks universal acceptance among the public and policymakers. Recycling the carbon tax revenue raised to vulnerable households is a promising solution to this issue. This study investigates the complex interplay between income distribution, consumption, and carbon emissions on an international scale. It specifically addresses the issue of disparate carbon footprints among various countries and income brackets. In addition, the study evaluates the impacts of climate mitigation policies, e.g. carbon taxation, on different household demographics, with a particular focus on the regressive nature of these policies, as well as proposing strategies to adapt fiscal policies to aid economically disadvantaged communities, thereby promoting equity.

Public and Private Partnerships Empowering the Future of Work in Energy and Sustainability.
Speaker: Erskine Faush

As CEO of the 2150 Center For Innovation, Commercialization & Growth at Miles College, Erskine "Chuck" Faush will present the work they are doing to close the gap with investments in underserved entrepreneurs galvanizing tech, talent and culture, with an area of focus on Energy and Sustainability. The CICG will serve

as collaborators matching research and with founders, ideating, testing and validating marketing driven products, incubator for early stage companies and accelerator for advanced startups offering resources and tools to accelerate successful companies. CICG's unique focus on the HBCU ecosystem will not only build successful companies but also communities helping campuses become economic engines. More businesses that locate, stay and grow in underserved communities will add jobs and increase local and national GDP.

SUSTAINABILITY AND CLIMATE EDUCATION

Advancing climate resilience: A model for sustainable workforce
Speaker: Narcisa Pricope

The Mississippi Climate Resilience Workforce Consortium (MCRWC) is pioneering a transformative initiative to bolster climate resilience while advancing sustainability innovation and workforce development. Through collaboration with public, private, academic, and tribal partners, the MCRWC addresses statewide climate challenges by focusing on underserved communities and diverse workforce needs. At its core, the initiative aims to close the implementation gap by equipping participants with essential climate resilience skills. The comprehensive training program, led by Mississippi State University (MSU) and other academic institutions, emphasizes climate change science, risk assessment, and sustainable infrastructure development. By analyzing job demand and engaging with employers, we identified key competencies required for climate-ready employment, ensuring alignment with emerging industry standards. Expert practitioners within the Consortium provide invaluable insights and support, contributing to the program's relevance and effectiveness. Partnerships with organizations such as the Southern Regional Climate Center and MSU's Extension Center for Government and Community Development enhance data accessibility and emergency management training, furthering the initiative's impact. By leveraging existing training programs and certifications, the Consortium seeks to bridge the gap in climate-ready skills, create employment opportunities, and pave the way for a national certification program. In conclusion, the MCRWC represents a groundbreaking effort to drive sustainability innovation, close implementation gaps, and support workforce development at all levels. Through interdisciplinary collaboration and strategic partnerships, the Consortium is poised to catalyze sustainable development and promote resilience, contributing to a brighter, more climate-ready future for Mississippi and beyond.

Latent workforce capacities for heat solutions in Arizona,using LLMs to find sustainability capacity
Speaker: Jieshu Wang

Facing the challenge of a warming climate, with a record of 54 days above 110°F in 2023, Arizona confronts frequent extreme heat events, impacting public health, water resources, agriculture, workplace safety, and economic development. 15% of Arizona workers face heat exposure at least once a week during summer, underscoring the need for improved workplace health and safety. However, creating a heat-resilient workforce requires more than enhancing worker access to water and breaks. With the purpose of building a strategic workforce that actively contributes to solving heat-related challenges, this research introduces the concept of latent workforce capacities to capture the existing skills within the current workforce that could be important in addressing future challenges. We first identified work activities across six dimensions that may help provide solutions to extreme heat: healthcare, infrastructure, engineering and technical activities, public service (especially emergency response), environmental and conservation efforts, and management and leadership. By formulating a list of keywords representing these dimensions (e.g., HVAC), we've identified 249 tasks across 133 occupations in Arizona that hold latent potential for offering heat solutions, such as electrical engineers working on renewable energy systems and public safety telecommunicators providing emergency medical instructions, covering 17% of Arizona's workforce as of 2022. Growing this capacity could be key to new solutions and the state's ability to respond to catastrophic future heat events. This study introduces a novel approach to workforce development for climate-related resilience, emphasizing the urgent need for identifying local capacities in combating extreme heat and other climate change challenges.

Qualifications needed for a global sustainability workforce
Speaker: Susila Bhagavathula

Recognizing the magnitude of global sustainability issues, governments, nonprofit organizations, multinational corporations, and international agencies have increasingly integrated sustainability considerations into their agendas. This is driving demand for workers capable of navigating the complexities of global sustainability issues. Recent reports predict that demand for sustainability skills will exceed the global talent supply with those skills. Extensive research has identified and refined the qualifications necessary to equip sustainability graduates. However, there has been little exploration of

what is needed to prepare students for sustainability careers in a global context, including roles involving international stakeholders, planetary systems, global governance, or positions abroad. To close this gap, the question was asked: What qualifications do employers seek when hiring for these so-called global sustainability jobs? To answer this question, 130 job postings from different job boards in four sectors (i.e., national governments, nonprofit organizations, multinational corporations, and international agencies) were analyzed to identify what qualifications are necessary for global sustainability jobs through the lens of employers. The statistical analysis included information on desired and preferred qualifications (e.g., educational level, years of experience, language requirements). The proposed presentation highlights the results of this ongoing study. The findings have the potential to provide insights into and recommendations on the qualifications necessary for sustainability graduates interested in securing a global sustainability job. By bridging the gap between the supply and demand for global sustainability skills, this research will inform curriculum design and educational strategies in higher education to enhance the employability of sustainability graduates.

The call for climate education
Speaker: Bryce Coon

This session will explore the current state of climate education in our schools and how education is a key component for addressing the climate crisis, developing sustainable practices, and the need for green skills in the workforce. We will demonstrate how providing access to quality climate education and career development will promote equity by creating clean and resilient jobs in historically marginalized and underserved communities. In addition to confronting these existing concerns, climate education will ensure young people enter the workforce with the knowledge and skills required to innovate diverse solutions to the climate crisis. This event will demonstrate the work that has been done around climate education and the benefits this education has provided to businesses, communities, and the environment. This event will outline the urgent need for expanded climate education to key stakeholders from a variety of sectors. The presentation will support climate education as a key tool for communities to reach their ambitious climate goals and how schools, university, governments, and business can support its mass adoption.

Graduate Sustainability Leadership Training - a university network approach
Speaker: Candice Carr Kelman

A Network for Graduate Leadership in Sustainability (ANGLES Network), represents a group of universities committed to increasing our collective capacity to deliver graduate student leadership training needs by synthesizing and sharing skills, programs, and best practices. The pressing challenges of global socio-environmental sustainability are inherently vast, intersecting, and complicated. Graduate students with expertise in sustainability topics need additional skills (e.g. collaboration, communication, visioning, interacting with policy, strategic planning, etc.)to be able to translate their knowledge into solving these real-world problems. Students need more than disciplinary or even interdisciplinary training to tackle these wicked problems - they need sustainability leadership skills. In 2020 ANGLES began synthesizing our separate program's leadership high-level aptitudes and their associated skills with a goal of understanding not only what students should know, but also examples of how we are teaching them and what programs like these might include in their scope. In this session we will discuss how a group of institutions is looking to implement change across the academic landscape, both within our own universities and across institutions. ANGLES skills & aptitudes can be used to design/revise sustainability leadership programs, or offer opportunities to students where they don't currently exist. ANGLES' next step is to begin a trans-university workshop where train-the-student and train-the-trainer happen concurrently and is highly accessible. We will use our next 2 years of pilots to assess and revise the 2020 skills and aptitudes, and reassess what graduate students need to know. https://anglesnetwork.com/

TOWARD JUST RESILIENCE

Risk Perception and Policy Preferences Among Policymakers in Hawaii
Speaker: Ketty Loeb

The State of Hawaii presents a "most likely" case study for the rapid advancement of sea level rise (SLR) policy because of its high vulnerability as a remote island state, deep blue politics, high public awareness of climate change, a strong Public Trust Law, and because of historical and cultural ties to living near water. In 2023 a research team from University of Hawaii conducted an online survey of elected officials in Hawaii, which revealed that 94% of respondents were concerned or very concerned about SLR, and 100% believe it will have serious impacts on Hawaii's residents in the next 50 years. Despite this high level of concern, only

17% of State Legislators placed SLR policy at the top of their priority list, and only 15 bills have been passed in Hawaii over the past decade. How can we account for this disconnect between risk perception and the passage of meaningful, concrete policies and planning actions? This study will provide findings of a new survey related to SLR risk perception and policy preferences in Hawaii, to be completed in the summer of 2024, which targets public servants in Hawaii State and County agencies. Agency staff play a significant role in researching, writing, and implementing prospective bills, which significantly impacts the passage and viability of proposed legislation. The study will provide insight into risk perceptions, challenges, and obstacles facing State and County policymakers and planners as they consider how best to respond to sea level rise.

Climate Risk Assessment & Benchmark (CRAB): Framework for Extreme Events in a Changing Climate
Speaker: Maggie Zarekarizi

In order to mitigate and adapt to the growing negative effects of global warming, we must first be able to quantify the impacts before identifying mitigation and adaptation strategies. Existing literature has been exploring the quantification of potential impacts of climate change across different regions and hazards; however, a gap still exists in algorithms that allow for flexible, systematic, and repeatable assessment of climate risk for a given geography. We have developed Climate Risk Assessment and Benchmark (CRAB), a framework which facilitates estimation of impact-driver risk metrics for hazards ranging from extreme hot and cold temperatures to tornadoes. CRAB's metrics and insights can be used for mitigation and adaptation as well as regulatory disclosures. Future projections of extreme events are uncertain which can compromise the confidence in downstream risk management for business decision making. CRAB includes rigorous uncertainty quantification as well as benchmarking and validation mechanisms to increase confidence in outcomes. CRAB quantifies the uncertainty of future risks and improves the representation of uncertainty by incorporating bias-correction, downscaling, and climate model uncertainties as well as internal variability. We project hazard metrics for 2030-2070 under RCP4.5 and RCP8.5 scenarios using an ensemble of downscaled projections of relevant climate variables. We validate our outputs using historical observations and benchmark results from various climate projection sources. This work contributes to future risk studies by offering a scalable end-to-end framework that better represents uncertainties.

New Delhi's Air Crisis: A Call for Sustainable Solutions
Speaker: Gupteswara Padhy

Air pollution in New Delhi, India's capital, continues to escalate, predominantly propelled by several factors including vehicular emissions, industrial plume, and the incineration of agricultural residue. Despite substantial attempts to mitigate this crisis, all strategies have unfortunately fallen short of achieving significant improvements. The detrimental health implications of this persisting issue are increasingly alarming. The local population copes with an intensified prevalence of asthma and influenza, while high-risk patients face heightened mortality rates due to respiratory distress. This research incorporates a multi-faceted methodological approach to evaluate and advance effective measures for ameliorating the escalating air pollution crisis in New Delhi, India. First, researchers emphasize the need to promote biofuel blending, a critical tool for reducing carbon emissions from vehicles. Secondly, urban planners should strategically limit the residential and operational activities in areas with high Air Quality Index (AQI) to decrease human exposure to pollutants. The third component focuses on initiating strict bans on the burning of agricultural residues, while simultaneously encouraging the deployment of microbial decomposition techniques to manage this type of waste. Final aim of the study is to enforce stringent provisions requiring industries to install effective pollution control equipment, such as electrostatic precipitators and scrubbers, to reduce industrial plume. To conclude, this methodologies highlights the considerable potential impact of the proposed interventions, compared to conventional, non-participatory AQI value. We assert that an evident attenuation in air pollution levels and improvement in public health in New Delhi can be achieved by participation of every stakeholder involved.

Storm-related power outage impacts in deep south communities
Speaker: Kandake Wallace

Communities across the United States (U.S.), particularly within the Gulf of Mexico region, are experiencing more frequent and intense storms related to climate change. These storms contribute to more frequent and longer infrastructure service disruptions. Disruptions to infrastructure can have a significant impact on the health and well-being of households, as they depend on infrastructure services like electricity and running water. The impact of infrastructure disruptions on individuals, households, and communities are not experienced equally. Studies show that disadvantaged and marginalized people and neighborhoods experience longer service disruptions and other adverse negative environmental consequences. Moreover, how communities respond to infrastructure disruptions like power outages is greatly influenced by access

to resources or lack thereof. The impacts of infrastructure disruptions are not well understood at the community level, especially when they are coupled together, exacerbated by other stressors, or when they occur in greater frequency which are all more likely as climate change continues to be exacerbated. Focusing on the U.S. Gulf of Mexico Region, this paper explores the impacts of power outages on individuals and households in Tallahassee through surveys and interviews. Findings from this study provide insights on the needs and preparedness of impacted households during power outages overlooked in traditional approaches to disaster planning and post-disaster power restoration; and offers considerations to better prioritize infrastructure investments based on societal impacts and needs in order to adequately address equity in energy policymaking and climate resiliency planning.

FRAMEWORKS FOR SUSTAINABILITY COLLABORATIONS

Envisioning a climate cooperation justice framework
Speaker: Joohee Lee

Cooperation stands as a central value and strategy in global climate governance. However, past climate cooperations under the Kyoto Protocol fell short of expectations, raising questions about justice and equity. To achieve the vision outlined in Article 6 of the Paris Agreement, addressing previously identified limitations and establishing a clearer conception of what constitutes just climate cooperation is imperative. This study proposes a conceptual approach to this endeavor by introducing the Climate Cooperation Justice Framework (CCJF). Building upon rich theories of environmental justice (e.g., ecological imperialism) and social justice (e.g., capabilities approach), the CCJF aims to address unjust gaps and loopholes widely observed in past climate cooperation practices. These include: a) insufficient transparency in carbon credit accounting, b) the presence of carbon-producing projects on the side, c) misalignment between project goals and the recipient countries' priorities or development orientations, and d) minimal attention to socio-cultural trust building and networking among partner countries. To operationalize the CCJF and illustrate its application, we employ discourse network analysis as an analytical tool. Drawing from the grey literature of Korea and Japan, we examine how justice issues are addressed or embedded in climate cooperation initiatives by identifying prevailing discourses, challenges, solutions, agents, and their networks in the policy documents. As case studies, we delve into Japan's Joint Crediting Mechanism and South Korea's equivalent strategy. Our study underscores the need for increased efforts in academia and practice to expand justice-oriented thinking in international climate cooperation projects.

Cross sector partnerships for sustainability: Adaptation as a pathway for effectiveness
Speaker: Amanda Sardonis

Cross-sector partnerships are touted as a means to effectively implement policies and meet sustainability goals, but are themselves difficult to sustain long enough to create value and meet their goals. While each partner brings different skills, experiences, and resources to a project, each has different cultures, priorities, and needs. Moreover, internal and external factors will change over time, making some partnerships unsustainable. Adaptability is a key condition for partnership effectiveness and long-term sustainability. Our research is connected to a database of high-potential environmental cross-sector partnerships, varied in structure, topics, and geographic scope. Through surveys and case studies, we have drawn out lessons for current and future cross-sector partnerships. Retaining flexibility and the capacity to evolve as the political and economic context changes was often the key determinant of whether a partnership succeeded or failed. This presentation will share specific examples of how partnerships grapple with the challenge of knowing when and how to adapt to changing circumstances, and lessons relevant to current and future cross-sector partnerships, partners, and supporters.

The Science Collaboratory- Addressing Local-to-Global Issues
Speaker: Anna Tinoco-Santiago

The Greater Atlanta Community Science Collaboratory is a group of Atlanta-based community organizations and Atlanta area institutions of higher education dedicated to addressing local-to-global issues through knowledge-sharing, problem identification, scientific collaboration, and public engagement. The group was founded and was born out of a very small seed grant focused on advancing the sustainable development goals through university-community partnerships. Some of the community-based organizations include Community Health Aligning Revitalization, Resilience, and Sustainability (CHARRS); Citizens for a Healthy and Safe Environment (CHASE), and Environmental Community Action (ECO-Action), all organizations who advocate for a healthy environment. Several higher education institutions include Emory University, Georgia State University, Kennesaw State University, and

Georgia Institute of Technology. Together these community-based organizations and higher educational institutions are grounded in shared values that include equity, accountability, and trust. Why is this important? In too many cases, decisions regarding communities - especially those that impact their land, water, food, and cultural resources - are made without the input of community member voices. To bridge that gap, researchers at universities often aim to partner with the community to tackle sustainability issues that these communities face. However, these collaborations do not always go according to plan. What are the key ingredients for such partnerships to be successful? What are important lessons learned in prior failed partnerships? How do very local examples speak to sustainability dilemmas on the global scale? How can I take the information presented in this session and apply it to my community? All of these questions and more will be discussed in this session. Lastly, this session will discuss the history, values, and the local contributions of the Collaboratory. The workshop will provide examples and key principles to encourage those in the audience to begin to envision (or extend) what their community's "Collaboratory" would be and do.

Bringing agility to the wicked problems of sustainability
Speakers: Kari McLeod, Joanne Stone

Sustainability Incubator Projects are taken on by cohorts who use the mindset, skills, and knowledge of agility and design thinking to the wicked problems of sustainability. Wicked problems are complex adaptive problems that defy a simple, straight-forward solution. As agilists, we excel in working with uncertainty, complexity, systems thinking, community, and change using iterative, adaptive, reflective, and structured approaches. We support cohorts of volunteers and partner with cohorts in organizations to work with community stakeholders to identify sustainability challenges and opportunities. Each cohort works on one challenge or opportunity and creates a prototype. They test the prototype with community members to validate whether it is a viable solution. We aim to make Sustainability Incubator Projects sustainable and scalable, so we believe in empowering others to do this themselves. As facilitators and trainers, we are developing ways to train team members to start and facilitate new incubator projects, thereby scaling this approach. Our goal is to have 10,000 of these incubator projects by the end of 2025. In this presentation, we share what we have learned from adapting a "traditional" design sprint of four to five days to one spread over two to three months to fit with the availability of volunteers and professionals. We are in the process of adapting and enhancing this format to create a semester-long college-level course. We anticipate this approach will ignite the interest in sustainability educators and practitioners alike.

Cultural evolution as a lens for sustainability science
Speaker: Jeremy Brooks

Sustainability challenges are intricately linked to humanity's ability to accumulate cultural information and to cooperate on a large scale. These traits facilitated resource exploitation and global expansion that benefitted early civilizations but have now created significant environmental problems. Thus, leveraging theoretical frameworks that elucidate our cooperative abilities and offer a mechanistic view of social and cultural change may significantly aid in addressing the urgent social and environmental problems we face. Cultural evolution is a body of theory that delves into the origins and dissemination of cultural elements such as beliefs, technologies, behaviors, norms, and institutions. Although interdisciplinary teams of scholars and practitioners have made recent advancements linking cultural evolution theory with sustainability science and practice, there remains substantial scope for developing an applied evolutionary science of sustainability. This talk will introduce pivotal concepts from cultural evolution theory and provide examples of work that illustrate how a cultural evolutionary lens has been used to describe the emergence of historical resource management systems, model the evolution of sustainable social-ecological systems, analyze the spread of conservation institutions, and study sustainable consumption patterns. The talk will also include insights from recent engagement with practitioners and policy makers that aimed to strengthen future applications. By highlighting key insights, advancements, and unmet needs, the goal of this talk is to encourage further collaboration, inspire new research avenues, and spark interest in exploring the potential value of using a cultural evolutionary approach across diverse sustainability contexts.

COVER CROPS FOR CLEANER SKIES

A Sustainable Aviation Fuel (SAF) Grand Challenge has been launched by the US Department of Energy (DOE), US Department of Transportation (DOT), and the US Department of Agriculture (USDA) to reduce the cost, enhance the sustainability, and expand the production and use of SAF to meet 100% of aviation fuel demand by 2050 while achieving at least a 50% reduction in greenhouse gas (GHG) emissions relative to conventional aviation fuel. Researchers across the country are exploring the potential for oilseed and herbaceous cover crops to be harvested for use as SAF feedstocks. Oil from carinata, camelina, and

pennycress can 'drop-in' to the existing aviation industry for short and long-distance travel since the Hydroprocessed Esters and Fatty Acids (HEFA) conversion technology is well-established. However, additional conversion pathways that make use of herbaceous biomass will also be needed in order to meet SAF goals by 2050. Growing oilseed and herbaceous crops between the harvest and planting seasons of traditional cash crops avoids land use change, and cover crops have traditionally provided ecosystem services benefits. But there much to learn about the potential regional availability of these intermediate crops and their sustainability. This symposium brings together scientists from national laboratories and research universities who have been seeking to answer these many questions about "cover crops" through projects funded by DOE, USDA, and DOT, including the Federal Aviation Administration's Center of Excellence for Alternative Jet Fuels and Environment (ASCENT), the USDA-funded Sustainable Partnership for Advanced Renewable from Carinata (SPARC) and Integrated Pennycress Research Enabling Farm & Energy Resilience (IPREFER), the DOE Office of Science Center for Bioenergy Innovation (CBI), and the DOE BioEnergy Technology Office's project on "National Availability and Delivered Cost of Cover Corps Managed as Biofuel Feedstock." The five talks provided in this symposium will provide an overview of the current status and prospects for using pennycress, carinata, and camelina for SAF production at national to regional scales and then dive into examples of research on carbon credit mechanisms to incentivize farmers to adopt carinata production, genetics research to optimize the desired properties of pennycress through seeds and use of soil microbes, and efforts to characterize the total life cycle emissions and associated with SAF production from cover crops.

Status and prospects for using winter oilseeds to produce sustainable aviation fuel

Speaker: Esther Parish

Oilseed crops such as pennycress, carinata, and camelina are promising feedstocks for sustainable aviation fuel (SAF) production and were included as intermediate oilseeds in the US Department of Energy's recent national assessment of renewable carbon resources (a.k.a., the "2023 Billion-Ton Report"). When oilseeds are grown in between corn and soy or between cotton and soy crop rotations, they can provide farmers with a winter cash crop without leading to agricultural land expansion. Researchers at Oak Ridge National Laboratory and The University of Tennessee are investigating the potential for these intermediate oilseeds to provide the ecosystem service benefits traditionally associated with unharvested cover crops, such as soil carbon sequestration and reduced nitrate leaching. We are also exploring oilseed crop adoption barriers, supply chain logistics, alternative uses of oil and meal, carbon intensities of SAF production, and the potential incentive payments that might be needed to grow this resource base. We are finding that all of these factors vary by US region and oilseed crop type.

Carbon Credits to Farmers for Viability of Sustainable Aviation Fuel

Speaker: Kazi Ullah

Fatty acid derivatives from oilseed cover crops, such as canola, carinata, and camelina, can be used as feedstocks for sustainable aviation fuel (SAF) production via a commercially available conversion pathway such as hydrotreated esters and fatty acids (HEFA) . However, the limited feedstock availability and price impose high operating costs for SAF. This high operating cost can be improved by a carbon credit as SAF has significant potential to reduce greenhouse gas emissions compared to conventional aviation fuel. Thus, by integrating ecosystem, farmers' crop adoption behavior, supply chain models, and life cycle analysis, this study shows how the incentive for soil organic carbon (SOC) sequestration can encourage farmers in Georgia to produce carinata under two farm management, Business-as-Usual (BaU) and no-till; thereby, determine the price of SAF and the carbon abatement cost, i.e., the required carbon credit to equalize the SAF price with conventional jet fuel. Stepwise, the ecosystem model estimates the county-level yield and SOC sequestration; the agent-based adoption model determines the county-wise potential land allocation and seed collections at different seed prices and incentives for SOC sequestration; the supply chain model determines the SAF price under 12 selected scenarios of seed prices and incentives; finally, the carbon abatement cost is calculated by applying life cycle analysis along the supply chain configuration. Following farmers' adoption trajectories between 2020 and 2050, the lowest abatement cost with viable SAF supply is identified from the selected scenarios. Thus, coupling the farmers' adoption behavior with the supply chain model, this study reflects how arranging carbon credit to the farmers could improve the overall process economics of SAF production.

Pennycress Systems Biology: Developing Bioenergy Cover Crops for a Sustainable Future

Speaker: Daniel Jacobson

The rapid advancement in high-throughput genomic and omics technologies has dramatically reduced costs and expanded data availability, paving the way for innovative applications in systems biology tailored for sustainable agriculture. Pennycress (Thlaspi arvense) presents a unique opportunity as a winter cover

crop, contributing to sustainable bioenergy without competing with food crops. Our research integrates multi-omics data and systems biology approaches to unravel the complex genetic networks of pennycress that influence growth, resilience, and biofuel yield. By deploying cutting-edge computational models, deep learning, explainable-AI, and multiplex network-based graph learning, we are able to identify the mechanisms for and subsequently enhance desirable traits in pennycress, such as stress tolerance, yield and oil content. This study not only advances our understanding of pennycress as a bioenergy crop but also supports the broader goals of sustainable agriculture and renewable energy. We propose a framework for the development of bioenergy cover crops that can thrive in diverse environmental conditions, optimize land use, and contribute to a reduction in carbon emissions. This systems biology approach to developing pennycress underscores the potential of integrating scientific research with environmental stewardship to address global energy challenges.

Microbial Allies for a Greener Future: Enhancing Bioenergy Feedstock with Beneficial Microbes
Speaker: JunHyung Lee

An emerging bioenergy feedstock, pennycress (Thlaspi arvense), is a fast-growing winter cover crop that produces seeds with high oil content, making it a promising candidate for sustainable aviation fuel. In the face of changing environmental conditions, our primary focus is on enhancing pennycress resilience by harnessing the power of beneficial microbes. Plants associate with diverse microbes which can confer both advantageous and detrimental effects on their hosts. Recently, considerable attention has been directed towards elucidating the role of beneficial microbes in mitigating plant abiotic stress. To assess the effect of microbes on pennycress thermotolerance, we developed a rapid evaluation method, and screened numerous genotypes collected from diverse geographic regions. Our findings revealed discernible genotypic variations in their capacity to derive benefits from microbial interactions. Furthermore, these genotypes exhibited considerable variation in phenotypic and physiological traits, suggesting that their genetic heterogeneity could be leveraged to develop new and improved cultivars. Currently, we are in the process of developing recombinant inbred lines through outcrossing of two distinct parental lines, followed by successive self-fertilization to establish a pedigree suitable for Quantitative Trait Loci (QTL) analysis. This systematic approach will facilitate the exploration of genetic factors underlying plant-microbe interactions that enhances feedstock resilience to thermal stress.

Life Cycle Assessment of Sustainable Aviation Fuel from Cover Crops
Speaker: Aye Meyer

Cover crops are generally selected and managed for the benefit they return to the soil and the following cash crops. However, an optimally grown biomass from cover crops could produce a harvestable feedstock of sufficient quality for biofuel production while still achieving environmental and agricultural crop benefits and reducing the carbon intensity of agriculture. Adopting cover crops in farm management practices could bring a revenue from selling cover crops to the biofuel production plant. A life cycle assessment (LCA) was performed to evaluate possible sustainability benefits from cover crops derived sustainable aviation fuel (SAF). This work will show the analysis results of sustainable aviation fuel from multi cover crops grown in Northwestern and Southeastern United States. Triticale, crimson clover, and pea are considered as cover crops grown in the Northwestern region. Oil seed cover crops such as camelina, pennycress and carinata are considered to be grown in the Southeastern region. Since cover crops are grown and harvested in between cash crops, they are not available all year round. Mixing cover crops with other existing biofuel feedstocks are also considered in this study. Hydrothermal liquefaction (HTL) conversion pathway is applied to convert herbaceous cover crop material to SAF while oil seed cover crops are converted into SAF via hydroprocessing. Sensitivity analyses were performed to estimate possible environmental benefits from cover crops and to identify key parameters driving sustainability metrics.

URBAN WATER ISSUES

Efficient nitrogen reduction for municipal wastewater
Speaker: Bruce J Godfrey

Wastewater-Resource-Recovery-Facilities (WRRF) in the US must soon meet new nitrogen effluent standards to reduce ocean nutrient loading and combat eutrophication. Meeting the standards using conventional biological nitrogen removal (BNR) is carbon/energy intensive due to aeration requirements and inputs like carbon substrate methanol and lime, and it produces N2O, one of the most potent greenhouse gases. WRRFs contribute a whopping 2% to global greenhouse gas emissions. Our goal is to reduce the greenhouse gasses produced and energy and other inputs needed for nitrogen removal from the effluent. Ocean discharge plants will require significant modifications to meet future effluent quality

standards. Just in the Puget Sound region of Washington State there are 58 local WRRFs that will have to build out nitrogen removal capacity in the coming decade due to new denitrification requirements. We have demonstrated an integrated system to perform mainstream ammonia removal by co-culturing Anaerobic Ammonia Oxidation (Anammox) with Ammonium Oxidizing Archaea (AOA). The novel combined hollow fiber membrane-based (HFM) and hydrogel bead-based process we have developed uses minimal oxygen, promises to reduce energy requirements and greenhouse gas emissions, and avoid additional land use and costly new construction at waste water plants normally required for conventional BNR. Our technology has been tested on pilot scale at an operating wastewater treatment plant in Washington State and the results are published in peer reviewed scientific journals.

Institutions and the robustness of urban water systems
Speaker: Adam Wiechman

Critical infrastructure systems, like drinking water, face unpredictable and accelerating social and environmental changes that will require significant and ongoing investment to be sustainable. While there has been substantial attention in the fields of engineering and economics directed towards investment recommendations, minimal attention has been directed towards the policy processes responsible for making such investments and whether they are capable of adapting to the uncertain social-ecological future. Here, we investigate how the scaffolding of these policy processes, their institutional structure, affects the robustness of an infrastructure system to various forms of environmental change through a mixed methods approach of dynamical systems modeling and empirical process tracing. We focus on two features of institutional structure: (i) institutional dependencies, or the conditioning of action on an external constraint (e.g., requiring an environmental assessment before acting), and (ii) institutional voids, or the lack of guidance on how an agent should act given certain problem information (e.g., not specifying what actions a city official should take during a drought). We develop a model to examine the way these concepts affect decision-making dynamics in investment and rate-making situations and then compare the model analysis to a detailed process tracing of investment and rate decisions made by the City of Phoenix in 2015-2021. Our findings highlight trade-offs in the design of institutions responsible for urban water investment and the need to bridge considerations of policy process with infrastructure system modeling to sustainably transition our critical infrastructure systems in uncertain social and environmental futures.

Investigating turf infill for tire derived antidegradant transformation products
Speaker: Alanna Hildebrandt

In recent decades, the number of artificial turf fields has drastically increased. Artificial turf fields with crumb rubber infill create durable sports surfaces usable in all weather conditions and provide a value-added reuse option for waste tires. However, contaminants leached from tire rubber are of growing concern for aquatic species. Recently, 6PPD-quinone (a transformation product from the common tire antidegradant, 6PPD) was found to be very highly toxic to aquatic organisms including coho salmon, chinook salmon, and steelhead salmon. In fact, 6PPD-quinone is acutely toxic to coho salmon at extremely low concentrations (41 - 95 ng/L), placing 6PPD-quinone among the top five acutely toxic organic compounds to aquatic organisms. The Washington State Department of Ecology has proposed a maximum permissible limit of 8 ng/L over one hour for 6PPD-quinone in freshwater sources. Research surrounding the release of 6PPD-quinone is primarily conducted on tire wear particles generated on roadway surfaces and in roadway runoff. However, crumb rubber infill and turf field runoff may also contribute to discharge of 6PPD-quinone to urban watersheds, and thus require more research. This study investigates the release of tire antidegradant transformation products 6PPD-quinone, 7PPD-quinone, DPPD-quinone, and DTPD-quinone from turf infills on the University of Washington campus. Solvent extractions were conducted to determine maximum leaching of antidegradant transformation products from the turf field crumb rubbers. Batch studies were conducted to estimate the potential for aqueous leaching in the environment. Future work will test runoff directly from the turf fields to determine how batch tests approximate field runoff concentrations.

Water efficient landscapes for urban sustainability
Speaker: Elizaveta Litvak

Urban trees, lawns, and green spaces are valued for their ability to mitigate heat, decrease energy consumption, and improve health and well-being of residents. Irrigation is often required to maintain urban landscapes, especially in dry regions where water resources are increasingly limited by the effects of land use, climate change, and population growth. To develop water-sustainable urban landscapes, new approaches to landscape design and management are needed. These approaches should be based on scientifically-informed, detailed understanding of water use of urban vegetation. This talk will summarize over 10 years of research based on in situ measurements of water use of urban trees and lawns across the

US on scales ranging from individual yards to metropolitan areas. This research utilized miniature probes inserted in tree trunks to measure sap flow and custom-designed portable chambers to measure water use of lawns. In situ data were combined with tree surveys and satellite images to estimate municipal-scale landscape water use and how it changes with irrigation restrictions and turf removal programs. This research have revealed five simple rules to guide the design and maintenance of water-efficient and livable urban landscapes. These findings provide a foundation for best management practices and call for rethinking not only traditional landscape irrigation but also the strategies currently implemented to reduce landscape water use.

TOOLS FOR SUSTAINABILITY COLLABORATIONS

Angaza Africa: Technical and community engagement case study
Speaker: Andrew Cowell

Angaza Africa demonstrated how, through a combination of collaborative development across continents, development of local skills and capacity and early in-community involvement, a first-of-its-kind transportable hybrid solar and wind power system widens access for rural communities to clean, sustainable energy. It was delivered by three partners: Glasgow Caledonian University (technology provider and developer); E-Safiri Charging Ltd (local partner providing technical support and training to local communities); and, De Courcy Alexander (sustainability consultant and project manager). The project had two parallel strands; development of a flat-pack hybrid power system providing electricity for loads of approx. 50 W for lighting and mobile device charging; and, engaging with rural Kenyan communities demonstrating the benefits of transitioning from conventional power sources e.g. diesel generators, to renewable electricity generation. Technical development demonstrated the applicability of a transportable flat-pack hybrid solar and wind device. It was demonstrated in Scotland and the remote Kisumu County (near Lake Victoria) in Kenya. Engagement with the local community was very positive; residents expressed enthusiasm for the potential of the portable device to address their energy needs for lighting and electrical devices. They identified various problems that could be solved: energy access, economic empowerment and, education and skill development. Support was given to build local capacity in the installation, commissioning and maintenance of hybrid renewable energy systems. This project proved the device, unique in the African market, has potential to increase electricity accessibility for rural communities, combining technology application with community engagement, whilst satisfying UN Sustainable Development Goals 7 and 13.

The Colorado River Basin Post-2026 Operations Exploration Tool: Connecting Policymakers and Stakeholders Through a Web-Based Decision-Support Platform
Speaker: Season Martin

The U.S. Bureau of Reclamation (Reclamation) is currently leading a formal decision-making process to replace Lake Powell and Lake Mead operating agreements, which expire at the end of 2026. Enabling a wide range of stakeholders to engage with technical information is key to identifying successor guidelines that are robust to the effects of climate change while balancing diverse resource priorities. To support these objectives, Reclamation has partnered with the University of Colorado, Boulder, and Virga Labs to create a web-based platform on which stakeholders can explore different operational strategies through a Decision Making under Deep Uncertainty lens. Across a series of dynamic dashboards, users can create their own custom strategies for Lake Powell and Lake Mead operations, compare hundreds of potential strategies in terms of performance tradeoffs and robustness, and learn what hydrologic conditions could lead to system vulnerability under any given strategy. This Colorado River Basin Post-2026 Operations Exploration Tool represents an advancement in the ability of policymakers at Reclamation to collaborate with stakeholders in the generation and analysis of technical information. The platform is also an example of a successful years-long partnership between a government agency, academia, and private industry to create an innovative tool that is supporting an important, ongoing long-term planning process.

Successes and challenges of environmental DNA as a tool for community science
Speaker: Meghan Shea

Ensuring sustainable engagement with ecosystems, and the organisms inhabiting them, requires both an understanding of how ecosystems are changing alongside connection and commitment to them. As new technologies for biodiversity observation and research proliferate, so too do efforts to put these tools in the hands of the public: an attempt to co-generate the requisite data and connection to nature. Collecting and sequencing environmental DNA (eDNA)–the genetic material organisms leave behind within their ecosystems–is a burgeoning tool for biodiversity monitoring, heralded for its relatively low cost, non-destructive sampling, and ability to identify rare and invasive taxa otherwise challenging to observe.

At the same time, due to the ease of collecting environmental samples for eDNA analyses, the technology has also increasingly been used in community science initiatives. However, little research has examined the particular successes and challenges of these efforts. Drawing on over 50 semi-structured interviews with practitioners using eDNA for community science, we characterize the rewards as well as the risks of efforts to conduct eDNA biomonitoring with the public. Across the development of these projects, their implementation, and their efforts to apply their findings, we highlight best practices for community engagement as well as areas of concern than may perpetuate inequities. Through community science projects, eDNA tools have already been powerfully leveraged to generate new environmental data and enable new types of ecosystem stewards; by synthesizing lessons learned across these projects, we chart a path forward for both expanding these efforts and ensuring their contributions to sustainability, equity, and justice.

Facilitating Local Electrified Energy and Transportation Services for All (FLEETS for All)
Speaker: Jeffrey Bielicki

Energy and mobility systems must transition to cost-effective reliance on resources, processes, and options that are more environmentally and socially benign. These transitions must address the ways in which some communities are underserved and marginalized (e.g., discriminatory siting of infrastructure, more adverse health consequences of exposure to pollutants). Physical, natural, and social scientific researchers must partner with communities and organizations to assure the transitions equitably elevate environmental, social, and health conditions. This talk presents a project that combines environmental engineering, environmental science, social sciences, public health, and policy analysis in a collaboration between Ohio State University, the City of Columbus, Franklin County Public Health, the Mid-Ohio Regional Planning Commission, and the Electrification Coalition. The project partners with fourteen underserved communities in the Columbus Metropolitan Area to (a) understand their needs for electrification and mobility and evaluate the effectiveness of current efforts; (b) understand how knowledge, perception, and values vary and inform decisions; and (c) develop strategies to guide transition investment and deployment to improve health, environmental, and social conditions over time for marginalized communities across the urban-exurban-rural gradient. The scholarly and practical implications of this work involve the integration of environmental justice in (1) scenarios of changes in electricity demand and generation capacity resulting from electrification and mobility shifts; (2) air pollution, and subsequent health impacts, of changes in tailpipe and electricity generation infrastructure; and (3) cost-effectiveness and benefit-cost analyses to evaluate and support policy decisions to guide the just transition to electrified home energy and mobility.

SUSTAINABLE AND JUST FOOD SYSTEMS

Toward a justice approach to emergency food assistance and food waste
Speaker: Christopher Bacon

The 60,000 food pantries in the United States are well known for charity-based emergency food assistance and edible food recovery, serving 53 million people in 2022. Tens of thousands of urban gardens emphasize vegetable production and food justice, but lack strong connections to food pantries. We explore how food pantries and urban gardens could partner to transform pantries into distribution sites that also become food justice education and organizing spaces. To assess this potential, we engaged in participatory action research with a leading social services provider that offers programs supporting both organized urban gardeners and a large urban food pantry in San Jose, California. We conducted and analyzed interviews with food pantry volunteers and urban gardeners affiliated with the same agency, and others with other urban gardeners and food pantry staff from external organizations. We found that while both food pantry volunteers and urban gardeners expressed concerns about increasing healthy food access and reducing food waste, pantry volunteers were often unfamiliar with food justice and uncomfortable talking about race and culturally rooted food preferences. These findings were similar with the informants from external organizations. We also calculated GHG emissions saved through food recovery and waste diversion work. To support urban gardener and food pantry volunteer collaboration, we developed a food justice approach to emergency food assistance and food waste management in which both groups co-create onsite vermicomposting infrastructure and partner with a university to design a training program focused on diversity, justice, and systemic change.

Social business solution to Apache tribe nutrition security
Speakers: Datu Buyung Agusdinata, Orlene Carlos

Nutrition insecurity among the White Mountain and San Carlos Apache tribes in Arizona poses significant

health challenges, including diabetes, obesity, and heart diseases. We shared a multi-year project aimed at co-producing social business solutions through a human-centered design and shared-action learning approach. Spanning four years, we engaged students from Arizona State University and various stakeholders in collaborative efforts to address nutrition challenges within these communities. Employing a human-centered design methodology, we focused on building empathy, using the creative process of generating and prototyping solutions, and fostering social business models. Collaboration extended to diverse stakeholders through shared-action learning, including mining companies, community farms, food banks, entrepreneurship training providers, and local grocery stores. Activities led by students include classroom sessions, site visits, and stakeholder consultations to ensure an understanding of the challenges and potential solutions. We co-developed prototype solutions including a meal kit, mobile kitchen, website, mobile app, nutrition education programs, and plans for a business that native women will run. These solutions were refined through ongoing feedback loops and impact metrics were established to measure effectiveness. Critical to the success of the initiative was the engagement of tribal women leaders, who provided valuable insights and feedback on the developed prototypes. To facilitate the launch of the social business enterprise, we seek financial support from the mining company and grocery chain, supplemented by matching funding from a State of Arizona economic development initiative. The project demonstrates the potential for community-driven solutions that universities facilitate to address the nutrition security of indigenous communities.

Nitrogen nutrition index for global N2O emissions monitoring
Speaker: Mark Lundy

Fertilizer-induced nitrous oxide (N2O) emissions are a main source of greenhouse gas (GHG) emissions in agriculture. Developing a scalable framework to quantify the risk of high N2O emissions from croplands and incentivize mitigation efforts with minimal data requirements is an urgent international priority. The nitrogen nutrition index (NNI) is a longstanding concept used to identify crop nutrient status in agricultural sciences, but no work has yet explored the potential for NNI to inform the risk of N2O emissions. Using a global dataset of 204 observations of wheat and maize crops grown across 54 environments and reported in 26 peer-reviewed studies, we quantified the relationship between seasonal N2O emissions and NNI derived from measurements of crop biomass and nitrogen (N) concentration. Crop-specific NNI relationships predicted N2O emissions with similar precision to the N-balance method (the established method). Using NNI and N-balance in tandem, we estimated the probability of high N2O emissions and applied these probabilities to ecosystem services pricing, with greatest financial incentives linked to lowest N2O emissions probabilities through well-managed fertilizer inputs. We anticipate this approach could be widely implemented, as the components necessary for estimating NNI (crop biomass and N concentration) are predictable with increasing precision via remote sensing platforms with global coverage such as multi-spectral satellite imagery. Thus, using NNI concepts to determine N2O emissions risks and corresponding ecosystem service prices is a novel approach to measurement, monitoring, reporting, and verification (MMRV) of GHG emissions in major cereal crops, with prospects for global scalability in the near-term.

Training Tomorrow's Master Urban Farmers
Speaker: Mike Hogan

Urban farming is now widely accepted as a valuable land use in urban areas of the United States and other countries. Urban farms have similar challenges related to sustainability as farms in more rural locations do. One of the challenges of sustaining urban farms is equipping urban farmers and aspiring urban farmers with skills that enable them to develop farms and food-based businesses which are sustainable environmentally, economically, and from a social or community perspective. The Master Urban Farmer program has been developed to teach urban farmers how to incorporate sustainable practices into production, marketing, and business functions of their operations. The program includes classroom training, on-farm training opportunities, internship opportunities, and ongoing professional development. More than 500 new and experienced urban farmers have completed the program, with more than half of participants indicating that they have identified methods for increasing the sustainability of their operations.

NATURE-BASED SOLUTIONS AND SUSTAINING NATURE

The private sector's public commitments and actions on biodiversity: An analysis of Fortune 500 companies in the U.S. Midwest
Speaker: Sam Reed

Reversing the loss of biodiversity and maintaining ecosystem services requires collective action across sectors, including drastic changes within the private sector. To this end, the U.N.'s Global Biodiversity Framework has set ambitious benchmarks to guide the world towards a stable biosphere by 2050. However, the path to achieving these U.N. biodiversity goals is unclear and far from assured, particularly within the private sector. n this talk we will eIxplore how the private sector is approaching the biodiversity crisis using a new dataset that collects each of the public-facing biodiversity perspectives and commitments of all Fortune 500 companies within the U.S. Midwest. In addition, we will discuss how a new partnership amongst academic, community, and industry leaders called the Midwest Carbon Leadership Project is allowing us to push the envelope on biodiversity action. From these data and experiences, we will explain which industry sectors are moving to conserve biodiversity in innovative ways, show which biodiversity metrics are being collected, and identify which implementation gaps remain. Our goal will be to highlight success stories, potential pitfalls, and ways forward for private sector biodiversity action.

The first-ever US National Nature Assessment
Speaker: Phillip Levin

The Biden-Harris administration has launched the first-ever National Nature Assessment to take stock of U.S. waters, biodiversity, wildlife, and lands and the benefits they provide to people. The National Nature Assessment (NNA) pulls together for the first time the vast array of scientific information, data, and Indigenous knowledge available about nature in the U.S. to provide a holistic view of the state of nature, how it is changing, and what those changes mean for the wide range of services nature provides. The NNA scope is directly informed by how people define their relationship to nature, from marine, coastal and estuarine systems to agricultural fields, urban parks, and wildlands; and how nature and its changes affect, and will affect in the future, our economic vitality, health and well-being, safety and security, and cultural heritage. Woven throughout the assessment are interactions between climate change and nature change, and an accounting of the equity, or lack thereof, with which both nature's benefits and the brunt of impacts from nature loss are distributed. The NNA will inform actions and guide decisions to restore and conserve the valuable natural assets so vital to people's lives now and for generations to come.

Evaluating state-led NbS in facilitating just transitions in resource-based cities
Speaker: Mengqi Shao

As global urban areas confront escalating challenges of climate change and social inequality, the concept of a "just transition" has emerged as a pivotal framework in urban sustainable transformation discourse. This study examines the extent to which state-led nature-based solutions (NbS) can promote just transitions within urban contexts, focusing specifically on Hegang, a resource-based shrinking city in Heilongjiang Province, China. Hegang, emblematic of China's rust belt cities, has a complex history marked by Japanese colonialism, Soviet technical assistance, and national-led industrialization and urbanization. Currently, it faces significant challenges due to resource depletion and the necessity for sustainable urban development under national ideology of ecological civilization. Different from Western shrinking cities suffering from long-term disinvestment due to neoliberal market forces, some of Northeast China's rust belt cities are undergoing state-led transformations and development, including imitating large-scale ecological restoration NbS projects. Through an empirical examination of a city-scale river restoration NbS initiative in Hegang, the research aims to contribute to understanding of how top-down environmental policies and projects are implemented at the local level and their efficacy in aligning economic and environmental priorities with the social needs of the community. Moreover, the findings will further provide insights into the challenges and opportunities faced by similar resource-dependent cities in China and potentially elsewhere, enhancing understanding of how localized strategies within diverse cultural and political contexts contribute to the global discourse on just transitions.

LA's newest Olympic sport: protecting and enhancing biodiversity
Speaker: Doug Walters

The City of Los Angeles' Biodiversity Program, housed at LA Sanitation and Environment (LASAN), leads the City's efforts in protecting and enhancing the City's diversity of species and ecosystems that sustain 4M Angelenos across 465 ecologically diverse square miles. Situated in the California Floristic Province, a

biodiversity hotspot, the program is uniquely positioned to showcase efforts to safeguard nature in a highly urban environment that is simultaneously very biodiverse. Through developing a customized biodiversity index, collaborating within and outside of the City, and formulating a formal action plan, the City's Program effectively addresses the threats facing native species that also protect Angelenos' green space and tree canopy–a significant way in which was can combat climate changes of the extreme heat and rainfall we have experienced these past several years. Initially based on Singapore's Index, LA's new Index contains 25 metrics covering topics ranging from habitat quality to social equity and governance, which are tailored to the specific challenges facing Los Angeles. Through developing a council of experts from various backgrounds, as well as collaborating with 11 City departments and academic institutions, the program demonstrates how tapping into local resources allows LA to expand its capacity to enact positive change while monitoring progress on these unique goals. By showcasing this groundbreaking approach towards enhancing and protecting urban biodiversity, we believe we can demonstrate to other local entities and private partners that we can cross the finish line for a greener, cleaner space for all across the world.

The role of nature-based solutions in addressing socio-ecological challenges: a case study of a university-community partnership in Tucson, Arizona
Speaker: Nataliya Apanovich

My work examines the co-benefits of Nature-based Solutions (NbS), such as community gardens, within and across societal challenges, such as human well-being, food security, and environmental justice among vulnerable populations. In this presentation, I will discuss a community-based participatory research project based in Tucson, Arizona, that aims to examine the role of community gardens in different but connected elements such as food insecurity and social and cultural isolation among university students and refugees within a multi-stakeholder framework. The project engages these two groups for an hour for ten weeks in a community garden run by a local non-profit that assists U.N.-recognized refugees with social integration and food access in Tucson. Ten students are paired with ten refugees to conduct gardening activities and attend sustainability-related workshops and trainings. Interviews are conducted before and after the study to assess any changes in their food access and social interaction patterns. This project helps better understand the synergies of NbS across ecosystem services and its transformative role in addressing socio-ecological challenges, including food insecurity and mental health among vulnerable populations in the U.S. Southwest. Overall, this project highlights the importance of adopting a co-benefits framework and engaging vulnerable populations to scale up existing grassroots innovations toward an inclusive, accessible, and equitable approach to addressing complex sustainability challenges in semi-arid riskscapes.

NARRATIVE AND GOVERNANCE APPROACHES

The shape of climate stories to catalyze engagement
Speaker: Trisha Shrum

The stories we tell ourselves shape how we make sense of the world. The stories we tell ourselves about our role in the climate crisis shape how we engage with the problem of climate change and whether we can sustain that engagement over time. The shape of the story itself – in terms of the emotional roller coaster that comes along with a reckoning with the reality of climate change—matters, but has not been carefully studied. This study opens a new frontier of research that examines the shape of a climate narrative and explores how the emotional journey corresponds to a willingness to take climate action. We examine a collection of experimental data with letters to the future written by participants. We use the Hedonometer, a narrative analysis tool developed by UVM data scientists, to classify the emotional arcs of climate letters to the future and analyze their correlations with the authors' incentive-compatible donation measures and other metrics of climate engagement. In preliminary analyses, we have found that stories that begin with a positive valence (connecting to what matters), move to a negative valence (grappling with climate grief), and end with a positive valence (envisioning a pathway to a livable future), correspond with the highest levels of donations to a climate mitigation non-profit. These findings have major implications for understanding how to leverage narratives to both provide a space for processing climate grief while engaging people in climate solutions.

Better governance to close the climate implementation gap
Speaker: P.J. Tillmann

Implementation is a common challenge of climate action plans (CAP). Whether the challenge is not fully planning for implementation, not fully implementing the CAP itself, or not fully realizing the outcomes of implementation, cities, counties, and their consultants often see CAPs have less impact than

anticipated—or take much longer to achieve success. Fortunately, many jurisdictions are now developing and implementing second- and third-generation CAPs—and they are capitalizing on what they learned the first time. Looking at cities and counties across the country, we use a comparative case study approach to answer the following questions: What aspects of implementation failed and why? Which challenges are common and unique across different jurisdictions? What solutions have been tried and how are they working? And what do these findings suggest about how we should be implementing and planning for implementation, and where might we start? Based on an assessment of jurisdictions and discussions with their CAP implementation teams, we will provide thorough explanations for—and draw lessons from—the key insights from this work: tailor to your local context; prioritize; be flexible, iterative, and ready for opportunities; and build staff buy-in and mainstream during planning. As a result, attendees will leave with concrete tips to improve the chances of implementation success during the planning stage and how to course-correct during the implementation phase.

Democracies of Food and Labor: Sustainability and Equity in Three Ecological Intentional Communities
Speaker: Monica Bhatia

My ethnographic research focuses on ecological intentional communities (EICs), democratically organized collective living groups that practice alternative ways of organizing work, housing, and food, in the attempt to create more sustainable and equitable institutions. I argue that by studying the successes and challenges of these communities, sociologists and environmentalists can deepen their understanding of sustainability and can gain insights into the kinds of social changes needed to avert ecological disaster, as well as the barriers to achieving this goal. I conducted observant participation and in-depth interviews at three EICs which each represent a different organizational form. I consider: 1) How does each EIC organize their food and labor systems to promote sustainability and equity?; 2) What barriers does each model confront in implementing these sustainable systems? At each of the three communities I studied, members identified fundamental transformations in the areas of food and labor as necessary to building a more sustainable society. I utilize a feminist organizational analysis to discuss how three EICs transform these two areas in the name of their just sustainability goals. In answering these three questions, I present three preliminary findings: 1) Economic communalization of food and labor supports just sustainability on the community level and can act as a buffer to class exclusion; 2) Hegemonic whiteness, racialization of organizations, and class exclusion in EICs constitutes a barrier to widespread adoption of EIC practices.

The Need to Resurrect the "Technology Won't Save Us" Narrative
Speaker: Shelie Miller

Current climate mitigation efforts are dominated by a focus on technological solutions. While massive systemic, technological change is needed to achieve sustainability goals, these changes are insufficient. There are alternatives that reduce the environmental impact of the status quo; however, there is no such thing as an impact-free technology. Technological change must also be accompanied by cultural change. The only way to ensure reduced environmental impacts is to reduce consumption; however, a growing body of research suggests that the presence of "green" technologies is accompanied by increases in consumption. This talk seeks to spark discussion on the relative importance of behavioral changes and technological alternatives with respect to current approaches to climate change mitigation. It will highlight behavioral and technological tradeoffs that have been identified by the life cycle assessment community and identify research opportunities where better collaboration between social scientists and engineers are needed.

COMMONING TOWARDS COMMONS (CCSC)

Recipes as Commons
Speaker: Sarah DeLano

Indigenous scholar Enrique Salmón (2012) believes that modern society detaches people from direct relationships to, and social processes involved in, "eating [a] landscape" (ibid, pp. 8), detrimental to individual wellbeing, community cohesion and urban sustainability. We are a group of immigrant women gardeners and a Métis researcher and gatherer who have used growing, gathering and recipe creation in Edmonton, Canada to investigate the relationship between local food, belonging, agency and sustainable urban futures. Through our community-based research project, we carved out our own understanding, and use, of urban commons based on relation to each other, to our natural surroundings and to generations of kinship in our city and many other parts of the world. Creating place-based recipes allowed us to assert an authentic place for ourselves in the physical urban commons. Recipe as a genre and research methodology, featuring intergenerational and communal knowledge and authorship, also champions what could be termed "common knowledges" relating to place, food, and medicine. A

public-facing recipe book is therefore a key piece of our research that shares our experiences with a diverse, non-academic audience and questions the primacy of "professional"/dominant knowledges as well as top-down urban greenspace and sustainability planning. Our stories and recipes present an alternative understanding and emerging imaginary of urban sustainability grounded in community building, diversity, and the freedom to shape natural commons through the uses and meanings that diverse citizens ascribe onto them.

Climate change and common water management: The role of irrigators organizations on adaptation
Speaker: Carlos Bopp

Irrigators organizations (ORs) have as a primary objective the equitable and efficient distribution of irrigation water among their members to achieve sustainability of the shared resource. However, achieving these objectives in many ORs is challenged by a significant decrease in water availability associated with climate change, with higher temperatures, variability in precipitation regimes, and extended periods of drought that are becoming recurrent in various regions worldwide. Therefore, it is essential that OR adopt measures to adapt to water scarcity at the community level that allow for more rational use of the resource (organizational demand-centered measures) or increase the availability of water (structural supply-centered measures). Using a sample of 68 ORs representatives from Chile, a Qualitative Comparative Analysis was carried out to identify the configurations of variables based on the IAD framework that concur with organizational (OMs) and structural (EMs) adaptive measures at the community level. The results revealed that both OMs and EMs occur mainly in OR located in areas with higher evapotranspiration (proxy of biophysical condition) and that OMs are also associated with a higher feeling of union between members (bonding social capital of actors) and the MEs to a higher number of meetings per year (proxy of rules-in-use). These findings highlight the relationship between higher temperature contexts that translate into pressure to adapt and the organizations' ability to reach agreements that strengthen internal institutions. Programs of organizational training and guidance or financing for the construction of civil works are suggested to promote community adaptive measures and increase resilience.

Power to the People: Commoning for Renewable Energy Revolution in Northern Pakistan
Speaker: Junaid Alam Memon

In the evolution of modern energy systems over recent centuries, there has been a systematic exclusion of households, individuals, and communities from roles beyond mere consumption. However, recent technological advancements in distributed power generation and decentralized accounting mechanisms, particularly applicable to sources like solar, wind, and microhydals, have presented an opportunity for communities to reclaim their meaningful participation rights. This transformational potential offers a pathway towards sustainable development within energy systems. This study assesses six communities in Northern areas of Pakistan, examining two models of off-grid community-owned utility systems: one designed, supported, and implemented by a faith-based NGO, and the other system designed and supported by the government but implemented by secular NGOs. Drawing on indicators derived from Elinor Ostrom's influential work and other pertinent contributions, such as the bundle of rights theory and design principles for managing commons, we scrutinize how these models perform in establishing sustainable community-owned energy systems. Our findings underscore the critical importance of genuine participation, including the provision of ownership stakes to communities and marginalized segments, such as women, individuals with disabilities, and diverse gender orientations, as a key condition for the sustainability of these systems. While acknowledging the supportive role of non-governmental organizations (NGOs) in fostering innovations and ensuring genuine financial and managerial participation of communities, we observe a notable gap in governmental trust levels towards communities, showcased in the design of the systems they support, systematically hindering their full and effective participation.

Participatory Governance of Urban Commons in Naples: Analyzing Democratic Participation and Ecological Transition
Speaker: Fabio Corbisiero

This study explores the participatory governance process of urban commons, focusing on Naples, which since 2011 has initiated a democratic participation initiative through the collective management of commons. Commons are resources accessible to all members of society, including public spaces, cultural assets, and community services, managed collectively by the community for sustainability and equitable use (Foster & Iaione, 2016). This approach has recognized thirteen sites as commons, generating relational, social, cultural, and civic capital, essential eco-cultural assets for the urban fabric (Dellenbaugh-Losse et al., 2020). Key case studies include the Ex OPG Occupato - Je so' pazzo and Scugnizzo Liberato, involved in regeneration projects targeting ecological transition, and the Ex Asilo Filangieri, known for its role in

drafting the commons decree. Naples' model, awarded the URBACT Good Practice Award in 2018 (2024), demonstrates how self-managed public spaces facilitate social, cultural, and environmental interventions, establishing a pact between citizens and administration to mitigate the social vulnerability of some minorities. Historic buildings in the Old Town have been transformed into social aggregation spaces through citizen action, highlighting the potential of public spaces as symbols of urban civilization (Bollier, 2021). This process is analyzed through a mixed-methods methodology, combining quantitative and qualitative tools, to study the physical and social regeneration of assets, with particular interest in ecological transition. The Naples case study provides significant insights into the effectiveness of this participatory governance model, aiming to develop guidelines for managing and revitalizing commons applicable in other urban contexts.

Using Archaeology to Consider the Long-Term Process of Commoning in North America's Chesapeake Region
Speaker: Jessica Jenkins

The unique long-term perspective afforded by archaeology allows researchers within the discipline to contribute valuable insight into the process of commoning. Archaeological evidence from North America has repeatedly demonstrated that coastal communities in the past acted collectively to manage the commons for hundreds and even thousands of years prior to European colonization through practices such as clam gardening, shellfish size and age restrictions, seasonal harvesting, and marine tenure. Evidence of commoning in the Chesapeake region comes into view as Indigenous communities began to settle down, forming the area's first villages by 200 CE. The case study presented here considers the deeply intertwined historical processes of settling down and commoning in the lower York River area of the Chesapeake's Outer Coastal Plain. Specifically, we will describe the circumstances under which commoning emerged in non-Western societies in the deep past, how practices associated with managing the commons were shared or diversified among nearby communities, and how institutions associated with the commons remained intact, even with shifting power dynamics occurring with the institutionalization of chiefly authority circa 1300 CE and the sixteenth century absorption of lower York communities into the Powhatan chiefdom. As well as offering a deep time perspective to processes of commoning, our case study responds to calls from our colleagues in the Virginia Indian community for focused attention on the deep histories of sustainable practices in the Chesapeake region and contributes information about the health and management of the precolonial oyster fishery that will inform contemporary efforts in conservation paleobiology.

COMMONING FOR SUSTAINABILITY (CCSC)

Spatial complexity and the emergence of institutions for the pollinator commons
Speaker: Aman Luthra

Insect pollinator declines and pollination scarcity is impacting food production and ecosystem integrity worldwide. For smallholder farmers of pollinator-dependent crops, the decline in pollination services from wild insects can threaten already precarious livelihoods. This problem has been posed as a 'tragedy of the commons', and many have highlighted the need for cooperative institutions to address pollinator supply, as current top-down efforts have not been effective. Yet despite the urgent need, there is little evidence of collective action institutions governing wild insect pollinators. What makes pollinators different from other resource commons is the inability of users to discern the ultimate economic value those insects contribute indirectly to crop production. Past work has demonstrated that landscape composition and configuration matter for diversity and abundance of insect pollinators at farm and landscape scales. However, pollinator outcomes, particularly in smallholder dominated agricultural landscapes, are also impacted by on-farm practices and the spatial arrangements of farms in relation to each other. For instance, the magnitude of spillover from on-farm practices (e.g., pesticide use or forage enhancements) depends on the location of a particular farm in relation to those around it. Any attempts to theorize the emergence of collective action in such situations therefore must contend with spatial complexity at multiple scales. This paper presents a conceptual model that takes these complexities into account to outline future research pathways, and on a more practical level, to determine the scale at which collective action would need to operate in a given landscape in order to achieve optimal outcomes for pollinators and farmers.

Role of Commoning in the Sustainability of Community Composting in China
Speaker: Xuehua Zhang

Composting is a natural way of recycling nutrients from organic waste back into the soil to grow food for

humans. In modern days, when composting takes place within a community such as an urban or rural residential complex, it is known as community composting. Food waste generated by individual residents and usually considered as private property therefore enters the common areas and the use of finished compost in turn benefits local communities. Community composting could be commoning projects. In the absence of markets and states, I designed and launched a first-ever national community-composting program in China as a bottom-up and nature-based local alternative of engaging ordinary citizens in managing their own waste collectively. The program aims to answer two questions: 1) Is on-site composting feasible in Chinese communities? 2) Could community composting be a technical solution for recycling food waste locally? A prerequisite for answering the second question is daily processing of a substantial amount of food waste (at least 100kg/day) or of a full amount of separated food waste. Through nearly five years of experiments, I found the sustainability of a community composting system, which was easy to start but hard to sustain over time, is the primary implementation challenge. Many participating communities believe the lack of governmental support is the major contributing factor; very few regarded the lack of citizen engagement as the key factor. Whether commoning as a way for everyday citizens to make decisions and take actions to shape the future of their communities could make community composting sustainable in an authoritative regime (e.g., China) is an open, empirical question.

The Relevance of Goan Communidades for Sustainable Development
Speaker: Mary Vayaliparampil

The global consequences of local actions in terms of climate change and other existential crises facing the planet today call for community collaboration. The presentation is based on an exploratory examination of the potential for community-based management system of low-lying coastal wetlands known as Khazans or communidades in Goa, India to inspire modern commons or commoning for sustainable development. The primary purpose of the presentation is to highlight the potential of the communidade system to address sustainable development problems so that a more detailed study can be undertaken. The presentation draws from a review of literature on the topic and interviews with experts in Goa. The presentation will identify the framework on which the communidade system is based, describe its significance to sustainability, and briefly discuss its potential to be adapted to the modern context across international borders. Goa is a former Portuguese colony in Southwest India. Traditionally, Khazan lands were managed by organized groups of self-regulating rural communities called the gaunkari. During Portuguese rule, the gaunkaris evolved into communidades. The communidades are appreciated as a successful environmental regime, for their relatively more efficient management of land resources in an equitable manner, and for promoting community participation.

The Garden as a Force for Change: Commoning and the Politics of Ecological & Naturalistic Gardening
Speaker: Brett Gilman

In what ways and under what conditions can the garden become an active force for social change? I propose that certain contemporary approaches in socio-ecological gardening can facilitate important forms of learning and politicization, and even inspire new ways of being and relating among the more-than-human world. I explore these possibilities specifically through the framework of commoning and examine the potentially subversive functions of the garden itself as a commons. Starting from the premise that the way we shape the landscape and the way we think are connected, I analyze ongoing debates among “Naturalistic” and “Ecological” gardening movements, and assess how they introduce affective, embodied experiences of landscape. Historical analysis reveals that enclosure always begins with the destruction of the commons as a mode of social relation. I argue that a critically-aligned and properly subversive socio-ecological garden can, in modest yet significant ways, help to regenerate the social bonds broken by the historical destruction of the commons and serve to disrupt dominant political, economic, and socio-ecological assumptions. Through commoning, the forward-thinking garden can itself become a political actor within a framework of convivial conservation that emphasizes living with biodiversity and everyday environmentalisms. Ultimately, by making the commons visible and felt as a mode of relation, by regenerating social and ecological bonds of obligation, and by drawing into clearer focus the self-same forces that fragment both biodiversity across landscapes as well as subjectivities across communities, the garden can play a vital role in wider efforts aimed at counter-narrating, re-worlding, and commoning.

Translanguaging research into commoning for urban sustainability transitions
Speakers: Annika Airas, Meg Holden

Diverse cities and diverse sustainable development pathways demand the mobilization of a diversity of languages to advance a meaningful transition. The dominance of English as a lingua franca of sustainability excludes an enormous wealth of potential for the sharing of human wisdom and the ideation of a common future. The practices of translanguaging or moving between languages are commoning practices; and the ways that commoning is expressed in multiple languages offer insights into the

centrality of commoning to sustainability transitions capable of motivating diverse cities. The multi-year research project, SAGA: Translanguaging and sustainability, examines the richness of non-English concepts related to urban sustainability, as well as everyday movement in between languages as means by which urban residents can generate a shared wealth of understanding necessary for shared sustainability transition. This presentation explains our original, interdisciplinary conceptual framework of translanguaging and sustainability and examines the case of the Finnish concept of talkoot. Talkoot is a practice with deep historical cultural roots in Finland, referring to collaborative and unpaid work for shared benefit. Today, talkoot is used in the Finnish policy discourse related to mobilizing sustainability and other forms of related social change. We develop this case study to demonstrate the mechanics of translanguaging analysis as well as the value and potential of commoning concepts and practices in more-than-English ways, as tools for transition. We will describe the translanguaging research methodology being deployed by our international team for this five year project, based on principles of collaboration, engagement and social learning.

COMMONING AS PROCESS (CCSC)

OAT, Commons as theoretical-practical initiative for socio institutional transformation
Speaker: Edurne Bagué

The work of the commons contains a high potential for social and institutional transformation in the current context. It responds to the axes of sustainability, resilience, adaptability and democratic quality in collective decision-making processes, the result of collective processes that seek to recover living spaces in the face of dispossession. The case presented is that of the OAT (Terrassa Water Observatory) due to its referentiality as a model of inspiration due to its transformative potential. Whose origin is in the process of remunicipalization of the urban water service. The group that promoted it defended that urban water was also a common good and that remunicipalization should be a tool for the transformation of the governance model. They understood that the remunicipalization of water should serve to initiate a process of communalization of urban water. The OAT is a case that arouses much interest due to its transformative potential and its capacity for replicability. The pillars of the theoretical approach that guide the work are mainly the commons framework proposed by Laval and Dardot i Massimo D'Angelis, Castoriadis' definition of institution, David Harvey's communalization, works on communals and the proposals of Deleuze and Guatari on the rhizome as a structure for social and institutional transformation and feminist and ecofeminist epistemology. We work from action-research with qualitative methodology that combines in-depth interviews with participant observation and annual monographic workshops, establishing a dialogue between the theoretical and the practical.

Complex Adaptive Systems and the Attributes of Commoning
Speaker: Leslie Paul Thiele

A commons is a set of institutions that facilitates the sustainable use of natural resources. Commoning refers to the practices that create and maintain these institutions and are exercised in response to them. My paper employs the scholarship on complex adaptive systems to illuminate the nature of commons and the practices of commoning. To "think like a commoner," and perforce to act like a commoner, requires what Bollier and Helfrich (2019) call an "onto-shift." This shift moves us beyond mainstream, market-oriented perspectives. When engaged in commoning, we forgo the ontology of sovereign individuals whose efforts to secure their interests in a world of scarce resources can be modeled as a simple system, like billiard ball impacting each other on a pool table. Instead, we understand ourselves to be constituted by the diverse relationships of the ecological, economic, and social communities we participate in. These generative relationships contribute to our self-understanding. A commons, in short, is a complex adaptive system that its human participants assume the responsibility of sustaining. And commoning might be defined as sustaining the ecological, economic, and social systems that—materially and, one might say, affectively and epistemologically—sustain us. Deploying insights from the literature of complex adaptive systems, my paper identifies forms of knowledge, perceived interests, emotional attachments, and skills that are conducive to commoning. These attributes facilitate the recognition and implementation of the "design principles" that Elinor Ostrom deemed crucial to sustaining a commons.

Environmental Civic Science: Developing skills and commitments to commoning in youth
Speaker: Erin Gallay

Collective action on sustainability issues is possible when groups have trust and reciprocity which affect levels of cooperation and joint benefits. Our developmental approach to commoning focuses on transformations in adolescents' collective identities, social trust, and civic commitments arising from their engagement in environmental civic science (ECS). In ECS youth work in teams with peers and adults from

community-based organizations to identify an environmental issue impacting their community, gather/interpret relevant data, determine a solution, and take action. Based on a decade of documenting how cohorts of 10-18 year-olds (majority Black and Latinx) engage in ECS, we contend that the process of working together to define and sustain their community's natural environment nurtures youths' identification with the group and its task that extends to their membership in larger communities and the rights and responsibilities associated with that membership. Based on youths' reflections on what they learn in ECS projects, we point to their awareness of the processes that make groups effective, the intellectual (more ideas/better projects) and social benefits (fun, collective efficacy, public regard) to argue that youth learn that bearing the costs is part of the benefit. Our work focuses on age groups that are typically absent from studies of commoning. Whereas the field has revealed much about the characteristics of effective groups, less is known about formative processes that prepare individuals to work with others to solve community issues. In light of the sustainability issues youth will face, they need opportunities such as ECS where they can develop skills in commoning.

Patterns of commoning at the intersection of being together and sustaining fai(rer) relationships
Speaker: Jill Philine Blau

Ostrom (1990) has focused on what principles commoners tend to require in order to succeed and be sustainable. More recent research has started to identify patterns of commoning that include "how" people work/ are together (Bollier & Helfrich 2019). Bollier and Helfrich (2019) have focused on how commoning is mainly about the maintenance of relationships. It is in this context they have identified different ways of what I call "working togetherness" such as peer governance, heterarchy, sociocracy and consent. While Habermann (2024:15) highlights how "commoning means taking care in common of the needs of life, and/ or reproducing them" and offers a theoretical analysis of the intersection of commoning and exploitation from an intersectional perspective, empirical analyses on the nexus between collective ways of working and caring from an intersectional perspective are still missing. In this article, I explore commoners' reflections on their working methods and present how different methodologies pose various potentials and also limitations on intersectional and just transformations - and how those moving within commoning spaces feel about them in terms of their creation of fair(er) relationships. The data presented stems from various urban commoning spaces in Germany.

Agricultural Commoning in the U.S. Upper Midwest
Speaker: Gary Hampton

With a history of Farmer-Labor alliances in political organizing, progressive populist constraints on corporate ownership of farmland, and also considerable reckoning with ongoing legacies of racial disparities and settler colonial agrarian culture, Minnesota and its surrounding states provide fertile opportunities for exploring the possibilities of commoning in the ongoing efforts of many racialized communities to secure equitable farmland access and tenure. This presentation reports on efforts to transform the status quo of farmland provisioning and support infrastructure by making commons a more legible form of agricultural cooperation. We use our organization and hosting of a series of dozens of peer-learning sessions over the past three years (most recently in the form of a USDA Sustainable Agriculture Research and Education Professional Development series of monthly webinars and collaborative workshops) as a lens to review key areas in which the addition of commoning helps transform state, private, and community resources to be more amenable to the processes of commoning. For example, several organizations have collaborated successfully on efforts to revise state and local rules governing eligibility for agricultural grants, land ownership, agricultural taxation, and resource flows (including from federal USDA programs), and to start changing default language in agricultural easements to recognize agricultural commons. Further, many farmer-centered groups are acting to protect land and hold it in commons-based structures. Efforts to build shared ways to learn about and engage together in commons governance practices across cultures have been particularly important in these initiatives, where, for example, Kenyan, Somali, Hmong, Bhutanese, and Latine farmers practicing commoning are encountering Indigenous Anishinaabe and Dakota land-based cultures, as well as cooperative education approaches.

EQUITY AND JUSTICE IN EVERYDAY ADAPTATIONS - PANEL 1 (EACC)

Climate Change and Food Security Disparities through a Gender-Specific Lens: An Agroforestry Systems Analysis in Multiple Countries of Africa
Speaker: Zerihun Amare

Food security and climate change have strong gender and equity dimensions. Climate change impacts vary among diverse social groups depending on age, gender, and wealth class. Climate Change and Food

Security Disparities through a Gender-Specific Lens study was conducted in Ethiopia, Zimbabwe and Burkina Faso. The study employed a quantitative approach complemented by qualitative methods, including key informant interviews and focus group discussions. Priority problems were identified and a significant number of households in all countries do not cover their household food consumption from crop production. The result findings showed that households rely heavily on perennial cash crops rather than annual crop production. Exposure indicators in Zege, Upper Save, and Nakambe, and sensitivity indicators in Zege and Nakambe show statistically significant and high correlation with vulnerability. In the Upper Save, adaptive capacity and exposure are also statistically significant and highly correlated with vulnerability. Vulnerability levels of the Nakambe are very high compared to the Upper Save and Zege. Female-headed households had a statistically significantly lower vulnerability index compared to males in Zege, while male-headed households had a statistically significantly lower vulnerability index compared to females in Upper Save and Nakambe. The reason is land certification in Zege is higher than in the Upper Save and Nakambe. Although their level of participation is varied, female-headed households in all catchments practiced agroforestry management activities to adapt to climate change. We conclude that agroforestry practices do have substantial benefits in increasing women's adaptive capacity and reducing vulnerability to climate change and food insecurity.

Social inequalities shape climate-induced migration
Speaker: Sechindra Vallury

Household adaptation strategies stem from intricate interplays of social, economic, political, technological, and cultural dynamics across multiple scales. Migration stands as one such option for households facing challenges. However, the decision to migrate in response to extreme events hinges on the household's adaptive capacity. Current development research examines the nexus between human migration and climate anomalies as well as the temporary versus permanent nature of climate-induced migration. However, there remains a gap in understanding how social inequalities shape migration as an adaptation response. To address this gap, we analyze longitudinal data spanning from 2008 to 2018, encompassing 45,000 households in Kerala, South India. Employing fixed-effects logistic and linear regression models, our study reveals differentiated migration rates among social groups, with historically marginalized households exhibiting lower likelihood of migration in the face of precipitation anomalies, indicative of their constrained capacities to migrate. Moreover, through a push-pull framework analysis of reasons for migration, we find that marginalized households are driven to migrate more by "push" factors, while advantaged households are drawn towards opportunistic labor markets. These findings, coupled with existing developmental research, contribute to a deeper understanding of migration as a multifaceted adaptive process, underscoring unequal access among marginalized households. They also suggest the potential for future development efforts to foster equitable climate-induced migration patterns, as part of an evolving response to climate change.

Everyday Environmental Peacebuilding
Speaker: Richard Marcantonio

Globally, conflict and environmental risks are simultaneously on the rise—and sometimes interactively. Concurrently, environmental stresses and displacement from conflict are increasingly challenging people's ability to produce a livelihood and undermining human security. Evaluating if, and subsequently how and under what conditions, these challenges can be simultaneously addressed is a critical area of research that requires an empirical foundation of evidence to address and determine generalizable patterns and practices to employ effectively. Importantly, it is the everyday actions that people undertake to meet their needs, produce their livelihoods, and live out their varied commitments and ethics that most contribute to both adapting to a changing ecological world while—potentially simultaneously—reconciling or degrading positive peace in their community. To date, most environmental peacebuilding has focused at the international and national levels, especially regarding resource access and distribution frameworks that might contribute to peace—that is, the absence of direct violence. However, environmental challenges happen at and pervade the everyday, and direct violence is not the only outcome of these challenges that degrades everyday life. In this paper, empirical evidence from cases of pre-, unfolding, and post-conflict contexts are explored to understand how peace positive programming can contribute to resilience, and vice versa, and how local level actions articulate and interact with higher level regulatory and other frameworks in everyday life.

Addressing the 'Complex Loop': Hydro Diplomacy and Integrative Adaptations in the Lake Chad and Congo Basins
Speaker: Martha Cassidy-Neumiller

Drawing on our New Frontiers in Research funded project Climate Adaptation and Resilience Strategies (CLARS): Socio-Economic Vulnerabilities among Urban Migrants in the Lake Victoria Basin and Great Lakes

Region project, and our International Development Research Centre (IDRC) Canada (PROJECT ID108976) funded project "Addressing climate- and water-driven migration and conflict interlinkages to build community resilience in the Congo Basin", we will explore the 'complex loop' of water stress, migration, conflict, and climate change in the Congo and Lake Chad Basins (LCB). These critical water arteries in Central Africa, are pivotal for the region's hydrology and critical to the socio-economic fabric of their riparian states. Despite their abundant natural resources, these basins are embroiled in complex socio-political challenges exacerbated by climate change, severely impacting indigenous and pastoral communities, and triggering new migration pathways for the most vulnerable. Using these basins as case studies, we emphasize the need for everyday adaptations to centre 'participation' and 'cooperation' among basin states and local communities, stressing the importance of consensus-building and integrating local needs and contexts into climate- and water-related decision-making. We suggest co-developing inclusive climate adaptation strategies that integrate regional hydro diplomacy through cooperation-focused arrangements and agreements could be leveraged as a win-win solution and advocate for policies that are reflective of and responsive to the complexities of the nexus. By fostering an inclusive approach that engages all stakeholders, particularly vulnerable communities, the African region can advance towards achieving just and resilient outcomes in the face of escalating climate challenges.

Anthropocene as a Theme of Community Activity
Speaker: Chris Milne

Introduction: Whether the Anthropocene becomes an official geological epoch or not, the concept and idea of the earth and humanity entering a new time, where human influence has the power to alter the planet and planetary systems is a helpful concept to create and underly new adaptive community activities/institutions that promote resilience, community well-being, and environmentally sustainable activities. Context: Climate grief in youth and climate nihilism more broadly stultifies the energy and community unification that any and all climate solutions require. Activities and community functions on the ground, that promote hope, and help people to realize our human capacity for innovation and resilience are paramount in order to help integrate sustainability more broadly, but also help communities deal with new challenges due to climate change. Main Question/Finding: Using the concept of the Anthropocene as a guiding theme in creating new community functions/institutions, I believe that we can help people reimagine what it means for humanity to have the power to influence planetary systems; today, this power is met with fear, uncertainty or even a lack of acceptance. My goal and main suggestion is that by reimagining this power as one that can inspire hope, that can be used to integrate sustainability practices and create community resilience necessary to adapt to this new world and new time, that more people will be inspired to act towards climate change, and that we may be able to counter the trends of increasing climate grief and nihilism. So What: The road to creating a more flexible and adaptive society that can face the challenges that climate change brings requires deepening community ties, increasing the resilience of these communities, but in my view, most importantly, we must inspire hope in people that this is a challenge we can face. In order to inspire that hope, we must reimagine and utilize the knowledge of our power as a planetary force to drive home humanities immense capacity for creative change, innovative resilience, and fundamental adaptability. If this can happen at the community level with activities and institutions, not only are more resilient and deepened community ties being formed, but these will be strong ties inspired by a creative hope, with people accepting that no matter what climate related challenge their community faces, that under the Anthropocene, humanity will find a way!

EQUITY AND JUSTICE IN EVERYDAY ADAPTATIONS-PANEL 2 (EACC)

Advancing Methodological Justice and Equity in Climate and Water Research: Innovations and Pathways for Sustainable Futures

Speakers: Chris Milne, Nancy Doubleday

Our study focuses on research design for methodological justice and equity in climate and water nexus, aiming to enhance outcomes through data diversification and methodological democratization. Over the past five years, we have contributed four key innovation pathways: 1) climate justice (JEDI); 2) Social-ecological systems (SES) and social-cultural-ecological systems (SCES); 3) adaptive co-management of research (ACMR); and 4) Co-creation of Indigenous Water Quality Tools. These innovations prioritize justice and equity, sharing power over design, methodology, participation, and resources to foster agency within civil society and equitably share research rewards, supporting engagement, research literacy, and self-efficacy. Our research networks, including Global Water Futures (GWF), Ohneganos: Let's Talk Water, and Participedia, exemplify these innovations. For instance, the GWF project integrates traditional knowledge with technology to address Indigenous water quality issues. Pedagogical initiatives, such as Water Without Borders, promote interdisciplinary collaboration and research literacy. Despite these

benefits, traditional research paradigms often prioritize top-down approaches, limiting participatory methods. To overcome these limitations, we will share our learnings to refine practices, promoting inclusivity and equity. We will demonstrate the value of integrating justice, equity, and participatory principles into research, enhancing the relevance and impact of research outputs and outcomes for more equitable and sustainable adaptation strategies.

Climate adaptation in a context of vulnerability: reflections on the power of the everyday agency of waste pickers in Brazil
Speaker: Isabella de Carvalho Vallin

The planetary environmental crisis, connected by climate change and poverty, is accentuating global inequalities. In this context, the burden experienced by certain groups can be understood as climate injustice. This proposal examines how waste pickers in Brazil use their agency in the face of climate change through everyday adaptations. The focus of this study is on understanding the local adaptations made by waste pickers, who operate in a context of socio-economic vulnerability but play a crucial role in the circular economy. Waste pickers recover urban solid waste and contribute to the efficient use of natural resources, thereby reducing the carbon footprint of cities. The research is based on a literature review and a combination of qualitative methods, including interviews and field observations, to explore whether and what adaptation strategies waste pickers have developed. One illustrative example is the participation of waste picker leaders in the Global Plastic Pollution Treaty. Waste pickers do not oppose the banning of plastic materials, but argue that this process should be conducted by upgrading forms of work to provide them with better livelihood opportunities and working conditions. The academic and practical significance of this work lies in demonstrating how crucial the local adaptations of waste pickers can be in contexts of vulnerability, lack of public policies, and lack of resources. Moreover, it illustrates the pivotal role of waste pickers in exerting social pressure towards climate justice.

Articulating Shared Values: A Pathway to Equitable and Just Everyday Adaptations to Climate Change and Other Sustainable Challenges
Speaker: Mari Harder

In the face of unprecedented turbulence and inequalities, the imperative to address climate change and other sustainability challenges with equity and justice is paramount. We present a methodological approach focused on articulating the shared values of communities, embedded in everyday activities. Drawing from 20 qualitative studies conducted across six countries, our project elucidates three pathways towards equitable and just everyday adaptations to climate change and other sustainability challenges. Firstly, our approach serves as a conduit to explicitly document and communicate people's shared values, enabling easy transfer and presentation of what is important to them. Secondly, it offers a shared values framework as a boundary object, fostering authentic perceptions regarding specific sustainable challenge contexts such as climate change impacts on everyday life (agriculture, health, family life), contributing to thinking systematically about how adaptations to climate change can be more equitable and grounded. Lastly, by empowering individuals to engage directly with their own values, our methodology supports shifts towards greater realization of local priorities, and consequences for everyday sustainability, which leads to innovations in thinking about everyday adaptations. Our diverse case studies encompass a range of sustainable development topics including local climate change adaptation plans, urban resilience initiatives, global health issues such as child stunting, land remediation, organizational change, and transformative leadership initiatives. Through centering on the everyday adaptations of communities and providing a platform for articulating shared values, our approach contributes to more inclusive, contextually relevant, and equitable responses to sustainability challenges.

Design as Making Space for Everyday Adaptation
Speaker: Dane Carlson

This abstract frames a model of climate justice-oriented design practice which, rather than designing solutions to problems, opens up space for communities to undertake everyday adaptation on their own terms. Amidst the widespread failures of design projects like planned relocations which ignore or violently erase the everyday design work of people on the ground, different practices are needed. In Nepal's trans-Himalayan Mustang district, the village of Lubra is migrating uphill away from chronic flooding. This movement takes place through layered forms of individual and collective adaptation: farmers build temporary walls to protect fields for one final harvest, families build homes uphill from the river, and new construction labor arrangements emerge amidst chronic depopulation. But Lubra's shift uphill is constrained by land laws which make it nearly impossible to secure formal title on newly inhabited lands. Policy here transforms the everyday adaptation of uphill movement into new forms of risk. Meanwhile, Lubra risks becoming a victim of top-down relocation planning which erases ongoing adaptation on the ground. This paper outlines how, in response, a loose coalition of designers, community organizers, and

policy specialists do the work of design through advocacy for land law reform that supports everyday adaptation and community-led migration. Though policy usually lies beyond the mandate of design, considering that policy has specific spatial, material outcomes clarifies that policy advocacy can be a form of design practice. Doing the work of opening up space for locally-driven adaptation is a critical frontier for design practice.

Climate and Energy Goals and the Hydro-led Energy Transition in Nepal
Speaker: Rajiv Ghimire

With the rapid development of hydroelectricity, Nepal is transitioning from the energy system based on biomass and fossil fuels to renewable energy futures. However, the rapid hydropower development across Nepal has sparked a debate about whether it is at odds with environmental sustainability, social-political reality, and the behavioral choices related to energy use. With the overarching framework of sustainability science, this study analyzes the dynamic relationship between the tradeoffs and co-benefits of the hydro-led energy transition on humans and the environment focusing on public policies and lived realities of the coupled human-environment system of the energy transition. We employ a review of the secondary literature and key informant interviews to understand how the renewable energy transition in Nepal aligns with the everyday reality and the national development and climate goals. Our preliminary analysis suggests that it is crucial to view the energy transition in Nepal as a coupled human-environment system to minimize tradeoff and maximize benefits. While the government of Nepal has introduced several initiatives to increase internal demand and export surplus energy, the pace has been slow. The large-scale utilization of surplus energy requires understanding the everyday resistance to the adoption of electric cooking, heating, and mobility. It is crucial to ask whether who the alternative energy economy is serving and whether rural, poor, and marginalized people are on board with the transition. Lessons learned from Nepal regarding concerns about access, availability, affordability, and sustainability apply to other countries undergoing similar energy transitions.

EVERYDAY ADAPTATIONS IN HIGH RESOURCE SETTINGS (EACC)

Coevolution of subjective attribution and climate action under intensifying weather extremes and political polarization in the US Gulf Coast
Speaker: Gabrielle Wong-Parodi

Climate action is needed for more sustainable and resilient societies as weather extremes intensify and insurance safety nets decline. Psychological processes such as subjective attribution – making the causal link between weather extremes experience and climate change – may motivate climate action, adaptation or mitigation, yet are understudied. Real-world studies capturing evolving exposure to weather extremes and political polarization are rare, thus limiting insight for effective intervention design. Our five-year (2017-2022) longitudinal representative panel of 2,774 Florida and Texas residents found: (1) subjective attribution polarization, but only during periods of major tropical cyclone activity, (2) subjective attribution positively correlated with future oriented (future tropical cyclones) but not personal risk perceptions (property damage or injury), and with negative emotions (fear and worry about climate/weather extremes, natural disasters) over five years, and (3) high levels of subjective attribution maintained over five years was associated with adaptation (personal or collective), but not mitigation (personal or collective).

Constraining and enabling factors for everyday adaptations – Insights from small German towns
Speaker: Julia Teebken

As of late, research on everyday adaptations started blossoming, investigating different forms of social adaptations to climate impacts. Drawing from our research in living labs we present a classification of social adaptation practices that includes individual behavioral changes, collective change, and social practices that demand concerted action. Everyday adaptation according to this classification includes social adaptation practices related with leisure activities, work related practices, as well as practices in the public realm. Adaptation targets, carriers of practice, coordination, space/place, and time can vary. To date however, we lack 1) an understanding of how public and "autonomous" adaptations are interconnected and 2) which factors enable as well as disable everyday adaptations. Building upon this classification of adaptation practices and drawing from the GoingVis project ("Governance through integrated visions"), which focuses on climate change adaptation in small towns in Germany, the paper presents governance approaches to empower citizens to initiate the adaptation of social practices to heat stress. It therefore aims at gaining an insight into the above-mentioned gaps and questions. GoingVis puts the agency of urban populations at the center of local climate change adaptation processes. As part of the project, citizens and urban stakeholders have been engaged in different experiments to actively develop precautionary adaptation practices that fit their everyday needs. Based on mixed-methods research

conducted in two small towns in Germany, the paper draws attention to enabling and disabling factors for adaptation practices that structure everyday life, alternative visions of the future and the role governance by local municipalities can(not) play in this.

Community-Based Design Using Nature-Based Solutions To Meet Climate Change Challenges Along Urban Hillsborough River, Tampa
Speaker: Richard Mbatu

The goal of this study is to involve diverse and vulnerable communities living along the lower Hillsborough River in Tampa, Florida, in the design of nature-based solutions (NBS) that will increase their resilience to storm damage and sea level rise. NBS is considered innovative in mitigating climate change and emphasizes collaboration with local communities. The Tampa metropolitan area has not experienced a direct hurricane hit with a significant storm surge in over 100 years, although the region has a high exposure to tropical storms. The study area includes a 17-km stretch of the tidally influenced Hillsborough River downstream of a reservoir dam, which meanders through most of the City of Tampa. This study included three consecutive stages. Examining the literature on infrastructure and communities is the focus of the first stage. The second stage focuses on locating communities that are at risk. In stage three, the communities' needs for resilience are elucidated, the potential effects of storm surge and sea level rise are conveyed, and the advantages of NBS are deliberated. This study's output is a design of nature-based mitigation strategies for climate change-induced Hillsborough River flooding that involves the community. By actively engaging the communities in the design of the NBS, we seek to contribute to awareness, preparedness, and long-term community resilience against sea-level rise and increased storminess.

Everyday adaptations in border regions: A comparative case study of the Rio Grande Valley, USA and Gilgit-Baltistan, Pakistan
Speaker: Rebecca Nixon

In international border regions, climate change impacts and adaptations occur in distinct social-environmental contexts that shape resource sharing, infrastructure, and mobility. Border regions are also sites of transit, informal housing, and resource conflict that intensify climate risks. Here, adaptation to climate change often occurs in everyday practices embedded in routine and local contexts, rather than through large-scale, planned action. In some cases, planned adaptations that do occur conflict with everyday adaptations. Despite the unique context shaping these everyday adaptations, very little research examines these processes in border regions. In response, we conducted a comparative case study of the Rio Grande Valley (RGV) at the Mexico- US border and Gilgit-Baltistan (GB), at the Pakistan-China border. We used household surveys (n = (LRV=92, GB=82)) to examine livelihood strategies, perceptions of climate change and the border, and adaptation. Our work reveals that in the RGV, residents tend to view the border as a connection to their families and cultural traditions, but escalating periods of extreme heat are putting a strain on their budgets and may threaten the health of a population that relies on medical facilities across the border. In GB, residents report both economic opportunity and environmental stress related to the border, but everyday adaptations are largely in response to flash flooding, increased competition over water, and extreme heat. Both cases highlight the complex roles of border specific infrastructure and mobility. Together, they reveal important details that may complement planned adaptations and help diminish the implementation gap in border regions.

KNOWLEDGE, PERCEPTIONS, AND ADAPTATIONS (EACC)

Farmers' awareness level and their perceptions of climate change: A case of Khyber Pakhtunkhwa province, Pakistan
Speaker: Shah Fahad

Climate change is an environmental threat to all the sectors, especially the agricultural sector around the globe. Several studies have reported the farm households' perception, adaptation and mitigation about climate change but there is inadequate knowledge available on the awareness of farm households about climate change in Pakistan. To fill this research gap, the purpose of research aims to examine the Pakistani farm household's awareness level of climate change and its associated factors. By using structured questionnaire in data of 400 study participants were collected from Khyber Pakhtunkhwa province of Pakistan through a household's survey. A stratified random sampling technique was utilized for collection of primary data. A probit model approach was employed to analyze the farm households' awareness of climate change and its associated socioeconomic and demographic variables. Results of our study exposed that 73 % farm households were aware of climate change. Socio economics and demographic variables such as age of farm households, education level, farming experience, land ownership status, extension and information sources access were pointedly related to farm households' awareness of climate change.

Further, results of our study showed that the evaluation of farm households' adaptation behavior suggests that farm households are active in using several adaptation strategies such as crop diversification and use of irrigation etc. It is expected that the findings of the present research will be helpful to guide governmental agencies and policymakers and contribute to the construction of sustainable adaptation measures in Pakistan and other regions in the framework of climate change.

Livelihood adaptations in the context of uncertainty and risk: understanding the perspectives of farmers across present day Belize
Speaker: Sofia Mardero

Climate change presents particular challenges to developing countries, where a large part of the population lives in physically exposed places and in precarious economic conditions. In the Central American country of Belize, farmers face increasing temperatures, more variable rainfall and extreme weather events (e.g. droughts). Our interdisciplinary project, Integrated ClimAte Resilience UnderStanding (ICARUS) Belize, seeks to understand adaptation and resilience to these changes, working with local communities as well as other local organisations. Interviews and workshops were conducted with farmers, government representatives, and NGO members across Belize to understand the impacts of, and responses to, climatic variability and extreme weather in relation to livelihoods and agriculture. From export industries such as bananas and sugar cane, to Mennonite national grain suppliers, and small-scale milpa and cocoa farmers, all report negative impacts related to climate change and extreme events. Adaptations range from individual, such as changing working hours, modifying the agricultural calendar, more use of irrigation, crop and labour diversification, to collective responses such as organising cooperatives and working groups to access international funding. This work has been complemented by a review of historical records, mainly since the 18th century, to give a long-term perspective on adaptation and resilience. Differences between regions, particularly the north and south can be considered in their wider socio-economic context. Understanding and recognising these adaptations is indispensable for promoting greater livelihood resilience, by assisting governments and decision-makers in designing appropriate policies, showing some practical approaches that have been successful and can be adopted and scaled up.

Millet Ark: A Resilient Livelihood Case from Taiwan's Indigenous people to Respond Climate Change
Speaker: Yih Ren Lin

This paper will address the issues how Tayal indigenous households respond to the impact of climate change through revitalizing their traditional farming knowledge. Millet ark, an action group composed of indigenous community members and university academia, has spent the last 5 years (including the covid-19 impact) to encourage a co-op style networking in several Tayal households by practicing the natural farming and millet growing. This paper provides the ethnographic narrative and reflection about the social process how the resilient practices were produced and embodied through the farmers' adaptation to the social and environmental changes. This paper will be divided into four main parts: 1. The social context and challenges of rural indigenous communities in Taiwan when they face the impact of climate change; 2. The organizing process of millet ark and its efforts in terms of indigenous community development; 3. The values and practices of natural farming and the growing of the traditional crop, millets and their knowledge related to bio-cultural diversity; 4. The resilient livelihood lessons that can be learnt from the social practices of millet ark networking. This paper concludes that both scientific and local knowledges, different kinds of capitals, and culture-based organizational principles and networking should not be alienated each other when the practices of resilient livelihood are discussed. Furthermore, the state policies implemented often ignore the interconnectedness of these different elements and even worse to separate them so that the remedy provided by the policies becomes the problems of the communities.

Perception and Response: Drought Risk Assessment in Irrigated and Flood-pulse Communities, Cambodia
Speaker: Snehalata Sainjoo

The Lower Mekong Region (LMR) faces increasing drought severity, threatening its connected agricultural-fisheries ecosystem and livelihoods. Subsistence farmers and fishers are at forefront to bear impacts and responds through behavioral changes at the farm level, which may depend upon their perceptions of drought risk. These adaptations may have consequences for the sustainability of critical ecosystem services. Thus, understanding how resource users understand drought risk is crucial. Here, we examine drought risk perceptions among households in irrigated and flood-pulse communities near Tonle Sap Lake, Cambodia. We apply Confounding Factor Analysis to capture multidimensional aspects of perceived risk —probability, severity, and affect—and utilize multilevel modeling to identify influencing factors, including biophysical, socioeconomic, and psychological dimensions. Our integrated approach,

combining quantitative analysis with qualitative insights from informal interviews, and causal loop diagrams, reveals significant heterogeneity in risk perception. Key factors include knowledge of drought, perceived control, organizational affiliations, information networks, and economic conditions. Interestingly, irrigated communities exhibit higher drought risk, potentially due to reliance on rain-fed agriculture, disparities in water distribution systems and behavioral changes reinforcing drought severity. The findings contribute to the development of context-tailored drought risk communication and management strategies, supporting vulnerable resource-dependent communities to manage drought risk and addressing socioeconomic disparities in adaptation capacity. Furthermore, our study underscores the significance of a holistic approach to identify region-specific challenges in drought management, offering valuable insights for future research and policy initiatives. These align with the conference's Implementation theme, focusing on translating sustainability research into actionable strategies that mitigate environmental challenges.

METHODS AND DATA FOR EVERYDAY ADAPTATIONS (EACC)

A Quantitative Model of Endogenous Climate Adaptation: Data Challenges, Validation, and Applications
Speaker: Riccardo Boero

To effectively assist local communities confronting the unprecedented threats of climate change, it is crucial to understand and model how human systems adapt. Climate change adaptation is inherently endogenous, heavily influenced by local expectations regarding natural hazards and shaped by the resources available locally, both at stake and at disposal. Here I present a quantitative economic model of endogenous climate adaptation. The model supports the identification of the main data challenges faced by researchers in this field. These challenges include differences in scales, the largely unobservable nature of data on adaptation investments and avoided losses, and the concurrent and compound nature of extreme events, which are the primary ways climate change affects our societies. Despite these challenges, the model successfully captures essential dynamics and offers valuable insights for addressing both research and policy questions. I conclude by presenting several applications of the model that validate theoretical predictions and address pressing policy questions.

The South Asian heat waves as a function of the hemispheric Rossby waves and land surface processes
Speaker: Waheed Ullah

Heatwaves during spring in South Asia (SA) have become recurrent in recent decades, causing severe socioeconomic losses and unprecedented ecosystem damage. These events expose over 24% of the global population and 3.85% of global GDP (as of 2021) to extreme heat during the pre-monsoon season. This study investigates the physical processes and mechanisms that trigger and amplify these heatwaves. Utilizing ERA5 reanalysis data from ECMWF and a combination of statistical and process-based techniques, we explore the physical mechanism behind SA heatwaves. Our findings reveal a two-stage structure: an initial stage characterized by thermal stress, followed by an absolute heat stage driven by high temperatures and energy accumulation. Zonally transmitted meridionally oscillating Quasi-resonant Rossby waves play a crucial role in the early stage, transporting energy and momentum into SA and triggering the heatwave event. Subsequently, as higher evaporative demands deplete soil moisture, strong land-atmosphere coupling creates a positive feedback loop, amplifying the second stage of the heatwave. Further research is needed to explore adaptation measures and strategies to mitigate the negative impacts of these recurring heatwaves.

Measuring Everyday Adaptation
Speaker: Martin Prowse

Everyday adaptation covers a wide range of actions, often beyond sectoral and disciplinary boundaries, posing particular measurement challenges. Recent contributions to quantifying household resilience may help. These can be clustered in three groups: those based on climate science and adaptation; those based on poverty traps and resilience; and those using statistical approaches to create resilience indices. This paper summarises approaches in the third group to ask: can we measure everyday adaptation in a way that is feasible, coherent, aggregable, transparent and sensitive to the local and national context? Doing so may help close the adaptation financing gap, and target support to where it is needed most

Using behavioural simulations to address uncertainty in climate change adaptation: the case of the Mijares River Basin in Spain
Speaker: Marcela Brugnach

Facing uncertainty when making decisions in water resources management within the context of climate

change is unavoidable. Beyond relying on the best available scientific knowledge and models, it requires deep insights into the social relational processes that underlie decision-making. Although this issue has been extensively acknowledged in scholarly literature, methodological and practical applications for managing uncertainty still lag behind. There remains a tendency to characterize and model uncertainties associated with the managing of water systems by focusing on reducing knowledge deficits while keeping social and political aspects separate. By adopting a social relational perspective, I argue that uncertainty not only refers to gaps in knowledge but also to the ambiguity resulting from the differences in meanings and interpretations that various actors bring to decision-making. From this perspective, I advocate for new methodologies of uncertainty analysis that, in addition to addressing deficits in the factual knowledge base, also attend to the social dynamics underlying decision-making. To this end, I introduce behavioral simulations as an innovative methodology for analyzing and understanding the impacts of uncertainty. This presentation focuses on the Mijares River Basin in Spain, where summer storms, responsible for nearly 70% of the area's rainfall, have significantly decreased due to land cover changes and climate change, severely impacting the agricultural sector and regional economy. Revegetation strategies are being considered to restore the water cycle, but their implementation faces many uncertainties and considerable debate. I will share the experience of developing and running behavioral simulations to better understand the role and function of uncertainty in selecting revegetation practices to restore summer rain."

EVERYDAY ADAPTATIONS IN AGRICULTURE (EACC)

Adaptations and Sustainability in Andean Socio-Ecological Systems
Speaker: Corinne Valdivia

Transdisciplinary research in Andean socio-ecosystem sheds light on how people and communities in rural communities are adapting to climate change, in the context of markets drivers and migration. We present a new coupled modelling approach, integrating agent-based modeling and network analysis, to examine drivers and processes of shifting socio-ecosystems in three distinct regions of the Altiplano of Bolivia. Rural communities in the central Altiplano have mixed crop/livestock systems and opportunities of both rural and urban employment. Until recently, increased access to urban markets has permitted farmers to take advantage of warming trends to switch to higher value crops as well as less cold tolerant varieties of traditional crops. However, later onset of rains, higher evapotranspiration rates combined with increased frosts around harvest times are now limiting the ability to respond further. Increased warming is also contributing to glacier loss and shifts in precipitation regimes that impact the water table. In addition, migration strategies reduce the presence of people and impede the ability to continue soil amendment practices that sequester carbon and irrigation practices that support sustainable production. In all these regions there is a tension between livelihood strategies and investments in the environment for resilient and productive socio-ecosystems. A collaborative, participatory approach is applied in this research to permit the co-production of knowledge. The translational process considers feedback loops across multiple scales/levels of governance, and integrates diverse knowledge systems aiming to develop scenarios of wellbeing and resilience in collaboration with rural communities impacted by climate change, informing stakeholders on actions for adaptation.

Tapping into farmers' bounty to adapt to climate change
Speaker: Olivier Dangles

Farmers have long used local ecological knowledge, intricate production systems and livelihood strategies that include off-farm options to cope, adapt and reorganize to meet climate uncertainty and risk, which have always been a fact of life. Those traditional systems are generally highly resilient, but the predicted effects, and variability of climate change, in particular extreme heat and drought events, may push them beyond their range of adaptability. In this context, agrobiodiversity may help farmers face a rapidly changing and warming world. Identifying resistant crop varieties is therefore crucial to ensuring people's food security and farmers' resilience. To date, many studies have been conducted on varietal improvement but few have examined the degree of genetic variety that exists within the same species. In this study we focused on the sweetpotato – the fifth most produced crop in the world, after corn, wheat, rice, and cassava. We assessed the heat-stress tolerance of 1,973 different varieties of sweetpotato from a collection of cultivars from 50 different countries comprising modern and traditional varieties. Analysis of the roots and foliage data allowed the effect of repeated exposure to extreme temperatures – greater than 35°C – on the plants' performance to be measured. Ine hundred and thirty two cultivars, of which 65.9% were traditional local varieties, demonstrated good heat tolerance. These are therefore promising candidates for selection as high-yield, heat-tolerant varieties. Intraspecific diversity – the result of hundreds of years of co-evolution between farmers and their crops – is proving critical in the face of climate change the role of agrobiodiversity in the resilience of tropical agricultural systems.

Everyday adaptation in the UK wine sector
Speaker: Kate Gannon

Our work considers everyday adaptation within the private sector, with a focus on adaptation in the UK wine sector. The UK wine sector is highly responsive to climate change. Grape vines are very sensitive to climate change and growth in the sector is an adaptation response to the increased ability to produce commercially popular grape varieties in the UK. However, climate change is also posing wide-ranging challenges to UK wine production linked to the rapid rate of change and more extreme events. Focusing, unusually, on both opportunities and risks of climate change, this research adopts a temporal and relational view of adaptation, through a sector-wide, value chain lens and through considering adaptation to both climate variability and longer-term change. Using the lens of 'a good year' and 'a bad year' in the sector, we consider the role of extreme events in everyday adaptation decision-making and how this contributes to longer-term learning. We find businesses continually refine their adaptation strategies in response to climate variability and extreme events. They enhance adaptation learning by experimenting with new technologies and strategies and irregular and extreme events can become important focal or tipping points in creative iteration and innovation of adaptation strategies, including for longer-term climate change. Our research considers how short-term everyday adaptation shapes longer-term resilience and we find a strong dependence on own experience in adaptation decision making risks creating adaptation lock-in. As a result, ways in which the sector is developing through everyday adaptation may limit its resilience to changing conditions in the future. These insights hold lessons and warnings for other sectors in other geographies.

No room for error: What satellite data should be teaching us about smallholder decision making
Speaker: Kurt Waldman

Applications of satellite data to understand smallholder farming systems have increased as the spatial, temporal and spectral resolution of these data have improved. We discuss what the use of satellite data is revealing about smallholder decision making and specifically about environmental cognition. The more precise that satellite derived observational data become, the more we see there are discrepancies between observational data and farmer perceptions across a range of topics. We argue that the use of satellite data reveals the limits of human cognition to recall and process various types of information, highlighting the problematic ways we have typically studied fundamental decisions around agricultural input use, production outcomes and perceptions about weather and climate. We demonstrate this with a sample of Zambian farmers with a focus on the implications for climate adaptation.

Clumsy solution to wicked problem of climate adaptation in the Himalayas
Speaker: Netra Chhetri

The ability of society to respond to impending challenges of climate change is unlikely to follow a smooth trajectory with time. Getting ahead of the possible consequences of climate change is contingent upon abilities of households, communities, and their supporting institutions to respond to it. Ambiguity, mind-bending complexity, and irreducible uncertainty associated with climate change make it a 'wicked problem' that continue to frustrate the search for elegant and linear solutions for which society has had a long history and experience. The 'wickedness' of the problem urge us to go beyond coherent approach and adopt what look like a 'clumsy solution' and deploy an array of pragmatic solutions that are embedded in values and norms of communities in question. Given this, it is important to unravel how existing repository of knowledge might help achieve climate-resilient systems that enable a smoother transition to future climate. Drawing upon case of conservation farming in the foothills of the Himalayas, this paper demonstrates the value of everyday practices of agriculture considering the need for adaptation to climate change. More specifically this paper demonstrates how smallholder agricultural system, which once was at risk, has evolved to become one of the most resilient systems to climate through complementarities achieved between local and expert driven knowledge.

EVERYDAY ADAPTATIONS AND FORESTS (EACC)

Bridging the Gap: Adaptation in Action Canadian Forest Sector
Speaker: Sheri Andrews-Key

Climate change is an increasing concern for forest managers. The impacts of climate change on forest ecosystems may limit the ability of forest managers to achieve sustainable forest management (SFM) objectives, and changes to management or practices may be required in response. While academic literature emphasizes the need for adaptation to climate change, and proposes what kind of higher-level changes are required to facilitate that change, less attention has been paid to what forest managers need

and their ability to implement adaptation. Here we describe a recent example of proactive climate change adaptation in Canada's forest industry, the first instance in which a Canadian forest company operating within a publicly owned land base has undertaken a formal climate change adaptation planning process. We show how Mistik Management Ltd., a partnership between nine indigenous nations and a pulp and paper company, used a climate change vulnerability assessment framework to identify vulnerabilities and develop management strategies to mitigate climate risks while also changing management practices. We also show how Mistik is mainstreaming climate change considerations into their management system and implementing it through changes in their management practices. At the institutional level, we found no substantive barriers to Canadian forestry firms seeking to incorporate adaptation into ongoing planning and management activities and observe a growing number of firms in Canada engaging in similar processes.

Native Plant Materials and the UN Decade on Ecological Restoration: A Sustainability Challenge and Opportunity
Speaker: Rachel Mitchell

Climate change is an increasing concern for forest managers. The impacts of climate change on forest ecosystems may limit the ability of forest managers to achieve sustainable forest management (SFM) objectives, and changes to management or practices may be required in response. While academic literature emphasizes the need for adaptation to climate change, and proposes what kind of higher-level changes are required to facilitate that change, less attention has been paid to what forest managers need and their ability to implement adaptation. Here we describe a recent example of proactive climate change adaptation in Canada's forest industry, the first instance in which a Canadian forest company operating within a publicly owned land base has undertaken a formal climate change adaptation planning process. We show how Mistik Management Ltd., a partnership between nine indigenous nations and a pulp and paper company, used a climate change vulnerability assessment framework to identify vulnerabilities and develop management strategies to mitigate climate risks while also changing management practices. We also show how Mistik is mainstreaming climate change considerations into their management system and implementing it through changes in their management practices. At the institutional level, we found no substantive barriers to Canadian forestry firms seeking to incorporate adaptation into ongoing planning and management activities and observe a growing number of firms in Canada engaging in similar processes.

Targeted nature-based infrastructure framework for large-scale native tree plantings and bioswales for ecosystem services enhancements in urban and industrial areas to improve climate adaptations, air and water pollution, health, and urban heat in vulnerability
Speaker: Deborah January-Bevers

Through a multi-partner, large-scale targeted native tree planting framework, implemented in Houston, Texas, thousands of native tree species that rank high in key ecosystem services are being planted in locations that experience substantial flooding during large rain events, have high rates of health effects exacerbated by air and water pollution and experience multiple days of elevated heat and air pollution. This multidisciplinary framework addresses a critical need to provide interventions accessible to urban communities, particularly in heavily industrial areas, and to educate on the connection between climate change adaptation, air pollution mitigation and health. Two case are discussed: (1) the regional Houston Ship Channel Trees and Riparian Enhancement of Ecosystem Services (HSC TREES) Program - that targets large-scale native tree plantings along the 25 miles of the Houston Ship Channel, and (2) the Riverine Targeted Use of Buyouts (Riverine TUBs) Program – that prioritizes FEMA-qualified contiguous buyout properties adjacent to riparian corridors leading to Galveston Bay (Texas) and the Gulf of Mexico. With the assistance of local, regional and federal partners, the Riverine TUBs Program implements targeted large-scale tree planting and bioswale installations on these contiguous public lands to increase coastal and riverine resilience, address harmful impacts from frequent rainwater and storm events and establish best management practices that can be emulated by other stakeholders/decision-makers in the region and around the coastal U.S. and the world. These climate change adaptations provide flood mitigation, air and water quality enhancements, increase carbon sequestration and riverine erosion control, among other benefits.

Nature-based solutions: efficient genomics-based 'end-to-end' selective tree breeding framework helps in shaping future forests
Speaker: Ilga Porth

To keep pace with the current rate of climate change, effective management of forest genetic resources needs to be developed. The assisted gene flow approach, using transfer functions, moves genetic material from different provenances towards their future optimal growing conditions to maintain current

productivity levels. Comprehensively understood patterns of genetic variation help to create new frameworks for climate resilient re-vegetation. To facilitate large-scale monitoring, the use of tools such as association genetics in conjunction with multi-trait genomic selection models is an efficient method that can elucidate molecular and genetic mechanisms and provide a framework to directly address the pressing environmental issues. Such framework will increase the efficiency of existing selective breeding programs, accelerate the launch of new programs for ecologically and environmentally important tree species, and enable more effective management of biotic and abiotic stress problems caused by climate change. Expanding the available reference genomes also provides important information for studying the genetic architecture of resilience traits and for identifying candidate genes that could be useful for breeding and adaptation management programs. However, applications of genomics are mostly limited to flagship species and their benefits for biodiversity conservation and ecosystem services management are underutilized. Finally, the main challenges for putting genomic applications into practice as decision-making assistance tools for forest managers, practitioners and decision-makers remain the current lack of understanding of the information and tools, lack of expertise, costs of using and analyzing data, uncertain funding, and the time required for data analysis.

Maximizing Pathways to Forest Sector Adaptation by Reducing Barriers for Small Enterprise
Speaker: Ryan Bullock

Forest ecosystems are experiencing the impacts of climate change, which are expected to increase in the future. So far, most adaptations in the forest sector have been in reaction to large disruptive events, such as wildfire, yet they are implemented though routine actions taken by local actors. According to the IPCC, adaptation refers to intentional adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli, and their effects or impacts. Our research examines adaptation actions in the forest sector, and translates this knowledge back to communities, industry, and policymakers to ensure that sustainable forest management is adequately supported. From speaking with stakeholders and rightsholders, we understand that small-to-medium sized enterprises (SMEs)—which account for >99% of Canada's forestry enterprises—are the "front line" for implementing adaptive actions. In partnership with the Sustainable Forestry Initiative, this research shares lessons from adaptation research and local actions based on case studies with SMEs. We develop a framework for evaluating how they can adapt while continuing to operate. By producing new systems knowledge and tools to support forest community and industry adaptations, our research directly addresses sustainability objectives outlined in The State of Canada's Forests 2023 annual report.

ADAPTIVE CAPACITY OF MARGINALIZED AND VULNERABLE GROUPS (EACC)

Enduring Adaptation: Maasai Resilience in the Face of Climate Change
Speaker: Crystal Tremblay

In the grasslands of Tanzania, climate change is impacting every aspect of the Maasai way of life and the land that is the basis for livelihoods. Our research employs community-based participatory methods to document how young Maasai women are adapting to climate change. We aim to better understand the challenges faced by this demographic to foster climate justice by empowering Maasai women and girls to actively participate in decision-making processes related to climate change adaptation and mitigation strategies. Through immersive engagement and participatory observation, our research uncovers the nuanced strategies employed by the Maasai to combat the erratic weather patterns threatening their pastoral way of life. We use storytelling and photovoice to bring to life the voices of some of the most vulnerable and unheard members of the community. Our findings reveal a blend of traditional knowledge and innovative adaptation methods, such as change in community-defined social roles, mobility, livestock herd management, pasture, and water conservation techniques, which are crucial in sustaining both their culture and the environment. The significance of this work lies in its contribution to the discourse on climate change adaptation, providing a unique perspective that underscores the value of Indigenous knowledge in developing sustainable solutions. It challenges the global community to rethink sustainability from the ground up, offering insights that could inspire adaptive strategies in similar contexts worldwide.

Climate Change at the Margins of the Megacity: Informal Settlements' Everyday Adaptation Infrastructures
Speaker: Brianna Castro

Climate change stresses all megacities, but especially marginal communities within the megacity. This article explores how marginalized communities in megacities adapt to climate change through the case of

Lagos, Nigeria. Informal settlements and traditional fishing communities hug the shorelines and sinking landfilled areas within Lagos, Nigeria. Communities rely on what they have to adapt by creating economies of adaptation and using traditional knowledge and ways of life within limited space at the margins of the megacity. Lagos State, though, has a self-proclaimed vision of Lagos as "The Next Dubai," and climate vulnerable informal settlements run counter to this vision. This paper explores this tension by using ethnographic and archival data to understand the complex adaptation infrastructures in informal settlements of Lagos. The infrastructures serve to collect sand to infill flooding land, live over water, distribute water, temporarily displace during high floods, and procure materials for elevating home interiors during flooding. These everyday adaptation infrastructures at the individual, household and community levels are undermined when residents are displaced from marginalized locations. This ultimately creates greater socioeconomic vulnerability, and thereby greater climate vulnerability, in a megacity lacking in formal, attainable housing options for residents of informal settlements.

Resilience Justice: Disaster Readiness in Marginalized Communities
Speaker: Abigail Andre

Despite the proliferation of government programs designed to help communities prepare for and recover from natural hazards, the disparate impact of disasters on marginalized communities persists. I explore the complex web of factors that contribute to disaster injustice and propose a framework to infuse equity into resilience building practices. I hypothesize that social justice practices could be harnessed in conjunction with existing legal processes to achieve just resilience. Research in support of this dual stream approach will include interviews of environmental justice leaders, disaster scholars, and individuals impacted by natural hazards and a synthesis of existing post-disaster studies. Consistent with movement law, this research is community-centered and designed to co-produce a framework that empowers communities to take advantage of what current legal systems do provide and fight for what they do not. Importantly, the processes contemplated here do not end with legal reform: resilience justice likely requires system transformation. This research builds on existing theory and bridges several areas of study. While numerous definitions of resilience exist, less attention has been paid to how resilience frameworks should account for community-level differences. Even in cases where socioeconomic characteristics are considered, the underlying systems that create social vulnerability are often ignored. The Resilience Justice Framework infuses Folke et al.'s framework for Resilience Thinking with social justice theory and Ostrom's theories for polycentric governance to address these gaps. This research will also identify the legal systems outside the disaster context that most directly contribute to disparate disaster impacts and suggest reform.

Conflicting Policies on Environmental Management and the Risk for Women's Role in Innovation and Socio-economic Production in Tanzania
Speaker: Martha Lerski

Equity and efficiency of environmental adaptations must be considered together. This emerging project explores how well-meaning sustainability initiatives impact local traditional handicraft traditions intertwined with ecosystems. The conference theme of Closing the Implementation Gap aligns with examination of unintended consequences of specific environmental policies. As this initiative emerges from collaboration between the National Museum of Tanzania's Ethnography Department and an academic library, methodologies include Ethnographic field studies, Museology, Library Science, and a framing conceptualization through Arts-based Research's deliberate examination of insights gleaned from gaps, silences, or negative spaces. The project will document a longstanding Tanzanian Living Heritage tradition: women's practices of basket weaving out of wetlands reeds. The project will explore the tradition's potential for supporting environmental and economic sustainability linked to Traditional Ecological Knowledge in the Eastern and Southern highlands of Tanzania. This practice has been at the heart of livelihoods and upsurging of the economies of rural marginalized communities, and women in particular. In this light, therefore, we view policy contradictions as well as inadequate recognition of local knowledge by women as portals to constructing climate solutions. How can policymakers bridge the sealing off of endangered areas and access for Local stakeholders with disappearing but dynamic and climate-change-relevant ecosystem management traditions and knowledge? How can conflicting objectives, such as support for female empowerment, be reconciled with policies which impose artificial boundaries on areas once open to Indigenous, primarily female, practitioners of basket weaving? Facilitation of environmentally sustainable livelihood traditions can support informed adaptations to environmental changes

Everyday adaptation across vulnerabilities: a national study
Speaker: Maya Negev

Vulnerable populations are disproportionately exposed to climate hazards, and have less means to adapt. Climate impact on vulnerable populations' health is exacerbated by gaps in infrastructure, institutional and

individual adaptation. This study explores everyday adaptation of individuals, and institutional adaptation of the health system, in Israel. Utilizing a mixed-methods approach, we conducted a national survey (n=1,492) with oversampling of the vulnerable Arab population. In addition, in the Negev Desert which is a climate hotspot prone to extreme heat and dust storms, we conducted 10 focus groups with vulnerable populations (n=69). Our results show that vulnerable populations are more exposed to extreme climate events, and practice diverse everyday adaptation measures. Nationally, 46% reported they missed a medical appointment due to extreme climate, including 65% of Muslims and 35% of Jews. When asked about coping with extreme heat, 58% of Jews reported they use A/C as needed, compared to 42% of Arabs, while in the Negev Desert 25% of Jews "bear the heat" compared to 29% of the Muslims. To cope with heat, 21% of 18-65 year olds visit family or friends, compared to 9.8% of 65+. The focus groups revealed that everyday adaptation is practiced, but is not sufficient during extreme heat stress, when outdoor workers get sunburnt while wearing protective clothing, and solar panels stop functioning. In conclusion, vulnerable populations are more exposed to climate hazards, and practice adaptation measures. However, individual adaptation is not sufficient and climate inequality is widening, requiring significant policy intervention.

SUSTAINABILITY TRANSFORMATIONS: NAVIGATING VALUES

Up in the Air and Down in the Water: Connections between air and water quality in an urban coastal environment and implications for sustainability policy
Speaker: Mary Lusk

Excess nitrogen in aquatic ecosystems can lead to eutrophication and the proliferation of harmful algal blooms that deteriorate water quality. Sources of nitrogen to water bodies include fertilizers, livestock and pet manures, soils, decaying vegetation, and atmospheric deposition. In the Tampa Bay urban watershed in Florida USA, atmospheric deposition (rainfall) is a leading source of nitrogen that drives water quality impairments. Nitrogen in the area's rainfall comes from both mobile and stationary sources, including vehicle emissions as well as power plant emissions. This presentation discusses recent research on the extent to which atmospheric deposition (rainfall) delivers nitrogen to the Tampa Bay coastal zone, how that nitrogen affects blooms of harmful algae in the area, and policy and education efforts to teach residents about how vehicle and power plant emissions can be a source of nitrogen in the local atmosphere that in turn becomes a source of nitrogen-laden rainfall that can harm local water bodies. It is the hope of the project to show how the atmospehre and local water quality are connected and how actions by residents (vehicle use, for example) can be a part of water quality as well as air quality.

Articulating Shared Values: A Pathway for Sustainability Transformation
Speaker: Yanyan Huang

In today's complex socio-environmental landscape, understanding and aligning shared values are crucial for fostering sustainability transformations. We focus on developing a method to articulate the shared values of naturally occurring groups within society in an effective manner. Grounded in the recognition that shared values serve as a foundation for collective behavior, our approach seeks to uncover the deep-seated beliefs and priorities of diverse communities. In a qualitative, ethnographic and participatory research manner, we obtain insights into what matters most to people, allowing them and outsiders a lens through which they can authentically engage with pressing sustainability challenges such as climate change. Our findings indicate that our method facilitates a deeper understanding of shared values, enabling communities to identify common ground and navigate towards more unified approaches to sustainability. By highlighting the importance of values alignment and complementarity in sustainability initiatives, we underscore the need for inclusive and participatory approaches to transformative change. Scholarly significance lies in our contribution to methodological innovation, offering a practical tool for practitioners and policymakers to understand and harness the power of shared values in sustainability endeavors. Our work advances the conference theme by emphasizing the role of values articulation in driving meaningful sustainability transformations and underscoring the importance of inclusivity, dialogue, and personal reflection in fostering a more sustainable and harmonious future. By synthesizing insights from diverse contexts, we offer a robust methodology for articulating shared values and leveraging them as catalysts for societal change.

Exploring Green Crime and Rationalization in the Rural Industrialized Water-Energy Food Nexus
Speaker: Deseret Weeks

This research contributes a mixed-methods case study of the water-energy-food (WEF) nexus in a rural region in the advanced stages of industrial development, Kern County, California, using green criminology as the theoretical lens. Pollution exposure risk zones were delineated and verified via a spatial analysis of

nexus industry-related chemicals in tap water using water quality data and California's public health goal safety thresholds. Qualitative survey responses (N = 100) and critical thematic analysis were used to explore the personal experiences and political-economic influence on the rationality of individuals living in the risk zones. Results show that Kern County's WEF nexus is producing green crime and that individual rationality shaped by the broader political-economic system is a driver of the treadmill of production. Contributions of this case study include its evidence for the unsustainable nature of the current economic paradigm and the need for a redefined version of sustainable development goal 6, which should include: 1) Thresholds for chemicals related to fossil fuel development and industrial agriculture in drinking water defined by science. 2) A goal of transforming a. The structure of the economy to match the needs of local socio-environmental communities to ensure pollution is not being produced beyond ecosystem renewal capacity to maintain threshold standards. b. Political-economic rationale via cultivation and strengthening of sustainability ideology. 3) Radical democratization and grassroots inclusion in WEF nexus management Further green crime case studies of the rural industrialized WEF nexus are needed to build momentum for sustainability transitions.

Functional Dynamics Influencing Offshore Wind Deployment in the Texas Gulf Coast
Speaker: Jenna Lamphere

The Biden-Harris Administration's goal of deploying 30 gigawatts of offshore wind projects in the Gulf of Mexico by 2030 has the potential to produce enough clean and renewable energy to power over three million homes, while also providing green jobs, advancing coastal resilience, and addressing the climate crisis. In support of this goal, the U.S. Bureau of Ocean Energy Management recently held four offshore wind lease auctions in the Gulf of Mexico, which resulted in one lease provisionally awarded in the Lake Charles area. Despite offshore wind being a critical piece of the energy transition, lack of interest in the lease sales underscores the challenges to building out wind in the Gulf. Drawing on the Technology Innovation Systems framework, this study seeks to support decision-making around the energy transition in the Texas Gulf Coast by examining the functional dynamics that influence the deployment of offshore wind. Research is mixed methods, consisting of a content analysis of major Texas newspapers, semi-structured interviews with industry and policy stakeholders, and a statewide public acceptance survey. Results, which are expected July of 2024, will advance understanding of the state of offshore wind deployment in the Texas Gulf Coast by identifying policy problems and formulating policy goals in functional terms.

Negotiating discord in sustainability transformations: Rethinking policy action in the face of fractious politics
Speaker: James Patterson

Policy action for sustainability transformation often faces many sources of conflict, pushback, and resistance (i.e., discord) which can undermine efforts to deliberately realize change in complex socio-environmental systems. This challenge is increasingly visible in recent years across many issue areas (e.g., climate change, biodiversity, cities), where ambitious policy action is derailed by incumbent opposition, community pushback, and political backlash. However, although scholars and policymakers often recognize the potential for discord in sustainability transformations, conceptual frameworks and policy prescriptions tend to underestimate its significance and centrality. Discord is often treated as an aberration that can be overcome through consensus-building, political will, or win-win solutions, leading to an emphasis on targets and roadmaps where politics is seen as less decisive than scientific goals. This leaves us ill-equipped to understand how policy action for sustainability transformations can be advanced in the face of deep social and political division. Combining insights from literature on sustainability transformations and peace and conflict studies, we argue that negotiating discord through continuously seeking 'partial political settlements' among divided actors can help to navigate sustainability transformations. This refers to uncomfortable compromise which creates temporary truce and loosens deadlock, making new actions possible in situations that otherwise risk intractable conflict and failed transformation. Studying empirical experiences of partial political settlements is crucial for learning about their diverse forms, variation, and effects. Doing so can offer fresh insights to debates on the politics and governance of sustainability transformations with a focus on processes of real-world action and change.

SUSTAINABILITY TRANSFORMATIONS: THEORY AND TRANSDISCIPLINARITY

Integrating environmental and technological perspectives to promote sustainability transitions
Speaker: William Clark

A failure to weave together the multiple stands of academic research and practical experimentation on

sustainability transitions has too often left advocates with nothing strong enough to pull promising initiatives along against the dual drags of technological path dependence and conservative incumbent interests. We report the results of a community effort to do some of the needed weaving, specifically of two strands that have emerged from studies of how human societies interact with nature on the one hand and of how those societies interact with their technologies on the other. Our effort sought to highlight those strands' common findings but also to link the environmental strand's comparatively advanced use of sustainability metrics and its focus on multi-equilibrium dynamics with the technology strand's comparatively advanced use of long-term transition histories and its focus on innovation dynamics. Our strand-weaving effort recruited more than 30 scholars from across the natural and social sciences, with contributions focused three particular consumption-production systems (energy, food, and mobility). Our findings argue that transition policy should focus on multi-level processes (with promising niche innovations struggling against entrenched regimes), on system reconfiguration (rather than replacement), on horizontal connections (e.g., across national boundaries), of tensions between speed and depth of change. Special attention should be given to mixes of policy instruments (rather than silver bullets) and to political strategies (as well as technocratic ones). A binding constraint that merits priority attention by the research community is the poor performance of long term impact assessments for transition policy options.

Improvisatory Ecologies: Jazz, Consciousness and Integral Sustainability
Speaker: Edward W. Sarath

Jazz's improvisatory foundations are increasingly recognized as instructive to creativity and innovation across fields—from engineering and architecture to business and medicine— and thus may lay groundwork for new inroads in sustainability discourse. Further expansion of this discourse comes into view through the lens of jazz's robust connections to consciousness/spirituality dimensions, as exemplified in the lives and work of Alice Coltrane, John Coltrane, John McLaughlin, Yusef Lateef and many other jazz icons. Exemplifying principles of an emergent creativity/consciousness-based worldview called Integral Theory, a jazz-inspired framework called Improvisatory Ecologies takes shape and poses strong implications for redefining sustainability studies and interventions. Creativity-based features of socio-ecological improvisation include heightened capacities for spontaneous invention, innovation, problem-solving, interaction, freedom from conditioned thinking/behaviors, deep listening and resilience. Less familiar are consciousness-based improvisatory criteria that, rooted in age-old indigenous wisdom and insights from the outer edges of scientific investigation (e.g. research at the Institute for the Noetic Sciences, University of Virginia Medical School Division of Perceptual Studies), may point toward a fundamentally new sustainability paradigm. Here principles such as enlivened intersubjective consciousness, or heightened oneness between individual, humanity, environment and cosmos, communication with subtle energies/intelligences, and mind-matter interaction exemplify, if not redefine, Kuhn's notion of anomalous phenomena as catalysts for paradigmatic transformation. While prevailing sustainability discourse exhibits conditional, politically-correct resonance with the need to honor culturally diverse perspectives, its contradictory aversion to the spiritual dimensions of such perspectives underscores unexamined ethno-epistemic racist tendencies as well as the need for a new model. Improvisatory Ecologies may thus make diagnostic as well as (re)evolutionary contributions to the sustainability transformations imperative."

Deep leverage: A theory of regenerative mindset development
Speaker: Rosalind Yunibandhu

From the continued deepening of climate crisis to the ongoing widening of socio-economic disparities around the world, it is becoming increasingly clear that old paradigms are insufficient to address the complexity of the poly-crises we face today - and that a fundamental transformation in approach is required. Donella Meadows, a pioneer in systems thinking, highlighted the profound impact of leverage points in transforming systems. These points are locations within a complex system where a small change can produce significant shifts across the whole system. Meadows identified paradigms and mindsets as crucial, yet challenging, points to intervene in a system. Acknowledging the critical role of mindset in shaping behavior and decision-making, this paper explores the development of a regenerative mindset as a potent leverage point for systems change. Based on a review of transdisciplinary literature, the paper proposes a definition of a regenerative mindset, as well as a theoretical model of regenerative mindset development. The paper employs Kantabutra's Integrated Theory-Building Methodology (ITBM), General Systems Theory, and the Mindsponge Framework as a basis for building a model for the development of a regenerative mindset. The model is recursive and consists of three subsystems: 1) Socio-ecological worldview development; 2) Regenerative paradigm development; and 3) Regenerative mindset development. All are preceded by a foundation of mindfulness and precision psychotherapy. The study aims to extend academic discourse on sustainability and regeneration and provide practical guidance for educators, policymakers, and individuals to foster a regenerative ethos within their respective spheres of

influence.

Urban sustainability transformations and the complexity science-practice interface
Speaker: Michail Fragkias

The path towards the long-term prosperity of our species passes through the sustainability of urban environments. Sustainability transformations will take place within socioecological complex adaptive systems. Thus, urban sustainability practice in the 21st century needs to seriously consider the relevance of a complex adaptive systems approach. This paper offers a new roadmap for practitioners operating in the space of urban sustainability. We extract lessons learned, utilizing different strands of the literature, aiming to assist sophisticated practitioners. Firstly, we attempt to clarify how complexity science can have relevance on sustainability practice through our understanding of emergent phenomena (universality, power laws, phase transitions and scaling laws). In particular, we clarify the role of complexity empirics and introduce a small-N comparative analysis of case studies on the scaling of carbon dioxide emissions that elucidate the theoretical points. Secondly, we explore the challenge that complexity places on practice given the unpredictability of policy outcomes; we explore policy-making that weighs rules/guidance over 'expediency' more heavily; we argue that this should be the case based on ideas regarding prediction, causal explanation, the unconscious mind and the erosion of moral sentiments. We argue that the synthesis of these ideas provides a more nuanced set of guidance for practitioners in the urban sustainability context. We argue that the rise of the theme of causality in evidence-based prescriptions presents an important challenge for urban sustainability science and the complex systems perspective.

SUSTAINABILITY TRANSFORMATIONS - FRAMEWORKS AND ASSESSMENTS

A Socio-Technical Systems Perspective on California's Pursuit of Energy Sustainability
Speaker: Garry Sotnik

California is the second most sustainable state in the United States (after Massachusetts) and the most solar-friendly. It is a recognized leader in energy efficiency, has committed to achieving state-wide carbon neutrality by 2045, and, to meet this goal, has recently launched many sustainability efforts, including substantially expanding conserved land, accelerating renewable energy projects, and forcing large companies to disclose their carbon emissions. Is California undergoing an energy transition or transformation, and is it sustainable? The presentation describes research that explores this question by analyzing energy use in the region from the days of indigenous tribes. The research applies an adjusted version of the Socio-Technical Systems Transitions Approach that accounts for California's context and a typology of change for defining and differentiating between system transitions and transformations. The research identifies multiple sustainable and unsustainable energy transitions throughout California's history, driven by discoveries of new energy sources and efforts to fulfill local energy demand, reduce pollution, conserve nature, and increase energy efficiency. It also identifies an unsustainable energy transformation in the mid-19th century, driven by a change in lifestyles that led to exponential per capita energy consumption growth, and what may or may not have been the start of a sustainable energy transformation in the 1970s, driven by sustainable transitions toward renewable energy and energy efficiency but undermined by continued growth in consumption and unsustainable transitions toward outsourcing energy production and manufacturing of energy-intensive products. The research adds a socio-technical transitions perspective to analyses of California's pursuit of energy sustainability and advances socio-technical transitions scholarship by contrasting transitions with transformations and accounting for globalization.

Facilitating global urban assessment through social data proxies
Speaker: Danielle Wood

For sustainability, transformation is enabled with usable knowledge at multiple scales and across social and environmental systems; this capacity is important for assessing current conditions and supporting investment and implementation decisions for adaptation and sustainability. Multidimensional longitudinal monitoring systems, if characterizing the systems well, also provide opportunities to inform our understanding of where to intervene within and across systems and critical levers. Our work focuses on the creation of comparable multidimensional assessment information across regions with high variance; we are piloting an approach for characterizing global cities. As such, our work facilitates the equitable prioritization of investment and implementation for more sustainable and adaptive communities. In many regions of the world, rapid urbanization and low governance capacity means socio-environmental data scarcity at multiple scales. The inability to characterize and examine trade-offs of intersectional issues becomes a barrier not only to grassroots efforts but to international actors (e.g.,

NGOs), exacerbating challenges with investment. For the Global Urban Climate Assessment (GUCA), we explored both primary data through remote sensing for environmental and urban characterization and secondary proxy social data. Key questions explored in the GUCA development of the social data include: how do we mitigate issues of data scarcity for comparable assessments across urban areas? What are ways to approach and estimate uncertainty for differently scaled data proxies? In answering, we also consider methodological implications for expansion. Intended as an open-source tool, GUCA would provide comparable core metrics across cities, with the process itself contributing to methodologies for measurement.

Integrated Assessment Framework for Socio-Ecological Trade-offs in Agroecological Transitions
Speaker: Lívia Madureira

Agroecology and ecosystem services are closely linked, with agroecological practices promoting the sustainable management of agroecosystems. There is growing interest in agroecology as a sustainable innovation, playing a crucial role in the transition towards sustainable agriculture. Agroecology also provides the scientific and methodological foundation for transformative paradigms of rural development, emphasizing community-led participation and local knowledge. Agroecological transitions require changes in practices, transdisciplinary knowledge generation, social and economic relations, and institutional innovations. Assessing trade-offs in ecosystem services, including food production, regulation, and cultural services, through trade-off analysis and data-driven scenarios submitted for community analysis and deliberative choice, will help bridge the gap between global policies (e.g., EU Green Deal) and the transition paths desired by farmers and communities at the local level. Here, we present an integrated assessment framework aimed at evaluating the socioeconomic benefits and socio-ecological trade-offs of sustainable and resilient agriculture and agrifood systems by combining data with stakeholders' subjective evaluations. The framework is being developed within the Horizon project AgroServ (agroserv.eu). The Douro Socio-Ecological Living Lab, led by UTAD, hosts the testing and pilot implementation of this framework in the context of the ongoing agroecological transition in the Douro Mediterranean mountainous wine region in Portugal. One of the framework's steps involves outlining feasible and desirable transition paths for rural landscapes using a socio-technical transition scenarios approach, encompassing the multidimensionality of the transition, triggers, and drivers (e.g., agro-production systems, technology, regulation, policy incentives, market and consumer preferences, societal pressures).

Sustainability as Adaptive Ecosystem Management: the Case of Novel Ecosystems
Speaker: Allen Thompson

Traditional environmental ethics sought to attribute intrinsic value, independent of human preferences, to parts of nonhuman nature while economists insist all values arise from the preferences of human beings. Since debates about sustainable development have been staged on the edges of environmental and ecological economics, which both recognize value in “capital” as instrumental for promoting human welfare (whether human-made or “natural” capital) by objecting to the economic framework of analysis (because it is anthropocentric), environmental ethicists have been at odds with both sides ("weak" and "strong") in the debate about how to define sustainable development. Yet, now more than ever, we need an environmental philosophy that can be useful advancing sustainability theory and guiding transformations in complex socio-environmental systems. With Bryan Norton, I advance a philosophy of environmental pragmatism that is more geared to learning to be sustainable than defining what kind of good nature has and more toward realizing human excellence in response to environmental problems than in protecting nature for its own sake. In short, thinking of sustainability as a socially-expanded version of adaptive ecosystem management also highlights excellence in our human adaptive capacities. This model, built on the axioms of adaptive management and prior generations accepting moral responsibility for their impacts on the choice sets of future generations, is applied to contemporary debates in land-management, species conservation, and restoration practices about the increasing phenomena of anthropogenic drivers exceeding ecosystem resilience and pushing complex systems over irreversible thresholds into new states, thus creating no-analog or so-called “novel” ecosystems.

In-depth analysis of Energy Earthshots Initiative’s governance frame-work
Speakers: Fabio Voss, Antón Freire Varela

There is a gap in the literature about the operationalization of mission-oriented innovation policy. The given study wants to close this gap with a comparative case study on the German Energy Research Program (ERP) and the Energy Earthshots Initiative (EEI) based on in-person interviews and document analyses. Already, the ERP presented five distinct missions to foster the transformation of the German energy sector towards a net-zero goal in 2045. The Biden-Harris administration assembled eight so-called “shots”, including affordable and sustainable housing, to reach the same goal for the United States. The DoE and its

ARPA-E execute the EEI by funding research projects, from basic research to more mature technology. The governance of the German case has already been analyzed by a different project at the professorship. Still, the focus on the EEI's governance is a blank spot in the research and a perfect comparison case. Since both policy mixes state to be mission-oriented, this research design offers a unique opportunity for an inductive approach to how mission orientation is or could be operationalized. For this purpose, the employees of the ARPA-E and other actors within the realm of the EEI will be interviewed, all relevant documents regarding the EEI will be coded jointly with the transcripts of the interviews. Subsequently, the findings will be compared to the German case. Furthermore, the comparative aspect of this paper fills a gap in the literature since the national innovation systems of Germany and the United States haven't been analyzed for over ten years.

CURRENT AND EMERGING TRENDS IN SUSTAINABLE SUPPLY CHAINS 1

Transparency for Sustainability: The New Supply Chain Imperative
Speaker: Jay Golden

Transparency in global supply chains has become a top priority of governments, institutional buyers, NGO's as well as the financial sector. Just within the last year, we have witnessed a new generation of regulations and policies all focused on supply chain transparency that will have unprecedented implications for sustainability imperatives. In October of 2023, the Governor of the State of California signed into law the most comprehensive set of laws (SB 253 and SB 261) for companies doing business specific to annual reporting of greenhouse gas emissions including those of the supply chain ie. scope 3. Reporting obligations starting 2026. On April 24, 2024, the EU's Corporate Sustainability Due Diligence Directive (CSDDD) was passed. The CSDDD establishes far-reaching mandatory human rights and environmental obligations on both European Union and non-EU companies starting as soon as 2027. Further, On June 29, 2023, the European Union's regulation on deforestation-free products (2023/1115) entered into force placing transparency requirements especially for packaging supply chains. New York State has proposed the Fashion Sustainability and Social Accountability Act (S7428/ A8352) (Fashion Act) which will require fashion retailers and manufacturers doing business in New York State to comply with stringent supply chain mapping requirements and to disclose the environmental and social impacts of their activities. And finally, over two-thirds of fortune 500 companies have committed to net-zero carbon emissions. This session will provide an overview of these new policies and how organizations need to address the global transparency for sustainability initiative in supply chains.

Achieving Net-Zero GHG Emissions Goals Across Multi-Tier Global Supply Chains
Speaker: Timothy M. Smith

The need to reach global net-zero GHG emissions by 2050 has increased the pressure for companies to disclose their supply chain carbon footprints and publicly commit to reductions. However, inconsistencies addressing the inclusion of indirect scope 3 emissions in regulatory and voluntary initiatives have created implementation delays and omissions. Given the outsized contribution of scope 3 emissions embedded in the final use of goods and services, attainment of companies' net-zero targets will depend on both the sufficient inclusion of scope 3 emissions in targets and new mechanisms for increased coordination between supply chain actors for effective mitigation. Based on high-resolution, country-specific environmentally-extended input-output (EEIO) models, we present multi-tier GHG emissions structures of supply chains operating in the United States, China, South Korea, and Mexico. We apply these data to two net-zero implementation challenges: (1) determination of scope 3 emissions coverage boundaries in the face of high transaction costs and poor data quality, and (2) attribution of mitigation intervention benefits where traceability is increasingly challenged. Based on the current criteria of the Science Based Targets Initiative (SBTi), we find that company targets and interventions will need to reach beyond direct suppliers (into tier 2, and in some cases, tier 3) to include enough emissions to meet near-term 1.5°C trajectories (and, into tiers 5 and beyond to meet longer-term net-zero criterion). To address the need for mitigation deep in supply chains, we discuss opportunities for targeted supplier engagement and market-based tradable mechanisms for attributing upstream mitigation to supply chain actors' scope 3 exposure.

Tensions and transformations: Competing institutional logics and the creation of dynamic capabilities for creating circular supply chains
Speaker: Zoe Schumm

Resource-dependent firms are beginning to implement circularity in their supply chains due to impending legislation, investor demands, and consumer preferences. The transition to circularity and implementing Circular Economy (CE) concepts is ripe with challenges due to the different institutional logics (e.g.,

economic, ecological) guiding the different systems (e.g., linear vs circular). No matter how essential the shift from a linear to a circular supply chain may be, it will significantly alter the firm's decision-making and operating principles. Competing logics are expected to create tensions at the firm and supply chain levels that will give way to the creation of innovative capabilities. Most previous research investigating competing institutional logics has focused on hybrid organizations, not conventional firms implementing CE in their supply chains. Research must investigate conventional firms and how competing logics impact their transition to a closed-loop supply chain since they are 'retrofitting' their operations and supply chains to participate in the CE. An exploratory case study with an exemplar firm in the apparel industry was employed to investigate how a firm manages competing logics to create a CLSC. This study is one of the first to address the intersection of managing competing institutional logics and the creation of dynamic capabilities as firms transition from a linear to a circular CLSC. Findings indicate that management of the competing institutional logics can be viewed as an antecedent to creating dynamic capabilities. Five dynamic capabilities specific to the circular economy and necessary for creating a circular closed-loop supply chain are identified.

Understanding the implications of United States industrial policy on supply chain sustainability: a case study on electric vehicles
Speaker: Caitlin Grady

Recent United States industrial policy such as the Inflation Reduction Act, CHIPS & Science Act, and Bipartisan Infrastructure Law have recently emphasized domestic manufacturing and sustainable consumption, with a particular focus on the electric vehicle (EV) sector. This study examines the implications of these policies on the sustainability of EV supply chains through embedded resource accounting. By assessing the current carbon footprint embedded within EV supply chains, this research identifies the benefits and trade-offs of shifting towards increased domestic production as encouraged by recent government incentives. Furthermore, we analyze potential modifications in the supply chain resulting from announced investments in domestic manufacturing facilities. Preliminary results suggest that while increased domestic manufacturing could reduce logistic emissions and enhance supply chain resilience, it may also lead to changes in who bears the externalities of production and potential environmental impacts associated with scaling up production. This case study provides a comprehensive overview of how industrial policy may shape supply chain sustainability and offers insights into optimizing resource allocation for future policy development. The findings are relevant to policymakers, industry stakeholders, and researchers aiming to balance economic growth with environmental sustainability in the EV market.

Decarbonizing Transportation Infrastructure in the Context of a Warming Climate
Speaker: Elizabeth Doran

Extreme heat has been the leading cause of weather-related mortality in the United States for the past thirty years and is a growing problem under rapidly warming climate conditions. Older people, young children, and those with low income are considered particularly vulnerable but everyone can be at risk. Individuals make a variety of everyday decisions that can protect their health when faced with potential extreme heat exposure. On the shortest timescales and with the least investment, these adaptive actions may simply protect one's own health or the health of ones' family (e.g. staying hydrated, changing plans, checking on neighbors). At medium time and investment scales adaptive actions may also have broader energy system implications (e.g. using air conditioning or fans, or going to a cooling center or public air conditioned space). And, at the longest time scales and with the most investment, heat-health adaptive actions may have implications for public health, energy and infrastructure systems (e.g. installing air conditioning, home weatherization, and migration or displacement). As the climate continues to rapidly warm differentially around the globe, regional variation in the public perception of heat-health risk and tolerance for adaptive action is required to understand the implications of this threat on public health, and to make projections for future energy and infrastructure systems. The typology of everyday heat-health behaviors will be illustrated using evidence from an online stratified survey of Vermont, USA residents (N = 1818) that was conducted in the late summer of 2022. Broader system implications will be extrapolated.

EMERGING TRENDS IN SUSTAINABLE SUPPLY CHAINS 2: HUMAN RIGHTS, INFORMATICS, AND BLOCKCHAIN

Through the Looking-Glass: the EU Corporate Sustainability Due Diligence Directive and Forced Labour Regulation in Improving Workers' Rights in Global Supply Chains
Speaker: Samantha Velluti

In this paper we examine the role of the (EU) internationally in promoting corporate sustainability measures with a particular focus on those aimed at ensuring a better working environment, better forms of legal protection and adequate legal remedies for the workforce in the global garment supply chain. The paper first examines global garment supply chains, the use of private regulatory mechanisms to ensure corporate social responsibility and the problems concerning unenforced international labour standards for workers' protection and for the improvement of working conditions in the global garment industry, both domestically and at international level. The remaining part of the paper looks at why it is necessary to ensure the legal implementation of corporate sustainability due diligence and corporate liability. Drawing on a labour approach to workers' rights, the analysis focuses on the implementation and potential impact of the EU-wide mandatory corporate sustainability due diligence regime and the contribution of the EU regulation on forced labour. In so doing it identifies strengths and limitations of the EU's measures in effectively tackling workers' structural disempowerment in global supply chains. The paper seeks to address the following questions:
• What are the normative argument for adopting these measures from a workers' rights perspective?
• Why have corporate sustainability due diligence in the first place? What is the EU's role and added value for labour standards in global supply chains?"

Perspectives on Mandatory Human Rights and Environmental Due Diligence Legislation: A Case Study of the Canadian Coffee Sector
Speaker: Emma Bowick

Efforts to promote the sustainability of coffee production have mainly involved sustainability certifications like Fairtrade or Rainforest Alliance, or voluntary corporate sustainability programs such as Nescafé Plan 2030 or Starbucks's Coffee and Farmer Equity (C.A.F.E.) Practices. However, these voluntary standards have been critiqued for not effectively mitigating the social and environmental impacts associated with coffee production. In response, international organizations like the UN and OECD are calling on state governments to implement mandatory human rights and environmental due diligence legislation in an effort to hold corporations accountable for their supply chains. The Canadian government is exploring policy options to implement these international directives, exemplified by the introduction of the Modern Slavery Act (Bill S-211) and proposed Corporate Responsibility to Protect Human Rights Act (Bill C-262). In this research, we investigate the both the institutional barriers hindering the implementation of mandatory supply chain due diligence legislation in Canada, and the ideal policy options and opportunities for such legislation. Employing the Discursive Agency Approach, we examine the roles of key actors and affected stakeholders in influencing the adoption (or lack thereof) of such a policy. Focusing on the coffee sector, semi-structured interviews with policymakers, civil society actors, political party representatives, and business leaders involved in the global coffee trade and sustainability governance will identify diverse perspectives on adopting due diligence in a Canadian context. By acknowledging the pivotal role of discursive agency in shaping the capacity of actors to influence policy change, this study ultimately aims to identify politically viable and ethically sound strategies for improving the environmental sustainability and of Canada's coffee imports.

Challenges and opportunities related to the digitalisation of supply chains for the UK automotive sector
Speaker: Michael Short

The UK's recent departure from the EU has brought sharply into focus its international trade activities and the role of its renewed presence within the World Trade Organisation (WTO). Of particular interest to logistics and supply chain management in industry are how new directions for trade policy can and will intersect and impact upon supply chains, including those within the industrial manufacturing sector. The UK automotive sector is one of the largest within this category, and has complicated supply chains expanding over Europe, Asia and beyond, and cross-border trade facilitation is required to enable them. The recent COVID-19 pandemic has highlighted the impact of delays and logistics issues not only in global trade and supply chains, but also within this sector where significant impacts were felt. It is widely recognised that digitalisation can help to build resilience into supply chains and reduce delays and paperwork requirements, and hence costs, and digitalisation could have significantly ameliorated these pandemic logistics issues. With the UK becoming the first G7 nation to adopt (in September 2023) the UN's proposed Model Laws on Electronic Transferable Records (MLETR), there are many significant and potentially paradigm-shifting implications for trade and industry for both the UK and its trading partners. This paper will examine the implications of digitalisation, IoT and electronic trade documents for the UK automotive industry and its supply chains, with specific focus upon ESG issues including cross-border supplies of Critical Minerals for EV Battery Manufacture and Rules-of-Origin clauses in UK-EU EV trade operations. The paper will also describe recent and ongoing funded project work and piloting activities by the authors to help support digital trade activities in these areas, and outline areas for future work.

Food System Informatics
Speaker: Michelle Miller

Trucks deliver most of our perishable products, more than 93 percent of the value and over 57 percent of the mass. What does this mean for our food systems? Just transitions to regional food systems are a means to adapt to and mitigate climate change and underpin success in meeting the seventeen Sustainable Development Goals. Considering network statistics generated by several databases and machine learning, we can see how geographic concentration in perishable food networks contributed to cascading systems failures during the Pandemic. Efforts to decentralize food production and processing at the local scale have been in place for decades and were recently buoyed by support from the Biden-Harris Administration. Local efforts are necessary but insufficient. Individual firms have used network statistics to strategically manage information, capital and time to meet business goals since the 1990s, while the public sector has lacked access to these tools to meet social goals such as food security and sovereignty, freight and transit optimization, GHG and other pollution reduction. Using information harvesting, data commons, ontologies, model commons and knowledge graphs to create an Interactive Knowledge and Learning Environment (IKLE), the NSF AI Institute ICICLE is developing the means to regularly generate reports to inform the public good and to support renegotiation of food systems going forward. This workshop will introduce participants to informatics for food systems. We will consider an example of machine learning with public data on food distribution, discuss how standard language makes it possible to organize and merge disparate datasets for analysis, and introduce participants to the NSF AI Institutes working on supply chain optimization and IKLE. We will also discuss sustainable computing, data sovereignty responsibilities and real-time challenges to implementing protections.

Blockchain Technology in Sustainable Supply Chains: Feasibility Study of the Limpopo Emerging Agro-Processors Shared Facility
Speaker: Nnamdi Nwulu

The Limpopo Emerging Agro-processor initiative aims to support young agro-processors by sharing the facilities they require for food production. The goal is to sustainably enhance food security and safety by leveraging blockchain technology's integration into agro-processing supply chains. This approach would reduce the barriers to entry for these young agro-processors and enable them to lend their quota to sustainable food production. In the Limpopo province of South Africa, a deeply rural area, a blockchain-enabled shared facility would foster a collaborative approach to human resources, equipment, and expertise. Blockchain technology has the advantage of supply chain provenance in this context, thereby boosting consumer confidence and increasing consumer purchases. The research methodology deployed in this work consists of evaluating the operational framework of a blockchain-enabled shared agro-processing facility and determining the role of blockchain technology in fostering supply chain traceability, waste reduction, and technology efficiency. Furthermore, we investigate the impact of these technological innovations in supply chains on the revenue streams and profitability of the Limpopo agro-processors. The research contribution lies in establishing the role of a blockchain-enabled shared facility in enhancing the efficiency of agro-processing supply chains and advancing sustainability and ethical agricultural practices. When compared to traditional supply chains, blockchain-powered supply chains have the potential to provide a reliable system that provides immense value to producers and consumers alike. Specifically, the blockchain-enabled Limpopo agro-processors shared facility would demonstrate the transformative benefits of digital/emerging technologies and collaborative infrastructure in advancing sustainability and resilient supply chains.

PANELS

Designing Climate and Sustainability Networks to Scale Impact
Speakers: Meghan Fay Zahniser, Tim Carter, Krista Hiser ; Chair: Meghan Chapple

This panel will focus on how to advance climate and sustainability initiatives at scale through national and international networks. Executive leaders from Second Nature and AASHE, two of the leading sustainability and climate organizations for higher education based in the US, will discuss their approaches to program design and strategy, comparing and contrasting their successes and challenges in past and future efforts, and discussing how the National Sustainability Society could best align with these organizations moving forward.

Integrating Sustainability Education Across the University
Speakers: Maria Conroy, Krista Hiser, Beth Mercer-Taylor, Richard Nevle ; Chair: Elena Irwin

With thousands of governments and companies committed to sustainability practices, the demand for a sustainability-related workforce is growing rapidly. A growing sustainability skills gap (Microsoft 2022, Boone and Seto, 2023) underscores the need for accessible sustainability education content and programs to equip the present, emerging, and future workforce with the knowledge and skills needed while educating diverse citizens and leaders (NASEM 2020). However, integrating sustainability across diverse forms of knowledge into university curricula brings multiple challenges as scholars debate definitions of sustainability, departments vie for ownership of courses and topics, and colleges compete for scarce resources. These conflicts are particularly acute at larger or more traditional universities with strong disciplinary units. This panel will foster discussion of key barriers and illuminate solutions to integrating sustainability concepts and content across diverse disciplines and academic units in complex university settings. Panelists will share their ongoing experiences with developing inclusive frameworks, engaging faculty from diverse disciplines, and implementing cross-unit sustainability programs that typically lack faculty of their own. The panel will catalyze in-depth discussion among the panelists and audience members to cross-pollinate thinking and spark new ideas to inspire and energize participants.

• Krista Hiser: An overview of the convergence in the Key Competencies in Sustainability Framework and an emergent typology of sustainability education programs based on the ""4D Model"" by Wiek et al.
• Maria Conroy: The “Six Dimensions of Sustainability” that guides sustainability education at Ohio State, including new curricula, courses, and a new general education track in sustainability.
• Beth Mercer-Taylor: H The evolution of multiple sustainability majors and minors on the five campuses of U. of Minnesota and co-creation of programs, general education courses that will soon focus on Sustainable Development Goals, internships, and new courses in environmental and climate justice.
• Richard J. Nevle: The three interdisciplinary programs that provide the foundation for sustainability education in the Stanford Doerr School of Sustainability, including their innovations and ways in which they are highly responsive to evolving student needs and interests.

Following the panel’s opening remarks, the moderator will pose several additional questions of panelists and then open up the discussion for audience participation. Students and non-academic audience members will be encouraged to share their perspectives as well as university audience members who’ve had their own experiences in developing programs.

“Show me the Money”: Mobilizing Private Capital for Climate Action
Speakers: Angela Adduci, Eli Lieberman ; Speaker and Chair: Edward Chu

According to the International Monetary Fund, the path to net zero by 2050 requires low-carbon investments to rise from $900 billion in 2020 to $5 trillion annually by 2030. Recognizing that public funding alone cannot meet the investment needs, governments around the world have been exploring ways to increase private investment in climate solutions. In the U.S., the Inflation Reduction Act made available billions for dollars in funding and incentives to spur private investment. This panel will explore how federal funding, incentives, and policies are catalyzing private investments in clean energy, sustainable transportation, green housing and green infrastructure. This distinguished panel of experts in green financing will explore barriers and challenges for private sector investment. Anticipated topics include how banks are approaching and supporting climate transition planning, how banks are leveraging government policies and incentives to help catalyze private capital and how green banks and private capital providers can work more closely together.

Sustainability Careers
Speakers: Peggy Brannigan, Andres Henriquez, Edward Chu, Ellen Weinreb, Wesley Herche, Alice Reznickova ; Chair: Christopher Boone

The number of sustainability jobs is growing rapidly and there are not enough qualified people to fill those positions. At the same time, the nature of sustainability careers is changing rapidly, making it challenging to prepare students and others seeking jobs and building careers in this quickly evolving field. This session will bring together sustainability experts from higher education and private, public, and non-profit organizations to discuss trends in job requirements and responsibilities, and the training and preparation necessary to succeed.

Institutional Innovation for Municipal Green Infrastructure
Speakers: Bardia Heidari Haratmeh, Joni M Palmer, Heather Himmelberger

Rapid urbanization under climate change conditions accelerates stormwater flooding, often beyond the capacity of traditional gray infrastructure. One commonly acknowledged solution to this capacity deficit is Blue-Green Infrastructure (BGI). BGI offers an array of environmental co-benefits. Although acceptance is

growing, BGI faces socio-cultural, financial, and institutional path dependencies that limit the production, restoration, enhancement, maintenance, and efficacy of nature-based solutions. A major challenge of community resilience and an unacknowledged opportunity to enhance sustainable stormwater adaptation is found in municipal management practices. This panel will discuss strategies for institutional innovation to support the adoption and scaling of blue-green infrastructure in the United States.

Sustainable Market Trends in Construction
Speakers: Angi Rivera, Mark Chen ; Speaker and Chair: Marisa Zylkowski

"What does it take to bring people together around a common goal? Learn from leaders in building construction about their journeys to educate, engage, and rally stakeholders from diverse disciplines around sustainability goals. The process of becoming a signatory of the Climate Pledge, MEP 2040, and BuildingGreen's Contractor's Commitment will be shared. Just like the phrase "think globally, act locally," these commitments help building developers, general contractors, engineers, and product manufacturers think globally with a very local outcome – the built environment. Hear about the process of creating a corporate plan, setting greenhouse gas reduction targets, and working as a team to accomplish these goals. Marisa Zylkowski is the Sustainable Design Manager at MacDonald-Miller Facility Solutions (MMFS). She provides leadership of the sustainable design efforts of the company, working closely with mechanical and plumbing engineers to communicate complex sustainability solutions and educate clients on the potential of sustainable design. Her most recent endeavor is developing the company's first Sustainability Report and supporting jurisdictions & campuses through electrification of their entire building portfolio. MacDonald-Miller Facility Solutions is a leading full-service, design-build, commercial mechanical contractor in Oregon, Washington, and beyond for nearly 60 years. Angi Rivera is the Director of Sustainability at Sellen Construction. With twenty years of experience, she is responsible for Sellen's sustainability strategy and reporting as well as enabling project teams to deliver projects that meet or exceed client sustainability goals; net-zero initiatives, energy and water efficiency, waste reduction and diversion, and embodied carbon. Sellen has been a leading general contractor in the Pacific Northwest for nearly 80 years. They have been committed to building communities more sustainably, minimizing impacts to future generations, and contributing to a positive legacy in the built environment. Mark Chen is the National Carbon Manager at Skanska USA. Skanska has set an ambitious target to achieve carbon neutrality by 2045 in our own operations and across our entire value chain. As an interim target, our operations aim to achieve a 70 percent reduction by 2030, compared to our 2015 baseline. Skanska has delivered over 44 million square feet of space that has been certified across several systems including LEED®, Envision-, Green Globes, Fitwel and Living Building Challenge. We also provide consulting to clients to help them achieve their sustainability goals. To support these endeavors, Skanska has a dedicated team responsible for carbon tracking and reporting, vision setting, R&D, and adherence to environmental standards and policy."

Universities and Nonprofits Collaborating for Innovation and Impact
Speakers: Judy Braus, Maria DiGiano, Mary Ruckelshaus, Julie Vano, Rachelle Gould ; Chair: Nicole Ardoin, Cassie Rauser

This panel will explore how universities and nonprofit organizations collaborate to enhance the opportunities for innovation and impact in their work toward transformative shifts in sustainability. For decades, and in many cases, the knowledge transfer has been one-way: from academic research to nonprofits and the government sector, with the research often being seen as an input to a relatively structured programmatic or decision-making process. More recently, new models of actionable knowledge and change have emerged, motivating exciting practices that create a flywheel of co-creation. In these new models, academic researchers and nonprofit partners collaborate to develop research questions, create action plans, and see programmatic inputs as ways to spark new studies. In this panel, we will explore several examples of university/nonprofit partnerships. We will discuss backbone organizations and professional networks that have grown to support such collaborations through the development and documentation of effective principles and practices. The discussion will build on insights shared in the NSS April 2024 webinar, available here: https://www.nationalsustainabilitysociety.org/webinars.

Community Science in Cumulative Impacts Analysis
Speakers: Eri Saikawa, Amanda Fencl (She/They), Alexa Dietrich ; Speaker and Chair: Samuel Kay

This panel will present and discuss recent methodological and theoretical challenges and developments that speak to the intersection of community science and cumulative analysis. Through lived experience and other forms of knowledge, communities have a unique and important understanding of the issues they face that is as vital to cumulative impacts analysis as scientific expertise (and these as not mutually exclusive, as communities facing environmental injustices have repeatedly demonstrated through driving

and conducting rigorous research.) It is clear that community science (often used interchangeably with or alongside participatory science or “citizen” science) has an integral role to play in advancing societal understanding of cumulative impacts. The past few years have seen a broadening and deepening of efforts in the policy world to characterize and address the cumulative impacts that people and communities face and that drive disproportionality in human health and environmental outcomes. By drawing attention to a wide array of social determinants of health among the totality of chemical and non-chemical stressors that together drive uneven outcomes, the framework of cumulative impacts raises new theoretical and methodological questions and challenges. This panel will consider: how to address combinations of multiple and different types of stressors in analyses, how to incorporate lived experience and quality of life, how to best leverage place-based research within large-scale decision contexts, and what qualitative, mixed-methods, and community science can all contribute to cumulative analyses.

Learner-to-Learner: Enterprise-Based Sustainability Education
Speakers: April Furin, Laura McGeary ; Speaker and Chair: Janna Goebel

This panel will showcase the transformative potential of collaboration between academia and industry through the case of an Enterprise-based Sustainability Education online course offered at Arizona State University (ASU). The course began in Spring 2022 and has served nearly 100 students through partnerships with enterprises from 5,000 – 60,000 employees. This learner-to-learner panel session focuses on workforce development across topical areas. In Fall 2023, Swire Coca-Cola (Swire) and ASU teamed up to offer students a real-world consulting experience in lifelong learning. A total of 21 students worked in 6 groups to generate sustainability education course materials for the Swire Sustainability team. Since this collaboration, Swire has launched a 5-module training course for its employees to understand their role in fostering more sustainable and equitable futures in their professional and personal lives. The panel will begin with an overview of the Enterprise-based Sustainability Education course. The course creator, Dr. Janna Goebel, will explain the background, vision, and mission of this course as well as the pedagogical approach to facilitating meaningful experiences for both students and industry partners. She will explain the importance of real-world educational experiences as key tools for workforce development in higher education sustainability courses. Following this overview, April Furin, Sustainability Manager at Swire Coca-Cola, will share her insights as a business partner for this course. She will speak to the importance of generating diverse perspectives of what an executive sustainability program is and share what contributed to the successful implementation of their resulting sustainability training at Swire. This collaboration allowed students to take a company's brand and create a bespoke product for their industry partner. At Swire, the resulting product is a first-of-its kind sustainability training which has already reached more than 1,500 learners since its launch in early May 2024. s a student participant in Enterprise-based Sustainability Education, Laura McGeary, who is pursuing a master's degree in sustainability solutions at ASU, will elaborate on the skills she gained through the collaboration as well as her hopes for the next generation of sustainability leaders as a rising leader in sustainability herself. The panel will conclude with comments from a Swire employee who completed the training course to illustrate the user experience made possible by this unique collaboration between academia and industry. Connecting university learners to learners in the workforce creates valuable opportunities for collaboration and reflection on what is needed to foster safer, more sustainable futures, together.

Are we Ready? Competencies for Between Times
Speakers: Vivian Forssman, Adam Lerner

This panel responds to the Workforce Development theme, by convening experts from diverse fields to challenge prevailing assumptions and orientations regarding the competencies necessary for navigating an era of polycrises and profound complexity. In these "between times" it is imperative to re-evaluate our approaches to competency modeling and education. Traditional competency models and workforce development approaches, while striving to envision a future, are characterized by both a tendency to deny the unsustainability of current cultural paradigms and an urgent call to recognize the magnitude of the challenges before us. The resultant models and approaches often inadvertently perpetuate existing norms and fail to fully acknowledge the pressing need for adaptation and evolution in the face of super wicked problems. How can we embrace uncertainty while still charting a course towards a horizon shaped by emergent cultures and sustainable practices? Dr. Robin Cox, is the Director of the Resilience by Design Lab at Royal Roads University. She will share insights from a comprehensive multi-year research endeavor aimed at identifying and exploring how to address the gaps in workforce upskilling to effectively respond to the imperatives of climate change and the transitions necessary for a sustainable, resilient future. As part of this, she will also share and discuss the potential and the limitations of a competency model designed to facilitate these crucial transitions. Adam Lerner is founder of Solvable, a team who designs and facilitates processes for groups and organizations working towards regenerative and equitable futures in higher education and finance. Adam will share emergent competency models emerging through collaboration

between academic institutions and the private and public sectors. In collaboration with accreditor AACSB, a new model is under development to cultivate societal impact leadership competencies within its global network of over 1,000 business schools. Through a multi-year inquiry with the Wellbeing Project, a set of ecological belonging capacities and practices are emerging to transform universities and organizations. Operational lead and higher educational consultant on many workforce upskilling projects, Vivian Forssman will facilitate this interactive dialogue and community engagement. This panel aims to not only challenge preconceived notions surrounding sustainability competencies but also to foster a collective exploration of innovative approaches for ushering in a more equitable, resilient, and sustainable society. By inviting participants to expand their own thinking and contribute to the ongoing evolution of competency models, we seek to catalyze meaningful action towards a future that is both just and regenerative."

What are Your Favorite Sports Teams Doing to Protect Planet Earth?
Speakers: Roger McClendon, Brandon Hamilton, Brianna Treat ; Chair: Edward Chu

Interested in what the Green Sporting Alliance and two of its members - Seattle Kraken and Kansas City Chiefs - are doing to protect Planet Earth? Attend a distinguished panel of green sports sustainability experts and learn about their career journeys and what the sports and live entertainment industry is doing to combat the climate crisis. Panelists will discuss opportunities and challenges facing the industry as well as the importance of designing and operating venues that optimize energy use, water use, waste minimization and carbon reduction. Panelists will also share their thoughts about the future as the industry is increasingly impacted by the greater frequency and magnitude of natural disasters.

The Future of the Energy Workforce: Identifying and Addressing Gaps in the Clean Energy Workforce
Speakers: Tatiana Bruce da Silva,Philip Jordan, Nikki Luke, Erin Mayfield ; Chair: Kristin Wegner Guilfoyle

The clean energy transition requires an increase of diverse workers across industries and technologies, which presents an unprecedented opportunity to provide workers access to good jobs that contribute to national clean energy goals**.** In 2024, the Department of Energy's Office of Policy contracted the National Renewable Energy Lab (NREL) and a team of researchers to assess the impact of unprecedented policies (IRA, BIL, and CHIPS) on workforce demand and supply projections across all sectors, occupations, and regions across the country. Part of the analysis also explored workforce supply generated from various workforce training programs and conduct a gap analysis between workforce supply and demand. From industrial decarbonization hubs to community-level clean energy systems, there are abundant opportunities to develop the workforce to meet employer workforce needs. In this panel presentation, the research team will present preliminary findings from the study and gather feedback related to the analysis and findings and explore opportunities to fill the gap between workforce supply and demand. Workshop participants will also discuss potential strategies to meet emerging needs related to the clean energy transition, identify specific strategies institutions or regions could develop to meet the needs, and explore regional partnerships to address the gaps between workforce demand and supply. A focus will be on workforce transition opportunities and training opportunities.

AI and Sustainability
Speakers: Eusebio Scornavacca, Travis McCoy, Amy Luers ; Chair: Christopher Boone

Organizations are increasingly engaging AI tools to meet sustainability goals. This panel will discuss how AI is driving organizational success, including increasing resource efficiency and employee productivity, deciphering patterns in large datasets, and fostering innovation for sustainability opportunities. Panelists will discuss how to create a skilled workforce required to effectively use AI for sustainability decision making and practices.

Tools for Utilities to Facilitate Decarbonization
Speakers: Dan Livengood, Jamie Dunckley ; Speaker and Chair: Gregory Rouse

All industries are working to accelerate decarbonization, with many of them electrifying their fleets and processes as a key mechanism, taking advantage of ongoing reductions in the electrical grid's carbon intensity. The energy utilities that maintain and power the grid can be key partners in enabling both company- and economy-wide carbon reduction. With a foundational mission to benefit society, EPRI delivers independent, objective thought leadership and industry expertise to help the energy sector identify issues, technology gaps, and broader needs that can be addressed through effective, collaborative research and development programs. EPRI SMEs can speak to the ongoing efforts, tools, and strategies at play within the energy industry that support decarbonization initiatives, innovation in sustainability, and implementation of emerging technologies. Greg Rouse (moderator and panelist) leads the Energy Sustainability Interest Group, the largest collaborative research group focused on sustainability in the

energy industry, with over 35 energy utility members across North America. This group conducts research and develops tools to support the development and enhancement of utility sustainability programs. Deep technical expertise at EPRI, covering the energy sector's value chain, further supports much of this sustainability work. Panelist Dan Livengood conducts technical research in energy supply and demand. He currently focuses on R&D in two areas: 24/7 Carbon-Free Energy, which explores hourly matching of clean energy to load rather than the more common method of annual energy consumption to renewable generation, and Energy Storage Systems, which could be key enablers of reliability and resilience in future electric grids with high levels of renewable energy. Panelist Jamie Dunckley is a Program Manager for Electric Transportation and a lead for EPRI's EV2Scale initiative. Jamie and her team have created a first-of-its-kind interactive map called the eRoadMap. This interactive energy map presents the approximate amount of energy needed at a local level to electrify transportation over time for light, medium, and heavy-duty electric vehicles. Please let us know if there are additional topics in the energy space that you believe would be beneficial to add to this conversation and we would be glad to work to incorporate them.

Research to Policy: National Academies Sustainability Roundtable
Speakers: Shefali Mehta, Marilu Hastings, Jeff Martin ; Chair: Franklin Carrero-Martinez, Emi Kameyama

Established in 2002, the National Academies of Sciences, Engineering, and Medicine’s Roundtable on Science and Technology for Sustainability represents one element of robust sustainability activities within the National Academies. The Roundtable draws on the expertise of leaders from research institutions as well as senior decision-makers from government and industry who deal with issues of sustainable development, and who are in a position to mobilize new strategies and resources for sustainability. The Roundtable works to provide a high-level forum for sharing views, information, and analyses related to harnessing science and technology for sustainability. The goal of the Roundtable is to mobilize, encourage, and use scientific knowledge and technology to help achieve sustainability goals and to support the implementation of sustainability practices. During the pre-organized panel, speakers will briefly present an overview of the Sustainability Roundtable, including its approaches to sustainability and recent accomplishments. Presentations will focus on perspectives from industry, academia, and nongovernmental organizations, including key messages from the National Academies 2020 report, Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels and opportunities for engagement with the Sustainable Development Goals. The specific topics to be highlighted during the session, among others, include the need for holistic workforce development for sustainability professionals relating to the National Sustainability Conference’s key focus areas. Sustainability professionals could be immersed in the dynamic facets of their field, cultivating enthusiasm, and a profound engagement with the diverse challenges and innovations encompassed in sustainability practices across ecological, societal, and other domains. In addition to sharing the Roundtable’s key accomplishments, this proposed session will include an interactive discussion among the speakers and participants to discuss possible strategies to engage youth, civil society, and local governments and foster partnerships between sectors, regions, and nations in addressing sustainability. The goal of this session is to reach diverse and influential audiences that cross all sectors to ensure that the audience to be inspired by the Roundtable’s work, in addition to identifying long-term science and technology strategy for sustainability. Intended audiences will include policymakers, researchers, practitioners, civil society, educators, business and philanthropic leaders, students, and other stakeholders involved in their efforts toward sustainable development.

Case Study: Using Academia and Sustainable Open Innovation
Speakers: George Basile, Satoshi Shimono, Stormy Light ; Speaker and Chair: April Deckert

Making progress on global sustainability challenges within global business requires a wide variety of coordinated technologies and actions and reframing sustainability as a strategic decision making and innovation opportunity. A single organization is often not able to make such transformative change by itself. Is it therefore possible for an academic institution to simultaneously transform a corporate sustainability innovation culture and help people and the planet through workforce education? The Global KAITEKI Center (TGKC) at Arizona State University (ASU) was established as a collaboration between ASU and Mitsubishi Chemical Group (MCG) to explore how this type of joint engagement could succeed. TGKC focuses on combining natural and social sciences, integrating academics and corporations, and scaling from local to global. TGKC is endeavoring, in part, to transform the workforce through focusing on re-skilling company employees and providing education in three unique modalities: individual learning for sustainable open innovation; workshops for teams developing market-informed sustainable innovation; developing a Sustainable Innovation Academy. Within Japan-based MCG, a unique culture of sustainability and open innovation has been steadily taking root and growing since the terms were defined. However, challenges have arisen. Indeed, sometimes organizations have difficulty thinking beyond short-term profit

maximization. Organizations may feel they have no choice but to retrench or become temporarily less sustainable. We will share our case lesson on how these seemingly irresistible dynamics can be mitigated and even reversed through workforce empowerment and engagement.

From Strategy to Action: King County's Green Jobs Movement
Speakers: Michael Carter, Rebeca Rivera

As the nation implements the historic Inflation Reduction Act (IRA), there is an opportunity to ensure that public dollars on the state and federal levels make a tangible economic impact in communities most impacted by climate change. King County, home to Seattle, has over two million residents and is committed to leading and implementing in addressing climate change. Join staff from King County Metro and the King County Executive Climate Office for an enlightening session on the development of our county's first Green Jobs strategy. The King County Green Jobs Strategy's mission centers on connecting frontline communities to living wage opportunities to build a diverse and skilled workforce. The Green Jobs Strategy goals include: (1) Partner regionally to grow green jobs through climate initiatives. King County will integrate scalable high-road workforce development into clean energy deployment and County climate initiatives while collaborating with partners to invest in resource networks to increase green jobs regionally; (2) Facilitate a green jobs pipeline for frontline communities. King County will materially support organizations committed to building accessible on-ramps to living wage green careers within frontline communities and lead specialized promotion of green industry sectors catered to frontline communities; (3) Invest in local high-demand industry sectors. King County will focus County resources and partnerships on existing high-growth sectors based on a regional definition of green jobs centered on creating opportunities for frontline communities now and in the future; (4) Support greening the County workforce. King County will develop green career pathways across identified County departments while providing opportunities for the County workforce to obtain energy conservation credentials. This strategy, which has received national recognition for its comprehensive plan, tangible lessons learned, and implementable tactics, offers a unique learning opportunity. Attendees will gain an overview of the community engagement process that shaped this strategy and its main goals and a review of the impactful implementation actions. Attendees will also engage in interactive activities around defining ""Green Jobs"" and receive a take-home toolkit on developing workforce development partnerships connected to clean energy development and conservation.

Harnessing biodiversity for a thriving sustainable future
Speakers: Meghna Tare, Rachel Gallery,Jeannine Cavender-Bares, Franklin Carrero-Martinez

Biodiversity serves as the foundation of life, offering crucial advantages to our societies and economies. Despite its importance, various factors such as changes in land use, excessive exploitation of natural resources, pollution, and climate change are leading to a significant decline in biodiversity. Habitat destruction, resource exploitation, and climate change are among the many stressors that have put 1 million species under threat of extinction and sharply reduced the populations of many plant and animal species. This decline contrasts with the support that biodiversity and ecosystems offer across global, regional, and local levels, including nutrient cycling, habitat creation, pollination, erosion prevention, and climate regulation. Importantly, there is a growing recognition on the global policy agenda of the urgent need to integrate biodiversity and ecosystem services more effectively into all aspects of decision making, as biodiversity underpins many of the 17 Sustainable Development Goals (SDGs). Just as climate change alters habitats and ecosystems, the loss of biodiversity also affects climate change, as many ecosystems are significant carbon sinks. Despite the interconnectedness of climate change and biodiversity, the loss of biodiversity does not receive significant attention, potentially due to its complex nature. This highlights the need to establish easy-to-understand targets and metrics to reverse biodiversity loss.

During this session, the panel will include a diversity of speakers from academia, non-governmental organizations, and industry or for-profit organizations. The panel session will: • Examine the impacts of biodiversity loss and its intersection with other Sustainable Development Goals, such as climate action. • Discuss potential innovative technological and data solutions that can help understand, monitor, and preserve biodiversity.• Explore nature-based solutions as tools to address both climate and biodiversity crises and how to achieve a sustainable, diverse, equitable workforce skilled in building nature-based solutions.• Discuss effective strategies to mainstream biodiversity, ensuring its inclusion and consideration into plans, strategies, and policies of key economic sectors.

Moderated by Franklin Carrero-Martinez, the panel features experts in biodiversity, education, technology, and climate who will discuss the importance of protecting biodiversity, its intersection with specific sustainable development goals, policies needed to develop and secure the future workforce, and new innovative tools and technologies. They will also explore how biodiversity and sustainability play a role in

their organizations. The goal of the session is to reach diverse and influential audiences across all sectors, highlighting the importance of protecting and restoring biodiversity in key strategic economic sectors, nationally and internationally.

Examining Regime Resistance to Sustainability Transitions
Speakers: Yiheyis Taddele Maru, Peat Leith, Edward Carr ; Speaker and Chair: Monica Contestabile

The sustainability literature emphasizes the urgent need for rapid and effective transformations of social-ecological systems to deliver more just, sustainable, and resilient futures. However, research, discourses, and policies have largely focused on new opportunities, technologies, innovation, and niche activities as enablers of transformations. Less attention has been paid to the incumbency and resistance of the existing regime, which hinders efforts toward the sustainability transition and the associated transformational change. Although appealing, a focus on innovation only is insufficient. It needs to be complemented by understanding the path dependency, lock-in, and the traps in existing and historical power, knowledge, institutional and infrastructure arrangements, and how these can be shifted successfully to set societies on more sustainable paths. The diverse drivers of resistance and incumbency across sectors, systems, scales, and contexts are poorly understood. Jointly with the journal Nature Sustainability, Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) has convened a Panel of international experts (researchers, practitioners, and policy advisers) to develop ways to examine and address these forms of resistance and incumbency, with particular attention to the agri-food, energy and automobility systems. In the session we propose, members of the Nature Sustainability-CSIRO Panel will briefly outline a systems approach to examining incumbency/ resistance and discuss levers for reorientation and change focusing on the agri-food system, based on three broad questions:
1. What are the unique features of agri-food systems that make sustainability transition/transformation challenging?
2. What have we learned so far on potential levers for just and resilient sustainability transition/transformation in the agri-food system?
3. How does a systems approach to agri-food regime resistance complement the current focus on niche innovation for sustainability transitions?
In this session, panelists will share progress to date of the Nature Sustainability-CSIRO Panel and open the floor to reflect more widely on the implications of the preliminary findings presented and where they might lead to in terms of recommendations to accelerate and scale sustainability transition and transformation in agri-food and other systems.

Leveraging Local Government: Lessons from King County's Sustainability and Climate Leadership
Speakers: Marissa Aho, Lara Whitely Binder, Michael Carter, Carrie Lee, Vicky Raya ; Chair: Bradley Kramer

Local governments are crucial partners in sustainability. Your host region, King County, has more than 20 years of establishing climate plans through innovative sustainability action and policies, setting national precedents. Whether your local government has a structured action plan, or not, there are government allies in your region that can assist with your sustainability work. Local government can bridge the gap to implementation, fostering meaningful connections and leverage resources. Learn from King County leadership about how to engage effectively to meet your sustainability goals. This panel will feature five senior managers leading efforts defined by the county's Strategic Climate Action Plan focused on greenhouse gas reduction, preparedness, frontline community resilience, green jobs, and public health. Each panelist will provide a lightning talk on how they work across sectors with community partners, highlighting key strategies, goals, and outcomes. Examples highlighted will include the King County-Cities Climate Collaboration, Puget Sound Climate Preparedness Collaborative, Climate Equity Community Task Force, Coalition for Climate Careers, and the Climate & Health Equity Initiative at Public Health. Our climate office Director will facilitate a lively discussion, including questions from the audience. Attendees can expect to gain insights on the benefits and practical steps to engage local government in their own work. By sharing best practices in sustainability, climate, and building community resilience, this panel aims to inspire attendees to take bold action in their home communities. In addition, the panel will share their engagement approach with frontline communities that guides our climate work and strategic planning. For frontline communities, the term sustainability has not always reflected the ways in which Black, Indigenous, people of color, immigrant, refugee, and communities with low incomes already implement sustainable practices. Nor has it reflected the ways in which these same communities often face systemic barriers to sustainable practices connected to historic disinvestments in housing quality, food access, transportation access, and other root causes. Local government and its partners can support these communities in building resilience through addressing a broad array of conditions that can enhance self-determination and sustainability.

Research Frontiers for Industrial Decarbonization
Speakers: Adam Warren, Sridhar Seetharaman ; Speaker and Chair: Benjamin Sovacool

Decarbonizing industry represents a complex, daunting technical challenge. The industrial sector provides critical products such as electronics, machinery, metals, chemicals, and textiles, but is technically "difficult to decarbonize" because of the diversity of fuels and services it harnesses across very heterogenous operations clustered across different types of factories and processes. This framing as a technical challenge lends itself to technical solutions such as advancing early-stage research and development in carbon capture and utilization and hydrogen technologies, improving the energy-efficiency of industrial processing, scaling new prototypes through demonstrations, electrification of heating, and investing in new sources of low-carbon electricity supply (among others). However, this framing obscures many of the nontechnical aspects of the industrial decarbonation challenge, aspects that involve social and even ethical considerations. Communities and workers may see their homes and livelihoods tied to oil and gas production and fossil-fuel consuming industries severely disrupted. Whether and how these industries decide to comply with government climate policies and public pressures to phase-out fossil fuels has the potential to transform the cultural, economic and political landscape. These nontechnical elements to industrial decarbonization are explored in this presentation, along with conceptual frameworks focusing on justice (such as Just Transitions) and accelerated low-carbon transitions as a topic.

Applied Sustainable Projects to Enhance Community Impacts
Speakers: Julia Davis, Alison Almand, Christopher Boone ; Speaker and Chair: Anne Reichman

Decisions made regarding land use, transportation, water, economic development, and social services have enormous long-term impacts on the future of sustainability for communities locally and globally. These issues are particularly challenging for cities and local communities, needing more capacity, expertise, and resources to promote sustainability policies and practices using evidence-based approaches. In Maricopa County, one of the fastest-growing counties in the United States, local communities face challenges related to extreme heat, water conservation, and weakening infrastructure. Nonetheless, they are also in an ideal position to confront these issues head-on, offering solutions to cities worldwide, particularly in arid regions. Arizona State University's (ASU) diverse, transdisciplinary community of scholars and students has enabled it to co-develop diverse partnerships with local communities to address their most complex problems through use-inspired research and community-embedded solutions. One such initiative is a city-university collaborative platform that leverages the capacity of student research and applied work to fulfill the needs of the communities. Designed 12 years ago by ASU's Sustainable Cities Network (SCN), an initiative focused on connecting communities while advancing sustainability and solutions, it identified an opportunity to connect cities and local communities with students eager to advance urban sustainability practices. The Network has invited Arizona communities to participate in sustainability projects through co-produced and co-designed classes such as the Urban Sustainability Best Practices Application course, a workshop course designed for the upper division undergraduate and graduate level that fuses disciplines across the university through student-driven projects. Through this course, students collaborated directly with city and organization stakeholders to research, design, and recommend solutions to pressing challenges, an essential aspect of project-based learning. Since 2014, over 30 projects involving 70+ students have been completed as part of the course, covering sustainability themes in energy, water, waste management, urban forestry, food systems, transportation, and health in arid and semi-arid environments. This model has scaled to a second, more expansive SCN platform, ASU's Project Cities, and involves upwards of 200 multi-disciplinary students per year in courses from all sectors of campus. A panel of ASU faculty and staff will discuss project-based learning between the university, community leaders, and practitioners and the "win-win-win" nature of the courses' partnership model, which has since evolved into ASU's award-winning Project Cities program. Join us to learn more about lessons learned over the 12 years of facilitated, student-led, project-based learning experiences to build more sustainable and resilient communities.

Weaving Indigenous and Western Knowledge Systems in STEM for Sustainability Education
Speakers: Miku Lenentine, Lomani Rova, Summer Wilkie ; Chair: Krista Hiser

In the swiftly evolving field of sustainability, the integration of STEM disciplines with Indigenous knowledge practices offers a promising frontier for innovative education and resilience building. This panel will explore practical applications and methodologies that weave these diverse perspectives into a cohesive educational strategy. The session aims to highlight effective ways to blend scientific inquiry with traditional ecological knowledge, creating a more holistic approach to learning and problem-solving in the context of sustainability with a special focus on lifting up the voices of Indigenous student leaders, women and community partners in this work.

The Power of Experiential Learning and Immersive Experiences in Sustainability Workforce Development
Speakers: Timothy Billo, Patrick Sean McDonald, Kristi Straus, Yen-Chu Weng, Eli Wheat ; Speaker and Chair: Lubna Alzaroo

Experiential learning and immersive experiences support sustainability workforce development by providing practical, hands-on opportunities for skill development and problem-solving. Through simulations and real-world projects, students enhance their critical thinking abilities and collaboration skills, mirroring workplace dynamics. These experiences increase retention of information by fostering adaptability, resilience, and motivation among learners. Immersive learning environments bridge the gap between theory and practice and empower individuals to explore career paths while gaining confidence in their professional abilities. This panel session will be an active discussion between faculty teaching Environmental Studies at the University of Washington (UW) about different ways we engage students in experiential learning and immersive experiences to support workforce development. Our curriculum prepares students with interdisciplinary skills and perspectives to address socio-environmental topics, among which food systems, climate and carbon, biodiversity, environmental justice, and sustainability and resilience are the core interests. Experiential learning and immersive components are central to our pedagogical approach. In this session we will share how this helps nurture a new generation of environmental leaders. Students in Environmental Studies have opportunities to learn about farming and food systems while working at the UW Farm, learn about a broad range of issues impacting Seattle communities while contributing to solutions through community-engaged learning in large introductory courses to smaller upper division course, study natural and cultural history in Seattle and around the Puget Sound region, and study abroad in locations as diverse as Morocco, Taiwan, Peru, and Costa Rica. In addition, all Environmental Studies majors do experiential capstone internships and research projects with the goal of developing solutions and gaining broadly applicable skills and insights. By grounding and contextualizing course content in experiential learning and immersive experiences throughout the curriculum, instructors support students in gaining transferable skills and expertise relevant in a variety of career fields.

Capacity Building for Sustainable Development: Challenges and Opportunities
Speaker: Mary Ruckelshaus ; Speaker and Chair: Alicia Harley

What capacity building is most needed for the effective pursuit of sustainability? A fundamental question for advocates of sustainable development is how to connect the normative goals of sustainability with the scientific understanding of the multiple intertwined crises– climate, pandemics, extinction, inequity–currently facing the Anthropocene. Our panel will begin from the premise that our ability to effectively pursue the goals of sustainability rests on the strategic capacity of actors to collectively pursue sustainability in the face of deep uncertainty. These strategic capacities include: i) the capacity to promote equity; ii) the capacity to measure progress; iii) the capacity to adapt to shocks and surprises; iv) the capacity to transform unsustainable development pathways; v) the capacity to govern cooperatively; and vi) the capacity to link knowledge with action for sustainable development (Clark & Harley, 2020). The panel will focus on the difficult task of building and maintaining these capacities in practice. The proposed panelists were selected for their long-standing commitment to bridging sustainability research with practice as well as their deep expertise working on a variety of challenges central to sustainable development. Chhatre focuses on the intertwined challenge of improving rural livelihoods while conserving the natural resource base upon which those livelihoods depend. Jepson focuses on water security and the challenges of collectively managing shared water resources. Mukherji focuses on rural water systems and the challenge of adapting to climate change while improving the well-being of vulnerable communities. Ruckelshaus focuses on the contribution of ecosystems and other natural resources to human well-being and the challenges of managing those resources in ways that improve access and protect long-term sustainability. Harley will moderate the panel with the goal of connecting the expertise of panelists to the six-capacity framework. The panelists will reflect on recent capacity-building initiatives in their areas of expertise that have advanced the pursuit of sustainability. They will address: i) why the capacity-building initiative succeeded ii) which of the six capacities identified in the literature were instrumental in the success of capacity-building initiative? iii) and finally more broadly which persistent weaknesses most inhibit further capacity building in their area of expertise. We hope that this panel will provide an opportunity for broader discussion by NSS participants on opportunities and challenges for capacity building for sustainable development. We offer the six-capacity framework as a potentially useful heuristic for scholars and practitioners to frame their thinking around capacity building for the pursuit of sustainability.

Preparing the Workforce: Justice, Equity, Diversity, & Inclusion in Sustainability Higher Education
Speakers: Arun Agrawal, Anne Kapuscinski, Christopher Boone ; Speaker and Chair: Garrick Louis

Sustainability challenges, such as climate change and food insecurity, exist at local, national, and global scales. People have different vulnerabilities to these challenges within each of those scales, depending on systemic racism impacts, their socioeconomic status, and other demographic characteristics. Effectively addressing sustainability challenges requires a workforce with a range of technical, interpersonal, and socio-cultural competences that allows them to work fluently on the diverse and collaborative teams needed to implement sustainable change [1]. Diversity, equity, and inclusion have been acknowledged as important competencies in sustainability higher education. However, the broader context of social justice has not received comparable, explicit acknowledgment. This panel will revisit the 2020 NASEM report, Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels [2] to focus on social justice and its implications for curricula, content, pedagogy, and practice in training the sustainability workforce. The panel will consist of the authors listed above, with Garrick Louis serving as the facilitator. The panel will begin with a summary of the 2020 NASEM Report by Garrick Louis. Anne Kapuscinski will review literature on Justice, Equity, Diversity, and Inclusion (JEDI) in sustainability higher education. Arun Agarwal will discuss linkages between sustainability competences and the workforce. Chris Boone will then discuss sustainability curricula and training in higher education. The panelists will address the status of social justice integration in sustainability higher education, then open to facilitated discussion with the audience. The panel will end with thoughts on the next steps by each panelist. This panel will build on the 2020 NASEM report by providing insights into the importance of JEDI in sustainability higher education, efforts to incorporate JEDI into training the next generation of the sustainability workforce, roles of industry, government, and civil society organizations in that training, and questions on how this training can be linked to specific sustainability challenges at the local, national, and global levels.

Partners in Progress: University-Industry Collaborations, Boundary Orgs for Sustainable Solutions
Speakers: Patrick Beary, Jessica Hellmann, Dave White ; Chair: Ben Packard

Boundary organizations play a critical role bridging the gap between academia and the private sector, public policy makers, tribes, NGO's and community organizations among others. Institutions such as Cornell's Atkinson Center, the Institute on the Environment at the University of Minnesota, the Global Institute for Sustainability and Innovation at ASU, and EarthLab at the University of Washington are models of advancing transdisciplinary collaborations. These organizations facilitate projects that integrate academic research with practical applications, driving innovative solutions to sustainability challenges. The session will specifically examine how different models of interdisciplinary collaborations with corporations translate academic research into real-world impacts and real-world questions into academic research. Panelists will share insights from their experiences, highlighting 3 successful partnerships and the mechanisms that supported their achievements. In this session we will specifically examine whether and how partnerships between academia and corporations close the implementation gap and drive innovation. We will explore three different academic/corporate collaborations- Cornell Atkinson's initiatives with NGOs and corporates on dairy sustainability and livestock methane, the University of Minnesota's efforts with EcoLab to mobilize a region to achieve ambitious climate goals and the Arizona State University's wide-ranging partnership with Starbucks Coffee Company. This discussion will explore when and how these different collaborations drive meaningful change. Additionally, the session will critically address situations where academic institutions may inadvertently hinder progress or fail to add substantial value. Panelists from these institutions, along with their partners from the private sector and NGOs, will share their experiences, challenges, and lessons learned, providing a balanced perspective on both the successes and limitations of these engagements.

Future of Sustainability and Transformative Change
Speakers: William Clark, Nancy Grimm, Billie Turner ; Speaker and Chair: Arun Agrawal

SPARK SESSIONS

NetZero Procurement: Leveraging supply chains to truly impact climate change
Speaker: Marc Heisterkamp

For most organizations, over 90% of greenhouse gas emissions impact comes from supply chains. Yet, most climate commitments and timelines only address direct impacts and are silent on Scope 3 emissions and supply chain challenges. Engaging, empowering and inspiring procurement teams and end users to deliver on NetZero procurement is critical to an organization's ability to reach its climate and sustainability goals. It's also how purchasing power can be leveraged to reward successful companies and spark progress

with lagging companies. But, how is this most effectively and efficiently done? How do we prioritize amongst the complexity of supply chains and stakeholder ecosystems? Who is leading in this critical work? How can we support and define success? Join us to engage in moving the sustainable procurement movement forward.

Maximizing the Impact of Sustainability Research
Speaker: Benjamin Sovacool

Researchers today need to secure funding, collaborate, share data, publish results, commercialize research, and demonstrate impact. Early career researchers in particular are faced with multiple pressures around these challenges. This workshop will help scholars, especially early career researchers, gain an understanding of how to design their research more effectively, and how to improve your chances to get your work published. Using examples from the energy and climate social sciences field, it will bring attention to the importance of clearly articulating research questions, objectives, and designs. It will provide a framework for conceptualizing novelty. It will suggest codes of practice to improve the quality and rigor of research. It will provide guidelines for improving the style and communication of results. It will lastly discuss what academic (and non-academic) impact are and propose ways to enhance it. In doing so, the presentation will give you first-hand insights into successful research methodologies, what journal editors (and reviewers) look for, as well as advice on how to successfully promote your work.

Beyond the Resume: Essential Skills for Sustainability Job Seekers
Speaker: Mary McGillicuddy

The demand for 'green' skills may be on the rise, but the competition for sustainability jobs is fierce, especially for early career and "pivoting" professionals. This session will facilitate discussion on the current challenges sustainability job searchers face, along with strategies and tools to overcome them (hint: it includes networking). Attendees will walk away with a list of crowd-sourced resources to support their career exploration and job search. While this session is geared toward students and early-career professionals, practitioners at any career stage are welcome to join the conversation!

ESG as the Catalyst for Innovation
Speaker: Kelly Burton

The goal of this session is to prompt the academic community and/or the learning and development departments within organizations to view ESG as a catalyst for innovation and to prepare for the 21st century business landscape. Workforce transformation requires more than just ticking boxes on ESG and regulatory requirements. It requires the next level of strategy and innovation, creating products and offerings that sidestep risk in the supply chain or developing new replacements to enable companies to find opportunities and thrive in a changing world. This presentation is suitable for academic institutions or businesses with adult learners, graduate and undergraduate students, entrepreneurs and business leaders who are seeking to explore the full potential of ESG as a driver for innovation. In this spark session, Kelly and Maggie will outline ideas and opportunities to leverage ESG to build climate resilient organizations. Leveraging 30+ years of practical experience in sustainability across law, technology, academia, and consumer products, this session will provide a unique perspective on workforce transformation."

Design|Sustainability: Mapping Environmental Design Studies
Speaker: Julie Johnson

As built environment designers play significant roles in shaping communities, landscapes, and structures, students in these fields seek to become fluent in sustainability-driven goals, processes, materials and outcomes. What essential knowledge, skills, and mindsets are needed to guide their future practice in public, private, and non-profit organizations? And, amidst accelerating climate disruptions, how do they navigate emerging urban challenges? To advance a sustainable and equitable future, we envision designers who know what questions to ask, how to engage and collaborate among diverse stakeholders, and how to creatively visualize and facilitate next steps. Their polices, planning, designs, and built work will provide models for achieving climate justice in synergy with myriad facets of sustainability. This Sustainability Spark Session engages participants in identifying essential interdisciplinary knowledge, skills, issues, and approaches for students learning sustainable environmental design. Session presenters will introduce a new environmental design & sustainability program as a case study to initiate themes for small-group conversations. Group ideas, proposals, challenges, and precedents will be mapped through interactive diagramming to share and discuss with all participants. These outcomes are anticipated to inform refinement of this case study degree program, advance shared insights on pedagogical directions, and inspire continued dialogue among educators.

Best Practices for Researcher-Community Co-developed Microgrids
Speaker: Sharon Klein

STORM (Data-Driven Approaches for Secure Electric Grids in Communities Disproportionately Impacted by Climate Change) is a collaboration between researchers and community partners in Maine, Alaska, Puerto Rico, and North Dakota to co-develop microgrid design with communities disproportionately impacted by climate change. This work involves challenges at all levels: engaging with communities that often have very little capacity on a multi-year project with very technical ideas and applications; working with engineers and other technically-minded researchers to navigate what we are realistically able to offer to communities; developing research-generated ideas and designs to be realistic in the context of electric utility, local and tribal government constraints and policies. Who else is doing this work, or some part of it? We would love to share our experiences and learn from you. Sample discussion prompts: 1) how are people collaborating with disadvantaged communities on microgrids or elements of microgrids (e.g., solar & batteries, Smartgrid solutions, etc.)? 2) what are researchers offering to disadvantaged communities to help them identify, develop, and implement microgrid solutions? 3) how are researchers able to see a community-led microgrid project through from beginning to end – when is the end? Session leader: Sharon Klein; Moderator: Louise Chaplin.

Next Level Frameworks in Sustainability Education: Personal, Place-Based, and Planetary— A Holistic
Speaker: Miku Lenentine

In the face of pressing global challenges, effective sustainability education must encompass a broad spectrum of themes, including food security, water resource management, energy sustainability, equity, social justice, biodiversity, technology, planetary boundaries, climate impacts, carbon management, and now, local-level disaster planning and preparedness. Moreover, sustainability education should also support the development of personal resilience in the face of an increasingly uncertain future. Do sustainability and climate educators need to address all these elements to effectively prepare the next generation of leaders? I offer a resounding yes! This session introduces a holistic framework that integrates Social Ecological Systems, emphasizing place-based learning, personal and community-level preparedness, and the values embodied in Indigenous Knowledge Systems—specifically, Aloha Aina. I will kick off the session by sharing innovative methodologies from our Resilience Corps Leadership Award Program at Kapi'olani Community College, which focuses on resilience hubs planning and the incorporation of local values to enhance community and ecological resilience within the broader context of planetary boundaries and efforts taking place globally. This introduction will weave the way for a dynamic, participatory discussion, inviting attendees to share their experiences and strategies for embedding these complex sustainability concepts into educational frameworks across diverse contexts.

Start Social: Discussion Guide for Transdisciplinary Collabs
Speakers: Alder Keleman Saxena, M. Jahi Johnson-Chappell, Jennifer Lee Johnson

Most sustainability issues are also social issues - a fact increasingly recognized by funding agencies' requirements that interdisciplinary, team-based research should include social scientists. In practice, however, such interdisciplinary collaborations can be challenging, due not only to differences in methods and epistemology, but also differing incentive structures, distributions of workload, and expected timelines for research results. This "spark session" explores discussion prompts to guide conversations about potential - or ongoing - transdisciplinary partnerships. Topics include:
1) Research questions: where and how are research questions developed, and how flexible are they after research has begun?
2) Timelines: What are the most time-consuming parts of research, and how should these be planned into team-based projects?
3) Relationships: How important is relationship-building for a project, either within the research team, or with community partners?
4) Incentives: What are time, funding, and tenure-and-promotion expectations from participating researchers' home departments, or home institutions?
The session will be co-led and co-moderated by three social scientists with experience in interdisciplinary research and community-engaged practice. Structured as a participatory discussion in small groups, the session will ask audiences to brainstorm responses to guiding questions, and share from their own experiences.

Accreditation for Sustainability and Sustainability-Related Degrees
Speakers: Krista Hiser, Cindy Cooper, Cindy Anderson

Accreditation is a lever for innovation in higher education that improves sustainability education, increases visibility of programs, expands access to a wider diversity of students, communities, and institutions. In this conversational ""double spark"" session, educators, employers, practitioners, students, and alumni can inform and support efforts to infuse sustainability into existing disciplinary majors and degrees through frameworks related to accreditation. Part 1: Pathways towards Accreditation for Sustainability and Sustainability Related degrees: Program Director Krista Hiser shares updates going into a third year of stakeholder input to develop program-level outcomes related to the Key Competencies in Sustainablity along with best practices for degree and certificate programs. What are the pros and cons of program-level accreditation for sustainability? Part 2: Engineering for One Planet: Cindy Cooper and Cindy Anderson share lessons learned from mapping the Engineering for One Planet framework to the Accreditation Board for Engineering and Technology (ABET), and how EOP works with ABET to support faculty and ensure that engineering graduates have sustainability literacy.

Suquamish Tribe and Sustainability
Speaker: Leonard Forsman ; Speaker and Chair: Edward Chu

Join us for a conversation with Honorable Leonard Forsman on a wide range of environmental issues affecting the Suquamish Tribe and the greater Puget Sound area. Our discussion will include the Suquamish history, ecological knowledge, treaty rights, salmon habitat protection, water quality protection, conservation and sustainability in the Puget Sound and climate solutions.

Staying with the Trouble': Environmental Literature and other Stories for Sustainability
Speaker: Arlene Plevin

Do sustainability professionals talk about futures with specifics that can be touched, heard, imagined as real? Do they understand how story can enable communication, propel progress? Does their background include the environmental humanities, which can bridge disparate disciplines and worlds, enabling invention and the presence of many voices? In Donna Haraway's ""Staying with the Trouble: Making Kin in the Chthulucene,"" she is among all species while arguing for being ""truly present"" in the ""messiness"" of all things. It is a call for collaboration and connection--of being in the possibility of new stories and making them. Her perspective, along with literature that embodies the environmental humanities, is what this Sustainable Spark session focuses on. This session will introduce Haraway and literature that can enable all in sustainability work to co-create and to discuss and imagine different futures. Two prompts would include:
1) What tools do you see environmental literature (writers such as Amitav Ghosh, Terry Tempest Williams) providing as a way to envision sustainable ways of living?
2) What monograph, short story, or novel would you want your organization or class to engage with that could enable invention and new ways of envisioning a sustainable life and community?

Do our Relationships Determine our Future? Let's Chat.
Speaker: Laura McGeary

Sustainability professionals are encouraged to focus intently on building a great network to help them land their sustainability roles. But does the value of our networks end there? Certainly not. With intergenerational justice a central aspect of sustainability, surely there is limitless potential for the change we can drive through our relationships. This spark session invites students, early career professionals, and leaders in sustainability spaces to come together to reflect on and imagine how relationships can drive meaningful change.

Communicating in the Public Interest
Speaker: Julie Hanus (she/her)

Traditional strategic communications programs seek to advance organizational goals. Public interest communications (PIC) is an emerging field of practice that leverages the science and approaches of strategic communications in service of outcomes that transcend the interests of any one person or organization. The opportunity to creatively integrate PIC in the context of sustainability research and practice is clear. Communications initiatives that seek to serve a public good – strategically driving change in attitudes, beliefs, and behaviors – are essential in closing implementation gaps and advancing a science-based, sustainable future. Join Julie Hanus, director of public interest communications at the

University of Minnesota's Institute on the Environment, for a lively spark session about PIC and the possibilities for your work or organization. All are welcome. Our session set-up will cover what PIC is; place it in the landscape of strategic and science communication more broadly; and present frameworks for exploring it in the context of sustainability research and practice. Our group discussion will touch on topics including: How might a public-interest perspective change or enhance your approach to communications? Who defines "public benefit" – and what are the implications for ethical practice? And: How might we collaborate in this emerging field?"

FLASH TALKS

Human Heath, Wellbeing, and Climate Justice Flash Talks

An environmental study of the Bruce Brook flooding in Connecticut
Speaker: Andreina Barajas Novoa

The goal of this study is to understand the case of flooding and pollution of the Bruce Brook from an environmental justice lens. In this study, I show how the downstream area of the Bruce Brook, a designated Connecticut DEEP environmental justice community with at least 76 percent minority residents and at least 32 percent of them living below 200 percent of the federal poverty level (CT DEEP, 2023), is a classic case of environmental injustice. In this study I analyze environmental injustice in Stratford, Connecticut through historical research data and perform content analysis of government documents, newspaper articles, and oral histories. I apply Critical Environmental Justice studies, environmental colonialism, and procedural justice frameworks to aid my understanding of environmental injustice in Stratford. I interviewed six residents whose homes and livelihoods have been directly affected by the Bruce Brook flooding and pollution. My research questions are to better understand: (1)How communities express environmental concerns in their neighborhood? (2) How people react to and understand flooding and pollution in their neighborhoods? (3) How people use their relationships with elected officials and other community members to mobilize? The findings of the interviews were categorized into the following themes: fear, health, property, and politics. The interviews with residents demonstrated how a lack of procedural justice has left residents feeling alienated. Residents described having low levels of trust with local elected officials and described feeling like second-class citizens. The lack of transparency regarding town projects further alienated residents from being active agents within their own environment.

Spatial patterns of exposure to extreme heat in Ogden, Utah
Speaker: Daniel Bedford

As the climate changes, heat waves are becoming more severe, more frequent, and are lasting longer, and cities have a growing responsibility to develop and implement strategies for mitigating the resulting health impacts on residents. Urban landscape features can amplify or reduce the high temperatures experienced during heat waves. For example, large asphalt parking lots amplify heat; well-watered, tree-filled parks reduce it. In general, these landscape features are not equally dispersed within U.S. cities, with cooler landscapes found in locations with more wealth and fewer racial and ethnic minorities. This poster / flash talk describes an initial effort to measure and map the geography of extreme heat across Ogden, Utah, a city of approximately 87,000 people about 35 miles north of Salt Lake City. Over 50 thermometers were deployed in four sections of the city, recording temperature every hour throughout the summer of 2023. The research was planned loosely in conjunction with Ogden City officials, with the goal of understanding which places and people were most at risk from extreme heat. Initial results suggest that neighborhoods occupied by some of the city's most vulnerable residents also experience the greatest exposure to extreme heat, and that variability within neighborhoods was occasionally high.

Biocultural conservation and the commons: exploring the synergies and tensions
Speakers: Orlene Carlos, Candice Carr Kelman, Lívia Ribeiro Cruz

In the last several years, the importance of indigenous rights and knowledge systems in nature conservation and resource management has become increasingly clear. The idea of biocultural conservation has taken a leading role in bridging the worlds of biodiversity conservation, indigenous cultural heritage, and numerous disciplines with wide differentiation in epistemologies, from ecology to politics to humanities. While the concept is, in many ways, able to bring together many schools of thought and provide a way forward for socially just conservation, there are also tensions both practically and theoretically. We explore the synergies and tensions between biocultural conservation and theories of the commons. The intention is to serve as a review and teaching tool.

Advancing a more sustainable agro-tourism
Speaker: Sally Elfishawy

Recognizing tourism's potential to contribute to the social and economic development in rural parts of Morocco, the Ministry of Tourism put together a strategy for rural tourism development in 2002. Since then tourism has expanded into the rural areas of Morocco and more and more tourists are favoring the rural areas of the country for their vacation over the coast. While the number of tourist lodges in rural areas have gone up significantly over the past few years, there still is a need to identify and incorporate the very many unique aspects of rural life in Morocco into tourist experiences through niche product development and branding. Agriculture, Berber culture and the sustainable lifestyle practiced in rural parts of Morocco are aspects that could be developed into niche tourist products.

Amplifying voices: Engaging diverse populations in the Maine Climate Plan update
Speaker: Louise Chaplin

Our project, at the University of Maine Mitchell Center for Sustainability Solutions, aims to increase participation and inclusion of Maine's disadvantaged populations in the 2024 statewide climate plan update. The Maine Climate Council and its six working groups are currently developing the new state climate plan, which will be released in December 2024. This is the second iteration of the 2020 "Maine Won't Wait: A Four Year Plan for Climate Action". The 2020 plan established the Equity Subcommittee (ESC); a group of researchers, community representatives, and professionals from diverse backgrounds. The ESC's March 2023 report outlines recommendations to increase participation of at-risk populations such as indigenous people, people of color, low-income households, and rural communities. This research project uses the ESC's recommendations to guide outreach in disadvantaged populations across the state. To better base our work in community-led processes and values, we partner with organizations local to target populations to help facilitate discussions, surveys, and focus groups. This poster will showcase the overall process, research methods, and final recommendations, providing valuable insights into best practices and challenges in "closing the implementation gap" at the state level while advancing climate and energy justice.

Identifying environmental bias in large language models
Speaker: Sola Kim

The rapid advancement of artificial intelligence, particularly through Large Language Models(LLMs) like OpenAI's ChatGPT, has the potential to boost productivity across various sectors. However, these models contain inherent biases from their undisclosed training data, which could inadvertently influence key societal functions such as policymaking and education. While efforts have largely concentrated on eliminating gender and racial biases, the possibility of environmental bias in LLMs has been insufficiently addressed. This study introduces a framework to assess environmental awareness in LLMs, categorizing their responses into three dimensions: knowledge, attitude, and behavior. Utilizing a carefully designed questionnaire, we evaluated more than five leading open and closed-source LLMs, including GPTs by OpenAI. Our preliminary findings reveal varying levels of environmental awareness among these models, highlighting the urgent need for strategies to mitigate environmental bias. Addressing this bias is crucial for ensuring that AI supports sustainable development and does not perpetuate harmful policies. By refining how LLMs process and generate information related to environmental issues, we can better align AI technologies with sustainability goals, making them more beneficial and responsible tools for future generations. This research not only broadens the conversation on AI biases but also proposes actionable steps towards more environmentally aware AI systems.

Fostering sustainable agriculture using microbial inoculants
Speaker: Bhoopander Giri

Salt stress drastically impacts plant growth, productivity, and yield. Nearly 50% of agricultural land worldwide expected to be affected by salinity due to factors such as low rainfall, increased evaporation, weathering, excessive fertilizer use, and suboptimal irrigation practices. Soil microbes play a crucial role in enhancing plant growth by forming symbiotic relationships, promoting nutrient uptake, and stimulating overall plant health in various habitats including saline. Serendipita indica and mycorrhiza fungi found to mitigate salt stress in the plants and significantly enhanced the plants morphological, physiological traits. Microbes inoculated plants exhibited increased biomass, photosynthetic and transpiration rates, internal CO2 and stomatal conductance and also accumulated the high content of glycine betaine, total sugars, trehalose, proline, putrescine, spermidine, carotenoids, proteins, α-tocopherol. The decreased lipid peroxidation, and lipoxygenase enzyme activity substantiates the increased stress tolerance in microbes-assisted plants. Besides, microbial inoculation also helped the host plant to overcome salt stress-induced nutrient deficiency along with reduced Na+ accumulation, which is an indicative of

enhanced nutrient status, and reduced damage to cell structures like, plasma membrane and chloroplasts. The ultrastructural analysis of leaf chloroplast revealed preserved thylakoids and grana in inoculated plants in contrast to uninoculated plants under saline condition. The plasma membrane of inoculated plants displayed reduced detachment from the cell wall, thereby signifying improved membrane integrity. Our results emphasize the substantial role of microbial inoculation of plants for mitigating salinity stress and the practical application of these microbes in enhancing tolerance of plants to salt stress and promoting sustainable agriculture in salt-prone areas.

Sustainability in Action Flash Talks

Transformative education for sustainability: Emergent trends and best practices
Speaker: Lelani Mannetti

As interest in transformative sustainability grows, educators and practitioners are increasingly recognizing the need for transformative education that goes beyond traditional approaches. This systematic review aims to explore emerging trends and best practices in transformative education for sustainability, with a particular focus on diverse values related to nature and biodiversity. Transformative education, grounded in the principles of critical pedagogy and place-based learning, empowers individuals to critically engage with socio-ecological challenges and cultivate a deeper connection with nature. By synthesizing recent literature, this review identifies key themes, pedagogical approaches, and case studies that illustrate the potential of transformative education to foster environmental stewardship, social justice, and resilient communities. Insights from this review can inform the design and implementation of transformative educational initiatives that promote holistic sustainability and honor diverse perspectives on nature and biodiversity.

Trans-sectoral challenges in sustainable investment
Speaker: Chad Dickson

This research compares responsible investing (RI) in the investment policies of universities and public sector organizations to provide context to the gap between sustainability commitments and implementation. These organizations have recently been hotspots for RI activism as they are perceived as social role models with influence on the societal norms which constitute understandings of the common good (Ranängen et al., 2018). Within an organization's sustainability transition, their investment policies play a key role in realizing their strategic approach (Williams & Keiden, 2021). Using our research-informed rubric (Dickson et al., forthcoming), we analyzed 102 North American university and public sector policies to evaluate trends in RI integration amongst publicly funded institutions. Our preliminary findings suggest that universities and public sector organizations face trans-sectoral challenges including a lack of comprehensive sustainability integration, a lack of specificity, and a lack of detailed delegation, which inhibit the actionability of sustainability strategies and exacerbate the implementation gap. Given past findings on the lack of capacity to implement RI (Ramani et al., 2022), our research contributes to overcoming the lack of literature regarding sustainability governance in the public sector, while also providing a research-informed tool which investment practitioners can use to evaluate their own policies.

Strategic Sustainability: Harnessing scorecards for success
Speaker: Andrew Neil

Colleges and universities across the globe are looking for ways to improve the planet and reduce their carbon footprints. Lofty goals such as carbon neutrality and zero waste are common and sound great, but actual success in meeting these goals is not so common. It is more imperative than ever for leadership to think strategically and to find ways to mobilize students and staff at all levels to ensure optimal resource stewardship. This presentation will highlight The Ohio State University's strategy that allows disparate areas across campus to clearly see how they can contribute to the organization's success and provide ways for them to actively impact sustainability. It will showcase the university's Resource Stewardship Scorecard that demonstrates how well the organization is executing on its goals, including effective ways to develop short- and long-term targets. It will also show the underlying analytics that allow accurate measurement and reporting to drive better performance. This is an essential step in closing the implementation gap, as it provides transparency, creates accountability, and helps to mobilize university staff and resources towards sustainability goals.

Sustainability literacy, culture, and behaviors in higher ed
Speaker: Nikita Lad

Sustainability assessments have garnered increasing attention and importance in higher education in recent years. Through a series of three studies, my dissertation examined the relationship between college students' sustainability literacy, culture, and behavior. It also explored the motivations and challenges for institutions to engage in these assessments, and what can be done within higher education to better assess the factors that influence student sustainability behavior. A theoretically-informed model reveals that time spent on campus and informal program participation influences nature-social connectedness and norms, which in turn affect sustainability behavior. However, the breadth of measurement variability for sustainability literacy and culture between a 4-year "very high research activity" (R1) university, a 2-year community college, and a historically black college and university (HBCU) suggests the need for more generalizable and robust scales.

Change is possible -leading the sustainability revolution in America
Speaker: Margaret Smith

To solve the climate crisis we must develop and deploy people who can lead change - a discipline I've dedicated my career to using applied behavioral science. To close the Implementation Gap we must bring climate solutions to reality faster. We have the financing and know what to do - now we need strong leaders at all levels of society to mobilize and organize people for action. Leading change is the single most critical skill needed to deploy a successful Sustainability Revolution. Drawing on the work of Marshall Ganz and my own experience as an organization change practitioner, I will walk the audience through three key leader behaviors to ignite inspired action in the US public. The movement we need to create in this country is akin to prior social movements such as the abolition movement, the suffrage movement, the civil rights movement, and the women's movement. What were the leadership traits and organizing principles that enacted sustainable change? If we are able to apply the lessons from social movements and develop strong change leaders in this arena, we have a chance at implementing climate solutions thereby saving humanity from natural disasters, migration, and ultimate collapse.

Federal seed funds: Exciting projects leveraging the energy efficiency and conservation block grants
Speaker: Katelyn Rousch

The ongoing $450 million energy efficiency and conservation block grant program is funding up to 2708 eligible states, cities, counties, and tribes. Projects can span fourteen categories, allowing localities to build capacity and workforce, develop data-driven plans, reduce energy consumption and emissions, transition to sustainable energy and electric vehicles, promote environmental justice, collaborate with community action, and provide green financing. Almost 200 projects have been awarded since the program launch in summer 2023, including many exciting initiatives that take an intersectional approach to improving community sustainability. For instance: Santa Monica, California has created an e-bike voucher program for low-income residents. Memphis and Shelby County, Tennessee are pooling funds to use the Memphis Zoo as ground-zero for energy education programming, solar installations, and a waste-characterization study that will inform a regional solid waste master plan. Ann Arbor is creating a net-zero resiliency hub and living-learning environment in a historically disadvantaged area of the city. While the EECBG program is an excellent source of funding to seed sustainability initiatives through October 31st, it is also poised to be a project repository that can serve as inspiration for anyone looking to design programs to improve community resilience and sustainability.

Zero-food waste by built-in automatic solid recovery system for sustainable high-rise apartment
Speaker: Dong-Hoon Lee

Due to the rapid increase in high-rise apartments, it became necessary to develop a clean and convenient system for the separate collection of food waste in high-rise apartment. Concurrently, it has become also necessary to promote recycling for carbon neutrality in 2050 and a circular bio-economy. This is a technical report that can simultaneously expect the effects of clean life, resource recovery, and carbon reduction at the source of food waste. The system consisted of 5 parts, which are a cut and transfer of food waste at sink, dedicated pipe system, solid-liquid separation, dehydration, and bio-drying. The advantages of system are as follows. First, to provide residents with the convenience and hygienic environment when food waste handling in high-rise apartment. Second, to recover the high quality biomass intensively with no odor clean environment. Third, unlike existing household disposers, it does not place a burden on sewage treatment plants because it provides intensive solid recovery treatment before discharging into sewer line. Fourth. to have the moisture content of recovered biomass less than 20% by natural energy (actually dried less than 15% and sterilized by the fermentation heat of bio-drying) not to deterioration when long-term storage and utilizing long. Finally, further research on the utilization of recovered biomass

can lead to the development of carbon storage and carbon neutrality score for residence or local government. Built-in installation of 9 buildings of 35-story apartments for 1,451 households in Seoul, Korea, has been operated for over 3 years without any resident troubles.

Toward a circular economy: Exploring drivers of repair behaviour for electronics - Case of mobile phones
Speaker: Neha Sharma-Mascarenhas

For the electronic products in use, repair work undertaken in proportion to the products owned has been in a long-term decline. These trends are fueled by a multitude of economic, technological, industrial, policy-related, and socio-behavioural factors: such as rising disposable incomes, aspirations of material wealth, absence of policies to regulate the repair landscape, planned obsolescence. Yet, research suggests that the consumer decision of product disposal timing remains independent of the designed lifetimes and of their own perceived-reasonable product lifetime. We delve into the electronics repair ecosystem, focusing on consumer perspectives—an essential viewpoint informing industry strategies and policy formulation. This paper explores the incentives and disincentives to repair that consumers face at the instance of an electronics product breakdown in this paper. We restrict the study to one set of products within the larger electronics category – mobile phones. A product category chosen for the pervasiveness, sheer volumes, and as an archetype of complex electronics containing varied raw materials from plastics to a multitude of critical & rare earth raw materials. We conducted an online consumer survey (n= 1,516) to investigate participation in the repair economy, employing a comprehensive survey instrument capturing phone repair and recycling behaviors, end-of-life disposal behaviors, willingness to repair, environmental values and motivations of consumers. We will share the results from this analysis for this talk / poster. This study contributes to the emerging body of research on electronics' repair through by empirically examining the consumers' stance towards the decision to repair. It seeks to contribute to the larger policy debates around legislations and social movements towards the right to repair, an action in a product lifecycle that leads to a longer product lifespan before it needs waste management.

A Public-Private-People plus Academia (3P+A) approach to building net zero communities.
Speaker: Samuel Chng

Community-based climate action and sustainability transition has been applauded as an inclusive way to recognize the needs, aspirations, and knowledge of local people and a platform to nurture innovation. There have been an increasing number of actors across the public, private and people/civil sectors joining communities' action. But their collaboration with local people and with each other is considerably hindered by the epistemological divisions between different sectors and between general and contextualized knowledge. In this talk, we will introduce a Public-Private-People plus Academia ("3P+A") approach to net zero community building, which advocates the interlocutor role of academia. This approach is currently being piloted in an action research on the emerging green worker communities in Singapore. We identified three facilitating roles of academia as (1) advocate for particular social goals, (2) intermediary between actors of different sectors and scales, and (3) manager of knowledge generation and learning process. We also find the involvement of multi-disciplinary researchers amplifies this facilitating effect. These findings highlight the strategic value of knowledge agents in community-based climate action and the importance of self-reflection in related research activities.

Scaling Ecosystem Services through Organic Agriculture Policy
Speaker: Erica Martin

Organic agriculture holds potential to build climate resilience and ecosystem health through the use of more sustainable practices. Research has demonstrated that organic practices, including reduced tillage and no synthetic pesticides, contribute to a range of ecosystem services, such as improved biodiversity, soil health, and water quality. As organic markets expand, increased production may lead to improved delivery of ecosystem services. However, little is known about how policy influences the proliferation and distribution of organic agriculture environmental benefits. The US Department of Agriculture (USDA) recently launched the Organic Transition Initiative (OTI), a $300 million effort to support organic farmers through direct assistance, mentoring and advice, and organic market security. A department-wide effort, OTI is the largest investment the USDA has made in organic agricultural production and markets, presenting a unique opportunity for analysis. Given federal prioritization of environmental sustainability, identification of policies to incentivize practices that contribute to ecosystem services and build climate resilience will be critical. This early-stage research will evaluate the effectiveness of organic agriculture policy to build resilience and scale ecosystem services.

POSTERS

Innovative Solutions for Environmental Sustainability: A Panel ARDL Study of Green Finance and Renew
Speaker: Awais Ahmed Brohi

Environmental issues in developing countries have been alarming in recent times. There are multiple factors behind those issues. Like other developing countries the economies of South Asia are facing the similar environmental degradation issues. This research empirically analyzes the nexus of green finance, renewable energy consumption with environmental quality in five Asian economies (Pakistan, India, Bangladesh, Nepal, and Sri Lanka) from 1990 to 2022. We employ panel data and the PMG/ARDL technique to analyze the long-run and short-run effects on CO2 emissions. Findings of this show significant and negative impacts of both renewable energy consumption and green finance on CO2 emissions. However, population growth is found to worsen the environmental quality. Exports also reduce the environmental quality inampled countries. Robustness checks confirm the stability of these relationships, even when alternative variables like GDP per capita and the number of patent applications are introduced. These results provide valuable insights into the importance of green finance and renewable energy in mitigating environmental degradation, as well as the potential environmental challenges posed by population growth and increased economic activity through exports.

A Life Cycle Inventory on Carbon Footprint in Plantations
Speaker: Su-Ting Cheng

In response to the global imperative of achieving net-zero carbon emissions by 2050 due to climate change, afforestation has emerged as a key strategy for mitigating excessive greenhouse gas (GHG) emissions resulting from various human activities. While afforestation aids in carbon sequestration, the use of machinery and specific practices in this process can contribute to GHG emissions. This study, rooted in a comprehensive review of domestic and international literature and informed by interviews with forestry organizations in Taiwan, aims to estimate the potential GHG emissions associated with pre-timber production stages. Employing a life cycle inventory approach, we present a detailed GHG emission inventory for Taiwan's plantation forest management activities, providing reference and record tables for domestic operators to assess emissions during various stages.Our interviews with domestic forestry organizations reveal estimated GHG emissions from plantation management activities and anthropogenic practices in Taiwan, ranging from 8,578.7 to 10,021.9 kg CO2e/ha. In contrast, foreign studies report GHG emissions during log production activities ranging from 7,083.4 to 19,155.1 kg CO2e/ha. Notably, commercial harvesting stages exhibit higher emissions than final harvesting stages. Comparisons with international practices indicate higher emissions in Taiwan, potentially due to rugged terrain and regulatory logging restrictions. To address future challenges, we recommend the adoption of renewable energy and the enhancement of machinery efficiency to curtail GHG emissions during Taiwan's forest management. Additionally, we suggest the establishment of a publicly accessible open database for forestry production activities to propel forestry research forward and promote sustainable forest management practice

Indigenous Traditional Ecological & Cultural Knowledge at Portland State University
Speaker: Suzanne Estes

Sustainable and climate-resilient cities originated with Indigenous Peoples, but Indigenous traditional ecological and cultural knowledge (ITECK) has rarely been applied to the design or operation of modern cities. This presentation will share information about the urban ITECK programming developed by Native faculty in collaboration with students, the urban Native community, and agency partners. This programing and its associated partnerships and projects aim to reclaim the urban landscape for food, medicine, ceremony and healthy lifeways. We offer a successful model of coalition-building with positive impacts for climate adaptation that is replicable for other urban areas.

Sustainable and Circular Public Procurement for Local Governments
Speaker: Josefina Hajek Herrera

Public procurement accounts for 12% of local government emissions, making it a critical instrument for local governments to advance their climate objectives, reduce emissions, and be a catalyst for sustainable and circular economic practices. With their higher share of economic output and stronger purchasing power than the federal government, local governments can make key investment decisions that influence

the greater economy. This proposal presents a Sustainable and Circular Public Procurement (SCPP) framework designed to empower local governments in aligning procurement decisions with climate priorities and circularity goals. The framework includes guidance for baselining SCPP, a report on best practices, and offers guidance for local governments to research, develop, create, and implement an SCPP program. While numerous existing tools and resources are available, local governments lack a comprehensive SCPP framework and sustainable supply chain resources. This gap in guidance inhibits efficient and effective action towards the development of local government circularity. The SCPP framework can offer local governments direct, indirect, and overarching benefits. Direct benefits include emission reductions, waste diversion, and reduction of materials consumed. Indirect benefits include job growth, reduced social cost of carbon, cost savings, innovation growth in public and private partnerships, and the potential to change supplier behavior. Overarching benefits include helping local governments meet their environmental goals in procurement while promoting an equitable transition to a sustainable and circular economy

Building marine macro-microalgae consortia
Speaker: Owen Knight

Using marine photosynthetic organisms to produce biomass and capture carbon holds the potential for a carbon negative bioeconomy. Yet this will require the demonstration of sustained and cost effective feedstock production. A key tool in this process is the application of microbial consortia to generate stable and resilient biomass. Microbial mutualism enables more efficient use of nutrient resources and sustained biomass production. The presence of a wide diversity of microbes in the ocean surface offers a wide potential range of consortia to choose from. Yet it can be difficult to identify and cultivate these microbial communities. This poster examines a test case using hydrogel and Chlorella microalgae to favorably isolate mutualistic and commensal photoautotrophs, bacteria and macroalgae from water samples of the Puget Sound. The work explores the complex microbial structure and ecology of the hydrogel communities resulting from initial marine culture. The process enabled the formation of consortia with species specific to the Puget Sound and surrounding marine ecosystem. This holds promise in assisting the localization of consortia selection for the purpose of ocean based biomass production.

Zero Food Waste with Built-in Automatic Solid Waste Recovery System for Sustainable High-Rise Apartments
Speaker: Dong-Hoon Lee

In Korea, where the food waste separation collection system has been mandatory since 2005, the rapid increase in high-rise apartments has led to the need for a more convenient and hygienic food waste separation collection system. At the same time, the need to reduce landfill disposal and recycle food waste has also increased for carbon neutrality and a circular bioeconomy society by 2050. We have developed a technology that can simultaneously achieve zero landfill waste through on-site material recovery along with hygienic and convenient food waste management at generation source. This system consists of five parts in detail: cutting and transporting food waste, solid-liquid separation, dehydration, and bio-drying processes. This system provides a convenient and hygienic environment for residents at home, and intensively recovers high-quality solid biomass in an aerobic environment, and the separated wastewater discharged into the sewer does not burden the sewage treatment plant, and the recovered solid biomass is recovered as a good-quality resource by drying it to a moisture content of 15% or less through biological fermentation heat and air drying. Therefore, there is no concern about deterioration even with long-term storage. The recovered solid biomass can be used as a raw material for compost, feed, biogasification, fuel, and carbon storage. It has been installed as a built-in system in two large complexes, including nine 35-story apartment buildings with 1,451 households in Seoul, and has been verified to operate without inconvenience to residents for more than three years.

Pump using electrical discharge for water sterilization
Speaker: Kazuma Matsuo

Microfluidic technology has the potential to make a significant contribution to a zero-carbon society in terms of resource and energy conservation. Furthermore, water and human health are essential for a sustainable society. Therefore, technology that can provide safe water using small fluidic circuits is important. Here, we propose a water sterilization rotary pump using underwater discharge with an asymmetric antenna structure [submitted]. Specifically, we demonstrate that by applying high-voltage pulses repeatedly, the rotary device having an asymmetrical antenna structure can rotate with a maximum angular velocity of ~25 rad/s, and can produce a net flow with an average velocity of ~3.2 mm/s along with an instantaneous maximum flow of ~9 mm/s. Moreover, underwater discharge may involve sterilization functions along with mixing effects. Our research results should contribute to sustainable water purification in the future

Asymmetrical spiral structure pump in the boiling region
Speaker: Tsubasa Sugitate

The utilization of waste heat plays a crucial role in striving for a sustainable society. For this problem, we consider that the energy harvesting (EH) technology using boiling phenomena is useful. Here, to clarify the basic principles of new EH technology using boiling phenomena, we propose a strong and simple pump using an asymmetrical converging spiral heater driven under subcooled conditions and validate it [submitted]. Surprisingly, the pump using this heater operates spontaneously after experiencing asymmetrical initial convection. Furthermore, it produces a net flow of up to ~68 mm/s (a volume flow rate of up to ~9500 mm3/s) in the converging direction. Our findings should contribute to the effective use of unused heat such as factory waste heat and environmental energy.

Transforming the concept of Walk Score for accessible design
Speaker: Ysabel Yu

Within many fields of design, there remains a challenge of creating accessible and inclusive spaces for physically disabled individuals. Sustainable environments should strive for mobility and encouraging healthy behaviors. While efforts have been made, there is a need for effective tools to identify accessibility disparities in the built environment. This research seeks to explore the concept of Walk Score to transform it into an accessibility tool that can uniquely assess walkability. This new tool would provide utility for designers in finding accessibility gaps to improve areas and inform future design interventions. Interviews with the disabled community will be conducted to provide perceptions of the status of current infrastructure. Existing geospatial data will be collected to inform the calculation of a new accessibility score. Both types of data will be synthesized to create a user appropriate interface for all to use. The tool will show an accessibility score for an area and display the accessibility features available. Existing literature suggests that current walkability measures, like Walk Score, lack utility for applications to the built environment. However, practical measures are needed to study relationships between infrastructure, health, and mobility in disabled communities. The proposed project seeks to address these gaps by (a) investigating aspects of walkability through an accessibility lens and (b) developing a tool inspired by Walk Score that can provide functional benefits for designers. Addressing accessibility disparities helps designers promote sustainable and inclusive interventions for the future.

Recognizing value through adaptable building designs
Speaker: Miranda Grice

The built environment is a vast system that supports the daily ongoings of our lives. According to the U.S. Environmental Protection Agency, competition for natural resources has escalated in tandem with the increase of global population and economic growth. The uncertainty of material availability combined with future building usage leads to the need for buildings that evolve with society's needs. Designing for adaptability is a key strategy for implementing sustainability in the built environment. Buildings that cannot adapt are at risk of becoming obsolete and demolished. Demolition of existing buildings wastes these waning natural resources. To empower engineers and architects to create adaptable designs and to justify these designs economically, real options analysis has been proposed. Real options analysis (ROA) borrows concepts from the financial realm of stock valuation. Although real options have been studied in the academic domain and adaptable designs are being established in the professional field, the gap between implementing real options valuation for adaptable designs in the industry remains present. Therefore, the authors aim to provide some insight on the utilization of real options in valuing adaptable designs, which suits the theme of "closing the implementation gap" between academia and industry. This research aims to address the implementation gap by making ROA from the financial field applicable to designers in the construction industry.

Sustainability Competency, ePortfolios, and Career Readiness
Speaker: Jeff Sharp

As colleges and universities expand their sustainability course offerings, there is a growing imperative to design curricula that effectively instill sustainability competencies in students. This poster presents an approach to improving student readiness for incorporating sustainability into their future careers by leveraging ePortfolios or folio thinking—a high-impact practice recognized by the American Association of Colleges and Universities. Our objective is to facilitate student reflection and documentation of their learning outcomes pertaining to sustainability competencies and associated disciplinary tools. The poster reports on an interdisciplinary Introduction to Sustainability course, comprising both lecture and lab components, offered in 2023-24 as part of Ohio State University's newly established sustainability general education requirement. We explore how sustainability competencies and disciplinary tools, particularly

from economics, sociology, and anthropology, are taught and applied within this course. Through the utilization of labs, assessments, and reflective exercises, we describe our efforts to develop student understanding of sustainability concepts and competencies. The poster highlights strategies we are adopting to encourage student reflections that can be integrated into an ePortfolio that that highlight the student's sustainability learning journey and their newly acquired insights pertaining to the application of sustainability principles to real-world contexts. By emphasizing active reflection and application, our approach seeks to empower students to better articulate their expertise and preparedness for future careers or work in sustainability.

U.S. University Campus Sustainability
Speaker: Pavithra Priyadarshini Selvakumar

In an era marked by pressing environmental challenges and the corresponding imperative for sustainable solutions, universities are playing a pivotal role in educating and promoting eco-friendly practices. American campuses, which host both domestic and international students, possess a unique capacity to disseminate sustainability knowledge globally. Yet, U.S. universities face significant obstacles in meeting sustainability goals due to traditional institutional practices, a lack of necessary resources, and other various reasons. Despite numerous studies on green campuses, there remains a gap in understanding the ongoing discourse on sustainability in U.S. universities and providing actionable recommendations for enhancing sustainability initiatives. This research will evaluate the effectiveness of Colorado State University (CSU) and Oklahoma State University (OSU) in integrating sustainability initiatives into their academic programs, operations, leadership, and community engagement efforts. This study will answer the two following research questions: 1) What are the primary drivers and barriers to effectively implementing sustainability initiatives at OSU in comparison to CSU? And 2) how do sustainability leaders at OSU and CSU engage key stakeholders to contribute to successful environmental stewardship on their respective campuses? To address these questions, I propose a qualitative analysis that employs a comprehensive approach, including a literature review on sustainability leadership in higher education, semi-structured interviews with sustainability officials from OSU and CSU, and a comparative analysis of sustainability initiatives between these two leading institutions. This research contributes to the existing literature by addressing the research gap and shedding light on the broader benefits of sustainability integration within educational institutions.

Catalyzing Gender Equity in the Energy Sector
Speaker: Hana Kim

The International Energy Agency highlights significant gender disparity in the energy sector, with women comprising only 16% of the workforce, holding less than 15% of senior management positions, and representing merely 11% of start-up founder roles. Studies further underscore women's underrepresentation in the decision-making process and professional positions within this sector. This compromises potential benefits such as enhanced innovation and productivity in this sector. In addition, the energy transition can be expedited when the potential of the workforce is fully employed. Thus, inclusive policy measures and decision-making processes have been practiced to promote gender equality in this sector. Governmental budget allocation is the most important policy tool reflecting societal priorities. It profoundly impacts stakeholders, including males and females. Gender-sensitive budgeting strives for gender equality by evaluating the potential budgetary impacts on different genders. As of 2022, 61% of OECD countries are practicing gender-sensitive budgeting. In this context, this study aims to examine how gender-sensitive budgeting empowers women in the power supply sector. Focusing on Korea and Taiwan, two East Asian countries with similar characteristics such as geopolitical isolation and heavy reliance on imported energy, as well as low contributions to renewable electricity in 2022. The research investigates the efficacy of gender-sensitive budgeting in enhancing gender equality in the energy sector. Through empirical analysis, this study illuminates the performance of gender budgeting initiatives and their impact on gender equality enhancement in the energy sector.

Raw Material Sourcing in LEED Projects: National Project Metrics and Industry Insights
Speaker: Radwa Eissa

LEED (Leadership in Energy and Environmental Design) was established as a comprehensive green building rating system to drive the built environment to a low carbon future. Nevertheless, sustainable material sourcing requirements in LEED have remained one of the least achieved aspects across different versions since its inception. LEED v4, published in 2014, provided significant updates to its requirements to enhance achievement. However, there has been no comprehensive study of the status of raw material sourcing credit points achievability. To this end, the authors 1) investigated the achievement status of the raw material sourcing credit in LEED v4 projects certified in the US, and (2) gathered insights from industry experts on the main challenges and best practices for better implementation. Results showed a severe lack

of achievement of the full credit, with only 6.5% of the projects meeting the full credit requirements. Industry experts emphasized the importance of enhancing material data availability and transparency, as well as coordinating material data tracking with stakeholders along the supply chain. Ultimately, this study contributes to the body of knowledge by providing a foundation for evidence-based discussions on enhancements to embodied emissions and the material supply chain impacts in LEED buildings.

Understanding the Drivers of Circular Economy Adoption in Construction: A Graph Theory Approach
Speaker: Bahaa Chammout

The construction industry, despite its crucial role in worldwide economic development, continues to be a significant contributor to global pollution, resource depletion, and environmental degradation. Circular economy (CE) - an economic and systemic approach aimed at minimizing waste and fostering sustainable resource use - has emerged as a remedy for the environmental impacts of construction. However, the construction sector persists as one of the industries with a great circularity gap, necessitating a further understanding of the factors influencing CE adoption in construction. This paper addresses this knowledge gap following a multi-step research methodology. To this end, the authors (1) conducted a systematic literature review and analysis of circular and sustainable construction studies from 2013 to 2023; (2) identified a comprehensive list of factors that affect the decision-making of incorporating circularity practices in construction; and (3) employed a graph theory approach to assess the level of scientific scrutiny awarded to each factor, thereby identifying research gaps for future researchers. This study identifies 40 factors impacting CE implementation in construction, addressing several areas such as regulations and policies, economic and market factors, project lifecycle management, and stakeholder engagement, among others. The graph theory analysis reveals that prior literature predominantly emphasized factors related to waste management and recycling, as well as environmental impact and certification. In contrast, factors pertaining to project lifecycle management, stakeholder engagement, and social responsibility have been comparatively understudied. Ultimately, this study contributes to the body of knowledge by providing a comprehensive understanding of CE drivers in construction.

Connection to Nature: A review to clarify definitions, measures, and implementations
Speaker: Jiaxuan Xu

In our rapidly urbanizing world, the “connection to nature” construct has become of increasing interest and relevance across the human and environmental health realms over the last two decades. While different terms, such as “connection to nature” or “nature connectedness” have been used, it is challenging to describe, characterize, and measure with consistency the dynamic relationships between people and the nature-rich world. Ranging from the innate connections human beings have according to the biophilia hypothesis to the energy meditators gain from spiritual connections, the definitions of connection to nature vary across academic disciplines as well as ecological contexts. Moreover, the mechanisms contributing to these human/nature connections are complex and variable, with most studies suggesting some combination of cognitive, affective, and behavioral elements. Additionally, in practice, questions persist about the extent to which connection to nature is an independent or dependent variable. Thus, the definitions, mechanisms, and implications of connection to nature–initially seemingly simple–necessitate problematizing. To this end, we undertook a narrative review and broad thematic analysis of the connection-to-nature literature to consider how contemporary literature defines, uses, and measures this construct. In particular, we were interested in implications for policy and practice within the intersectional field of sustainability. In this poster, we will share findings from the review, as well as a survey of practitioners; discuss implications for practice; and solicit further questions of interest from other conference participants.

Environmental and economic assessment of agri-voltaic systems using Life Cycle Perspective
Speaker: Giuliana Vinci

The demand for food and energy is increasing as the world's population increases to 8 billion in November 2022. Such energy needs cannot be met by fossil fuels due to their depletion and the effects of climate change. Therefore, the transition from fossil fuels to renewable energy sources is necessary. In this context, solar energy could meet a substantial portion of the world's nonrenewable energy needs. However, spatial competition related to land allocation conflicts between food production, biodiversity conservation, and electricity generation could be an obstacle, as large-scale solar systems will require 2 million acres of land to meet these future needs. In this context, agri-voltaic systems (AVS), which combine agricultural production and photovoltaic power generation, could offer a potential solution by increasing productivity and land use efficiency, as well as helping to promote sustainable agriculture. This is also supported, at the European level, by Directive (EU) 2018/2001 known as the RED II Directive, focused on promoting the use of energy from renewable sources. Although the global installation of AVS has increased exponentially, from 5 MW in 2012 to 2,800 MW in 2020, to date the literature is rather lacking on the environmental impacts of

agri-voltaic systems, as well as little is known about their economic feasibility. Therefore, the objective of this research will be to assess the environmental and economic sustainability of an AVS configuration through Life Cycle Assessment and Life Cycle Costing. The assessment will be carried out using Simapro 9.5 software.

Energy harvesting using boiling phenomena
Speaker: Hideyuki Sugioka

Energy problems are argent matter to solve. Here, we will review the recent findings of our group concerning sustainable energy harvesting methods in a nucleate boiling region; i.e., we will introduce a new energy harvesting method using unused heat with surface structures in a nucleate boiling region. In particular, we will demonstrate that fixed oblique beams [Physics of Fluids 35, 024102(2023)] and surface overhang structures [Physics of Fluids 36, 024124(2024)] in a channel produce a net flow in a nucleate boiling region. Our findings should help effectively utilize unused heat such as factory waste heat and contribute to a sustainable zero-emission society in the world.

Linking SDGs and LCSA to evaluate technologies and products
Speaker: Alexander Barke

Using new technologies and products is directly linked to a contribution to more sustainability. To demonstrate this, companies usually highlight their contribution to the 17 Sustainable Development Goals (SDGs). However, these are often subjective forecasts that focus only on using the technologies or products, neglecting the entire life cycle. Furthermore, such forecasts are made after the technology and product development, and the question remains how exactly the contribution to achieving the SDGs can be quantified. Precisely these aspects can provide an important impetus in the early stages of technology and product development to make them truly sustainable. For this reason, we have developed a method that enables the quantification of the contribution of technologies and products to SDG achievement by linking prospective Life Cycle Sustainability Assessment (LCSA) and the SDGs. While the basic procedure of the method is introduced in an oral presentation, this poster contribution will describe the method in detail. For this purpose, the characterization of SDGs using LCSA impact categories, the general calculation procedure, and the contribution to SDG achievement by means of SDG contribution scores are presented. Finally, the developed method is applied to next-generation lithium-sulfur all-solid-state batteries as an example, and the individual steps of the method are illustrated using the example. This poster contribution thus complements the contribution submitted for an oral presentation and provides more detailed insights into the method developed to quantify the contribution of technologies and products to SDG achievement.

Using LLMs to Find Sustainability Capacities in Occupations
Speaker: Jieshu Wang

As we pivot towards sustainable development, there is growing concern about the impact of job transitions in sectors affected by environmental policies. This study addresses these issues by exploring the existing skills and activities within the workforce that could ease the transition to a greener economy. Utilizing OpenAI's GPT-4 model, a large language model (LLM), our research identifies tasks within the U.S. workforce that align with environmental sustainability. Utilizing prompt engineering practice, we instructed GPT-4 to evaluate whether each task within the O*NET dataset involves making production processes more environmentally friendly or using fewer natural resources. Through the OpenAI API, GPT-4 analyzed 13,075 tasks, classifying 17% as environmentally friendly, 81% as neutral, and 2% as unfriendly. Our analysis further revealed that 61% of U.S. occupations include at least one environmentally friendly task, and 20% of occupations have at least 30% green tasks. Forty-nine occupations, including energy auditors and recycling coordinators, are predominantly green (80%). Currently, we are developing a set of more sophisticated criteria to capture more nuanced aspects of sustainability workforce capacities. Our next step is to help formulate a “greening” pathway for various occupations, given their existing sustainability capacities. This research marks a pioneering use of LLMs to identify green capabilities within the U.S. workforce. By mapping existing green tasks, this study could alleviate concerns and provide useful strategies for policy-makers and businesses. It demonstrates that many workers are already equipped with green skills, paving the way for smoother transitions.

A Public-Private-People plus Academia (3P+A) Approach to Building Net Zero Communities.
Speaker: Yunjing Li

Community-based climate action and sustainability transition has been applauded as an inclusive way to recognize the needs, aspirations, and knowledge of local people and a platform to nurture innovation. There have been an increasing number of actors across the public, private and people/civil sectors joining

communities' action. But their collaboration with local people and with each other is considerably hindered by the epistemological divisions between different sectors and between general and contextualized knowledge. In this poster, we will introduce a Public-Private-People plus Academia ("3P+A") approach to net zero community building, which advocates the interlocutor role of academia. This approach is currently being piloted in an action research on the emerging green worker communities in Singapore. We identified three facilitating roles of academia as (1) advocate for particular social goals, (2) intermediary between actors of different sectors and scales, and (3) manager of knowledge generation and learning process. We also find the involvement of multi-disciplinary researchers amplifies this facilitating effect. These findings highlight the strategic value of knowledge agents in community-based climate action and the importance of self-reflection in related research activities.

A Typology of Everyday Heat Health Behaviors and Implications for System Sustainability Across Scales
Speaker: Elizabeth Doran

Extreme heat has been the leading cause of weather-related mortality in the United States for the past thirty years and is a growing problem under rapidly warming climate conditions. Older people, young children, and those with low income are considered particularly vulnerable but everyone can be at risk. Individuals make a variety of everyday decisions that can protect their health when faced with potential extreme heat exposure. On the shortest timescales and with the least investment, these adaptive actions may simply protect one's own health or the health of ones' family (e.g. staying hydrated, changing plans, checking on neighbors). At medium time and investment scales adaptive actions may also have broader energy system implications (e.g. using air conditioning or fans, or going to a cooling center or public air conditioned space). And, at the longest time scales and with the most investment, heat-health adaptive actions may have implications for public health, energy and infrastructure systems (e.g. installing air conditioning, home weatherization, and migration or displacement). As the climate continues to rapidly warm differentially around the globe, regional variation in the public perception of heat-health risk and tolerance for adaptive action is required to understand the implications of this threat on public health, and to make projections for future energy and infrastructure systems. The typology of everyday heat-health behaviors will be illustrated using evidence from an online stratified survey of Vermont, USA residents (N = 1818) that was conducted in the late summer of 2022. Broader system implications will be extrapolated.

Supporting community-led sustainable energy action through community-engaged research
Speaker: Sharon Klein

Without intervention, the transition from fossil fuels to sustainable energy (renewable energy, increased energy efficiency/conservation) is likely to follow a similar path to fossil fuel adoption with large companies benefiting the most, often at the expense of historically disadvantaged/underserved populations. Yet, due to the nature of the technologies involved, this transition has much potential to play out differently and empower underserved populations. Sustainable energy options are everywhere and can be sized to multiple scales. People and communities can invest in themselves, increase their energy sovereignty and improve their local economies. But, they often need help. Energy options are technically complicated, and underserved communities often have limited capacity to consider a multitude of options with very site-specific considerations. How can we as academics provide support while also advancing sustainability science research? Our community-engaged research project uses a multi-level perspective to understand how statewide networks of communities taking action on sustainable energy can support historically underserved communities in advancing their own sustainable energy goals. At the national level, we are searching for and comparing these networks across multiple criteria. At the state level, we are developing a network in collaboration with many partners and studying it from the ground up: the Maine community-led Energy and Climate Action Network (MAINECAN). At the community level, we are working alongside four indigenous nations and seven other underserved communities in Maine to co-develop and test multiple "targeted interventions" to help them reach their sustainable energy goals. Building on this research, the workshop will focus on how to build cooperative, thoughtful, future-oriented relationships between underserved communities and academic researchers for mutual benefit. We will begin with an overview of our research and community partner actions (at least one partner will join us). Then, we will facilitate small group discussions about: 1) how to engage in non-extractive, cooperative research; 2) challenges and successes faced on both sides of the collaboration; 3) how researchers can use their resources to put systems in place that will continue to support communities over the long term. This workshop is meant for both sustainability researchers and community practitioners. The overall goal is to co-develop a set of best practices for this type of work from multiple perspectives. We are especially interested in co-developing knowledge with others who have experience with statewide networks of communities taking action on sustainable energy and/or with underserved communities (e.g., people of color, low income, rural, tribal, indigenous, and other populations that may be disproportionately impacted by environmental harms and risks).

Amplifying Voices: Engaging diverse populations in the Maine Climate Plan update
Speaker: Louise Chaplin

Our project, at the University of Maine Mitchell Center for Sustainability Solutions, aims to increase participation and inclusion of Maine's disadvantaged populations in the 2024 statewide climate plan update. The Maine Climate Council and its six working groups are currently developing the new state climate plan, which will be released in December 2024. This is the second iteration of the 2020 "Maine Won't Wait: A Four Year Plan for Climate Action". The 2020 plan established the Equity Subcommittee (ESC); a group of researchers, community representatives, and professionals from diverse backgrounds. The ESC's March 2023 report outlines recommendations to increase participation of at-risk populations such as indigenous people, people of color, low-income households, and rural communities. This research project uses the ESC's recommendations to guide outreach in disadvantaged populations across the state. To better base our work in community-led processes and values, we partner with organizations local to target populations to help facilitate discussions, surveys, and focus groups. This poster will showcase the overall process, research methods, and final recommendations, providing valuable insights into best practices and challenges in "closing the implementation gap" at the state level while advancing climate and energy justice.

Policy Memo: A Brief Analysis of California's Clean Car 4 All Program
Speaker: Tripti Basant

The California Clean Cars 4 All program aims to transition lower-income consumers to cleaner vehicles, incentivizing options like electric and hybrid cars. The memo analyzes the program's implementation and impact to inform evidence-based policy decisions. The program's eligibility is based on income, residency, and vehicle choice, with funding sourced from various programs. The dataset (California Air Resources Board Participant Level Dataset) facilitated comprehensive analyses, including evaluating EV adoption trends, incentive distribution among demographics, and effectiveness of funding sources. Statistical analysis using R revealed relationships between attributes, employing techniques like t-tests, correlation and linear regression. The analysis highlighted program's success in promoting Electric Vehicle (EV) adoption, particularly among low-income groups. Despite temporary setbacks in 2020, probably due to the Covid-19 pandemic and microchip shortage, the program showed resilience. Participants' preferences leaned towards Plug-in Hybrid Electric Vehicles (PHEVs) and Hybrid Electric Vehicles (HEVs), although there has been an uptrend in the adoption of Battery Electric Vehicles (BEVs) in recent years. The analysis also shows that the program effectively targets lower income groups with higher incentive amounts. Low interest in the "mobility options" (grant funding for public transit or e-bike purchase) is concerning. Encouraging this transition aligns with California's environmental goals and also help alleviate traffic congestion, benefiting urban areas. Overall, while the program effectively targets lower income groups, addressing disparities and enhancing interest in alternative mobility options. are crucial for maximizing its impact and equity.

Conceptualization of a water footprint label (WaFL) for food in the United States
Speaker: Yufei Zoe Ao

Eco-labels have emerged globally as a tool to address information asymmetry, curb wasteful behavior, and leverage environmentally conscious consumer choices to influence producers' operations. While there is extensive research on the consumption of water for production of goods and services (defined as water footprint), limited studies on water footprint labels only involve consumers in Canada, European countries, and California. This highlights a significant gap in understanding US consumers' reactions to water footprint metric labels on food products and how various consumer attributes and past experiences shape their attitudes towards these labels.

This study will employ a nationwide multi-part survey to investigate key research questions:

Are US consumers willing to accept water footprint labeling in grocery stores?

What demographic and socio-economic characteristics correlate with high acceptance of water footprint labeling?

What form of water footprint labeling would be most accepted and effective?

What is the willingness to pay for a water footprint label?

By addressing these questions, the study aims to provide insights into market and policy implications, including guidance for institutional procurement, encouraging water-friendly practices among producers

and retailers, and promoting consumer awareness to reduce food waste and water footprint. The findings have the potential to inform policymakers, food industry stakeholders, and consumers, shedding light on the efficacy and acceptance of water footprint labels within the US food market landscape.

Review on Research of Corporate Environmental, Social and Governance (ESG)
Speaker: Yuting Xie

Environment, Social, and Governance (ESG) is a governance approach used to monitor the practices operated in organizations to promote sustainable development and encourage organizations to report risks and opportunities regarding environmental, social, and governmental issues. Meanwhile, many public companies or organizations are highly willing to disclose information about ESG to gain the public's and shareholders' trust, as sustainability becomes a more and more serious global issue. However, there is a lack of analysis using literature research methods to reveal the current trend of ESG study, as there is limited theory attribution for studying ESG information disclosure. Therefore, this paper aims to use the Latent Dirichlet Allocation (LDA) method within a conceptual model to review, code, and classify various pieces of literature related to the use of ESG, to provide insights and light for further research and analysis of the ESG mechanism, especially for climate-related information reporting.

Global Interactive Tool Communicating Health Impact of PM2.5
Speaker: Nishka Sharma

Air Pollution is one of the greatest health threats facing humanity today. But, how can we effectively communicate its impact on human health to the public, specifically the implications it has on our life spans? How do we effectively nudge people to take action on air pollution? Air Quality Life Index (AQLI), an interactive map tool, fills this gap by estimating the relationship between PM2.5 pollution and Life Expectancy, allowing users to visualize the gain in Life Expectancy they could experience if their community met the latest World Health Organization (WHO) Annual PM2.5 guideline, national standards, or another standard.It does so by leveraging results from a pair of large cohort quasi-experimental studies set in China. The results of the studies are combined with detailed global population and satellite derived PM2.5 data to estimate the impact of particulate matter on life expectancy across the globe. This presentation will share the latest findings of global air quality and its impact on human health, as calculated by AQLI. It will also discuss methods AQLI uses to communicate about air pollution to the public, including AQLI's interactive map tool, providing a hyperlocal view of air pollution in a given region and how it compares to other regions and across time. The presentation will also discuss how various public stakeholders have used this information to nudge their communities, cities, and countries to action.

Equity and justice in carbon capture and storage: Case of Southeastern Michigan
Speaker: Rajiv Ghimire

The escalating climate change crisis has demonstrated the need for carbon capture and storage technologies to complement the mitigation efforts for long and short-term decarbonization goals. While the technological aspects of carbon capture and storage have matured in the past decades, there is a limited understanding that these technologies call for a meticulous understanding of social, political, and justice implications as this can negatively impact disadvantaged communities. This study focuses on Southeastern Michigan, a historical place for the environmental and climate justice movement, to understand the societal impacts and benefits of a potential carbon capture and storage project considering the latest federal and state-level plans such as the decarbonization goals and the Justice40 Initiative. Our study combines quantitative and qualitative approaches, including geospatial analysis, social life cycle assessment, and stakeholder engagement. Our findings suggest that carbon capture and storage, especially from major sources like power plants, in heavily burdened areas need to be combined with targeted social justice interventions. Addressing labor rights, community engagement, and indigenous rights is paramount to ensuring an equitable and just transition to net-zero emissions. Transparent communication, thoughtful implementation, and genuine stakeholder engagement are essential to ensure equity and leverage Michigan's geological potential for carbon storage. This holistic approach will enable the region to navigate the complex interplay between technological advancement, environmental sustainability, and social equity. Through a comprehensive approach, this study presents effective strategies for dealing with carbon capture and storage projects that are socially equitable and environmentally sustainable.

Playing for change
Speaker: Kelly Burton

Imagine a daily dose of fun and education that not only entertains but also empowers individuals to take action against climate change. Introducing The Impactist, a groundbreaking initiative that combines the

nostalgia of a classic word game with the urgency of climate awareness. Our daily hangman-style puzzles feature words related to climate change, from scientific terms to indigenous practices, delivered straight to your inbox with our informative newsletter. But we're more than just a game – we're a movement. By joining The Impactist, players not only challenging their mind but also joining a community dedicated to making a difference. With innovative monetization strategies and a focus on sustainability, we're not just raising awareness – we're revolutionizing the way we engage with one of the most pressing issues of our time.

Decision-making in heat stress mitigation: a cross-cultural study of students in Japan and Malaysia
Speaker: Masa Haraguchi

The direct, immediate impacts of climate hazards, such as floods and hurricanes, are typically uniform among populations. In contrast, those of heat stress significantly differ among individuals, depending on physiological and behavioral factors. Consequently, understanding personalized decision-making processes is paramount to reducing heat stress risks. Here, we include social and cultural factors influencing decision-making to better understand cultural differences. We conducted pre- and post-workshop surveys in Japan and Malaysia to evaluate the effectiveness of the intervention in the workshop and compare changes in student's decision-making processes to reduce its risks. We employ the prototype model, which assumes the decisions of an adolescent's health behaviors are reactive and influenced by social contexts, such as peer pressures. We find a significant relationship between risk-mitigating behaviors and psychological and cultural factors. The model effectively captures the decision-making process of an individual student. This highlights how cultural differences differently influence decisions to reduce heat stress risks. In Japan and Malaysia, we observed an increase in implicit decision-making processes, such as those impacted by peer pressure. Furthermore, while explicit decision-making based on intention was less impacted by the workshop in Japan, it was significantly positively impacted in Malaysia. This indicates that the intervention's effectiveness differs across cultures, so it is crucial to design interventions that capture social and cultural dimensions of decision-making.

Examining Urbanization and its Implications for Sustainable Development: Insights from China's Urban Growth Dynamics Abstracts:
Speaker: Wei-Qiang Chen

The rapid and extensive process of urbanization constitutes a notable challenge to achieving sustainable development, given its profound impact on resource consumption, environmental degradation, and energy-related greenhouse gas emissions. This research investigates the dynamics of urbanization in China, focusing on approximately 300 cities at the prefecture-level and above. The aim is to gain comprehensive insights into the relationship between urbanization and sustainable development, with a particular focus on the speed, scale, and implications of urban growth. The study reveals significant findings that contribute to our understanding of the urbanization phenomenon. Firstly, it identifies a declining trend in inequality regarding developments in buildings, infrastructure, transportation equipment, and household appliances among cities. This suggests a move towards more balanced progress and distribution of urban resources at the city level. Secondly, the growth trajectories of these key development indicators display an S-shaped curve, indicating imminent limitations and saturation points in the urbanization-driven expansion. Lastly, the ownership of these assets on a per capita basis in Chinese cities remains considerably lower than that observed in developed countries, showcasing an early decoupling between urbanization and consumption-led economic growth.By intensively investigating China's urbanization trajectory, this study enhances our comprehension of the complexities, challenges, and opportunities associated with urbanization and sustainable development. It specifically highlights the crucial role of deliberate urban planning and the implementation of sustainable strategies to effectively address adverse environmental impacts, while simultaneously ensuring equitable resource distribution and societal benefits.

The Role of Communication in the Activation of Climate Resilience Hubs
Speaker: Nayomi Cawthorne

This poster describes and explores the activities of a Detroit- based community recreation, wellness, and climate resilience hub, The Stoudamire, a 17,000 sq.ft. center that is led by Eastside Community Network on the eastside of Detroit, MI. The multi-purpose center serves over 2000 members and hosts nearly 30 weekly community programs, events, and classes in advocacy, the arts, and fitness. The consistent and culturally relevant communication methods of weekly bulletin emails, automated reminder emails for each reservation, and personalized reminder calls for registrants of each class, allow for effective communication during times of climate emergency when The Stoudamire is activated to serve as a temporary warming or cooling center. Scheduled programs serve as interventions to reduce the risk of

negative health impacts during extreme heat or cold. Existing communication channels during climate-related emergencies increase resident use of the Hub who express both appreciation and a sense of belonging to the center. A comparative assessment of the different communication strategies reveals the particular effectiveness of personalized reminder calls and a weekly informational email bulletin because they generate needed familiarity and knowledge that residents expect. Challenges to the effectiveness of communication about climate emergencies included lack of clarity in the messaging of scope of services of the Hub and the ability for staff to respond to the time-sensitive nature of climate related conditions. The analysis contributes to existing scholarship on by highlighting the role of relevance in addition to salience, credibility, and legitimacy in scientific knowledge communication.

Spatial patterns of exposure to extreme heat in Ogden, Utah
Speaker: Daniel Bedford

As the climate changes, heat waves are becoming more severe, more frequent, and are lasting longer, and cities have a growing responsibility to develop and implement strategies for mitigating the resulting health impacts on residents. Urban landscape features can amplify or reduce the high temperatures experienced during heat waves. For example, large asphalt parking lots amplify heat; well-watered, tree-filled parks reduce it. In general, these landscape features are not equally dispersed within U.S. cities, with cooler landscapes found in locations with more wealth and fewer racial and ethnic minorities.This poster describes an initial effort to measure and map the geography of extreme heat across Ogden, Utah, a city of approximately 87,000 people about 35 miles north of Salt Lake City. Over 50 thermometers were deployed in four sections of the city, recording temperature every hour throughout the summer of 2023. The research was planned loosely in conjunction with Ogden City officials, with the goal of understanding which places and people were most at risk from extreme heat. Initial results suggest that neighborhoods occupied by some of the city's most vulnerable residents also experience the greatest exposure to extreme heat, and that variability within neighborhoods was occasionally high.