Environmental Science and Policy Program

Student Research Symposium

Fall 2024

October 11, 2024

Kellogg Hotel and Conference Center

East Lansing, MI

Agenda

Time	Activities
8:00 - 8:45 AM	Registration and breakfast (Lincoln Room)
8:45 - 9:00 AM	**Opening Remarks by Dean Donnellan (College of Social Science)**
9:00 - 9:50 AM	**Keynote Talk: Dr. Norbert Kaminski** (Pharmacology & Toxicology): **Title:** The benefits and challenges of interdisciplinary research. NIH Superfund Research Centers as a case study
9:50 - 10:00 AM	**Group photo** and coffee break (Lincoln Room)
10:00 - 11:50 AM	Concurrent Oral Sessions • Oral Session #1 (Lincoln Room) • Oral Session #2 (Room 103A) • Oral Session #3 (Room 103B)
11:50 - 12:00 PM	Break
12:00 - 1:20 PM	Poster Session (Lincoln Room)
12:30 PM	Lunch (Lincoln Room)
1:20 - 1:50 PM	Oral Session #4 (Lincoln Room)
1:50 - 2:00 PM	Closing Ceremony (Lincoln Room)

Welcome and Opening Remarks

Dean Brent Donnellan, PhD

College of Social Science
Michigan State University

Dr. Brent Donnellan is the Dean of the College of Social Science where ESPP is housed in, and Professor of Psychology. Brent served as the Chairperson of the Department of Psychology from 2018 to August of 2022. He investigates research questions at the intersections of personality psychology, developmental psychology, and psychological assessment. Brent's current research efforts focus on the assessment of well-being, personality trait development, and methodological reform in psychological science. He is the Senior Personality Editor at Collabra: Psychology and is the co-author with Richard E. Lucas of the *Great Myths of Personality* published in 2021.

Keynote Speaker

Norbert Kaminski, PhD

Professor of Pharmacology and Toxicology
Director of the Center for Research on Ingredient Safety
Director of the Institute for Integrative Toxicology
Michigan State University

Norbert Kaminski, PhD is the Director for the Center for Research on Ingredient Safety (CRIS). CRIS is focused on chemical ingredient safety in consumer products including food and beverages. He also is the Director of the Institute for Integrative Toxicology (IIT). IIT is a campus-wide organizing unit for toxicology research and graduate training at MSU. He is also the Food and Consumer Product Ingredient Safety Endowed Chair. He holds joint appointments in the College of Human Medicine and Veterinary Medicine.

He has over 40 years of experience in toxicology with research interests in immunotoxicology and immunopharmacology. He has published over 180 papers in the peer reviewed literature. He has served on scientific advisory committees for National Academy of Science and the US Environmental Protection Agency and has served as a member of the NIEHS National Advisory Environmental Health Sciences Council. Dr. Kaminski served as the President for the Society of Toxicology (2014-2015). He received the Society of Toxicology Merit Award (2020) and the George Scott Award from the Toxicology Forum (2017). Dr. Kaminski received a dual major PhD in Toxicology and Physiology from North Carolina State University.

Title: The benefits and challenges of interdisciplinary research -- NIH Superfund Research Centers as a case study.

Abstract: The objective of this presentation will be to discuss both the benefits and challenges of conducting interdisciplinary research. The NIEHS Superfund Research Program, which funds interdisciplinary P42 Superfund Research Centers (SRC), including the MSU SRC, will be discussed as a case studies. The elements of a P42 SRC will be introduced and then used to provide examples of interdisciplinary collaborations and the advantages this approach provides when tackling complex research problems.

Oral Session #1

(Lincoln Room, Session Chair: Jing Zhou)

Time	Presenter	Title
10:00 AM	Pei-Jyun Lu	Factors Influencing Policy Termination: Cloud Seeding Program in Kansas
10:15 AM	Sungmin Cheu	Effects of Crop Insurance on Water Use: Mitigating Effects of Irrigation Costs
10:30 AM	Leo Baldiga	The Fading Echo? Stagnation, Diversification, Exit, and Continuity in Aquaculture in Central Thailand
10:45 AM	Parker Hopkins	Agroforestry in the Great Lakes: Assessing Landowner Intentionality and Land Use Practices (Withdrawn)
11:00 AM	Emily Milton	Honest Brokering Isotopic Methods in Environmental Archaeology
11:15 AM	Yousef khajavigodellou	System Thinking of Water Bankruptcy: A Systemic Approach in the Water-Food-Energy Nexus of Transboundary River Basins
11:30 AM	Michele Remer	Tourism and Species Invasion in a Warming Arctic

Oral Session #2

(Room 103A, Session Chair: Jincheng Huang)

Time	Presenter	Title
10:00 AM	Angelique Willis	Evaluating Inequity in Drinking Water Violations in Metro Atlanta
10:15 AM	Graham Diedrich	The Race for Renewables: Modeling Renewable Energy Productivity Amid Local Siting Restrictions in Michigan
10:30 AM	Jae-Yu Jung	Do Charging Stations Care About the Electricity Rates?
10:45 AM	Musab Wedyan	Exploring Visitor Satisfaction in Urban Parks: Insights from Sentiment Analysis and Facility Usage
11:00 AM	Johnny Musumbu	Localizing Sustainable Development at Natural World Heritage Sites in Africa: Implications for Conservation and Socioeconomic Development of the OKapi Wildlife Reserve in the Eastern part of the D.R. of Congo.
11:15 AM	Tiffany Williams	Fostering trusting relationships between health agencies and citizens: Centering community vulnerability and increasing perceptions of awareness
11:30 AM	Kate Wernicke	An analysis of previous decision frameworks for prioritizing contaminants in potable water.

Oral Session #3

(Room 103B, Session Chair: Nudrat Fatima)

Time	Presenter	Title
10:00 AM	Liang Zhao	Tracking Chlamydia and Syphilis in the Detroit metro area by molecular analysis of environmental samples
10:15 AM	Sandhya Sharma	Spatial and Temporal Drivers of Wildfire Severity in Nepal: A Study with High-Resolution ECOSTRESS Data
10:30 AM	Alexandra Sexton	A new toxicity testing framework: Interpreting complex PFAS mixtures for ecological risk assessment in Daphnia magna
10:45 AM	Lala Kounta	Marine heat waves under climate change and climate intervention
11:00 AM	Muhammad Bilal Zafar	Advancing Flood Resilience through High-Resolution Hydrodynamic Modeling: Insights from the Middle Mississippi River
11:15 AM	Zhicheng Xu	An Integrated Methodology for Evaluating Climate Vulnerability and Resilience in Midwestern Rust Belt Cities: A Framework for Policy Development and Urban Planning
11:30 AM	Tasha Siame	Lead Contaminated Groundwater Exposes Residents to Health Risks in Makululu, Zambia

Poster Session

(Lincoln Room)

Poster #	Presenter	Title
#1	Daniel Horowitz	Organized Opposition and Support for Renewable Energy Systems in the Midwest
#2	Zhiliang Xu	Transport and Distribution of Per- and polyfluoroalkyl Substances in Soil Profiles from Land Application of Biosolids
#3	Aman Shrestha	Investigating Sustainable Irrigation Practices and Water Management in the Mississippi River Basin using Community Land Model
#4	Mohsen Faghihinezhad	Exploring Substate Amendments for Trichloroethene Biodegradation in Soils and Sediments
#5	Andrew Huang	Evaluation of Cation-Bridging Sorption of Per- and Polyfluoroalkyl Acids by Soils
#6	Clara Graucob	How much resilience is there in urban resilience plans?
#7	Harley Curtiss	Casparian Strip can Reduce PFAS Transport within Plants
#8	Andreana Louise Roxas	Perception of Non-Energy Impacts for Industrial Energy Efficiency Measures in Small and Medium Sized Manufacturers in the Midwest
#9	Maede Dashtpeima	The Overlooked Mechanisms of Atmospheric Microplastics from the Plastic Packaging on the Sources and Regulations.
#10	Phyllis Angemwin Gyang	Addressing Community Vulnerability to Dam-Induced Floods: A Case Study of the Bagré Dam
#11	Coumba Niang	Influence of the Madden Julian Oscillation on extremes precipitations and its state-of-art climate CMIP6 historical simulations over West Africa
#12	Saesol Kang	EPA water quality standards and their influence on water quality
#13	Qucheng Zhang	Between the Lines: A Critical Discourse Analysis of Chinese Climate White Papers

#14	Katherine Foss	Hydrophobicity of Apple Skin: Effects of Waxing and Washing on Interfacial Interactions with Viruses. A comparative U.S.-France-China study
#15	Ahmed Elkouk	On improving land model simulation of reservoir release and storage across the American Southwest
#16	Anurag Ganapathi	Upcycling Polyolefin Waste for Sustainable Hot-Melt Adhesives: Advancing Circularity in Adhesive Production
#17	Mohammed Imran Khan	Advancements in Hypersaline Wastewater Treatment: The Promise of Quasi-Liquid Surfaces to Reduce Salt Scaling
#18	Xin Lan	Forecasting Vertical Lake Water Temperature Profiles with a Process-Guided Deep Learning Approach
#19	Qianqian Dong	Immobilization of PFAS in Soil Amended with Geosorbents
#20	Natalie Overton	Who's Going Green? Mapping Pro-Environmental Consumer and Political Behaviors

Oral Session #4

(Lincoln Room, Session Chair: Joe Hamm)

Time	Presenter	Title
1:20 PM	Jayla Simon	Advancing circularity among the built environment through the comprehensive study of the structural lifecycle, Domicology.
1:35 PM	Sampriti Sarkar	Aging infrastructure and altruistic preferences: consumers' valuation for water and sewer policies

Faculty Judges

- Anthony Kendall (Earth and Environmental Science)
- Jennifer Carrera (Sociology)
- Wei Zhang (Plant, Soil and Microbial Sciences)
- Geoff Henebry (Geography, Environment, and Spatial Science)
- Soren Anderson (Agriculture, Food, and Resource Economics)
- Yadu Pokhrel (Civil and Environmental Engineering)
- Michael Olabisi (Community Sustainability)

List of Abstracts

*Abstracts are listed in alphabetical order by the presenter's last name which is in **Bold.**

The Fading Echo? Stagnation, Diversification, Exit, and Continuity in Aquaculture in Central Thailand

Leo Baldiga, Ben Belton, Yan Lin

This paper examines the historical development and current state of aquaculture in central Thailand, through the lens of Szuster's (2003) ""Boom, Bust, and Echo"" framework. We integrate insights from geospatial analysis with quantitative surveys and in-depth qualitative interviews with aquaculture farmers. We find that while aspects of Szuster's framework still apply, aquaculture and associated land cover land use change (LCLUC) entered a more complex phase over the past two decades, where stagnating growth and processes of cautious but continuous adaptation to changing market conditions replace stark 'boom' and 'bust' cycles. Key drivers include long term declines in global shrimp prices, the growth of domestic markets for shrimp, trade and price shocks, policy shifts, and environmental challenges associated with climate, pollution, and disease. The confluence of these factors is increasingly leading farmers to seek alternatives to intensive production. Unlike during previous periods of rapid expansion or contraction, aquaculture LCLUC has increasingly stabilized, with small-scale conversions from and reversions to agriculture taking place simultaneously. While aquaculture farmers are increasingly squeezed by multiple pressures, many pursue adaptation strategies to manage them. These include diversification into alternative crops and off-farm activities, cost-cutting, and modifying farming practices. Exiting aquaculture completely, selling land, or giving up rented land is rare. In examining the ""fading echo"" of Central Thailand's aquaculture boom, this research provides insight on long-term trajectories agrarian change and continuity in the aftermath of a crop boom.

Effects of Crop Insurance on Water Use: Mitigating Effects of Irrigation Costs

Sungmin Cheu, Molly Sears

Excessive water use for irrigation can accelerate the depletion of water resources, undermining agriculture's resilience to weather-related shocks. Understanding how farmers make water use decisions is important for developing effective policies to manage water resources. This study investigates the effect of crop insurance on water use. Using crop-specific water use data and unit pumping costs for groundwater extraction, we analyze moral hazard behavior in water use

and the effect of pumping costs on water use responses to insurance participation. To address potential endogeneity between water use and insurance participation, we adopt an instrumental variable approach using government-set premium subsidy levels and insurance participation from the previous year. We focus on areas overlying the High Plains Aquifer where groundwater serves as the primary source for irrigation. We find that an increase in insurance participation raises per-acre water use when pumping costs are low. For average pumping costs, a one percentage point increase in insurance participation leads to a 0.6\% increase in per-acre water use. When the pumping costs are high enough, we observe moral hazard in water use, where per-acre water use decreases in response to insurance coverage. These findings provide policy implications that the programs increasing water prices may lead to over-pricing and inefficient use of resources, if moral hazard effect is not considered.

Casparian Strip can Reduce PFAS Transport within Plants

Harley Curtiss, Geoff Rhodes, Raymond Hammerschmidt, Wei Zhang, and Hui Li

PFAS enters agricultural production systems primarily through irrigation with contaminated water supply and/or land application of biosolids in farmland as soil amendment. Many PFAS demonstrate uptake by crops and become distributed throughout the plant from roots to shoots, into edible portions. This occurrence introduces PFAS into the food chain, raising significant concern regarding human and environmental health. Further investigation of factors that instigate accumulation and translocation of PFAS within plants is required to identify effective prevention and remediation measures. One factor being considered is the Casparian strip. Located in plant root cell walls, the Casparian strip functions as a barrier against contaminant uptake by impeding transportation beyond roots. Model plant Arabidopsis thaliana wildtype and mutant strain possessing an incomplete Casparian strip were examined to evaluate the efficacy to block PFAS uptake. When compared to the wildtype, the mutant strain maintained comparable transpiration rates and biomass at harvest after 120h of uptake time. PFAS accumulation in roots was similar across both strains; however, significantly higher PFAS concentration was observed in the shoots of the mutant. Advanced microscopy techniques will be used to examine physiological characteristics of the Casparian strip to determine its role in transportation and distribution of PFAS in plants.

The Overlooked Mechanisms of Atmospheric Microplastics from the Plastic Packaging on the Sources and Regulations.

Maede Dashtpeima, Yoorae Noh

Microplastics (MPs) are now one of the top prioritized environmental concerns in the plastic world. Extensive research has been conducted on detecting MP in marine and soil environments, however, microplastics in the atmosphere are still poorly investigated. The atmospheric MPs have the potential to directly cause air pollution and adverse impacts on human health. Besides, it can be suspended and migrated to remote areas, affecting plastic contamination in marine and terrestrial environments through various pathways. Unfortunately, the sources and fate of the atmospheric MPs are not clearly defined and explored. Our study explored the main sources of atmospheric MPs from the packaging industry, which is the most prominent contributor to plastic production (40%) and waste (60%). The poster presentation will sectionize the point sources of atmospheric MPs considering the life cycle of packaging from production/processing to single-use and disposal, and recycling. It will also clarify the pathways by which these particles are reintroduced into the ecological environment. The poster will highlight the adverse effects of atmospheric MPs on human health, especially occupational risks in the worksite. Through the unveiling of atmospheric MPs sources, the scope of MPs R&D will be reconsidered, and occupational health guidelines will be devised.

The Race for Renewables: Modeling Renewable Energy Productivity Amid Local Siting Restrictions in Michigan

Graham Diedrich

This research, supported by the ESPP Competitive Research Grant, examines the relationship between renewable energy productivity and local siting restrictions in Michigan, focusing on wind and solar at the township level. It seeks to determine whether localities with the most productive potential are more likely than not to have restrictive ordinances that hinder development or ban sitting altogether.

This is an incredibly important issue, as Michigan has statutorily obligated itself to reach 100% carbon neutrality by 2050. By analyzing the interplay between renewable energy productivity and local restrictions, this research will provide insights into how such restrictions might affect Michigan's progress toward its climate goals. The study will explore whether these restrictions are creating barriers to optimal renewable energy deployment and assess the broader implications for permitting, economic development, and equity, especially as the state prepares to implement new permitting controls starting in late 2024.

Immobilization of PFAS in Soil Amended with Geosorbents

Qianqian Dong, Zhiliang Xu, Wei Zhang and Hui Li

The contamination of per- and polyfluoroalkyl substances (PFAS) in agricultural land is widespread across the United States due to exogenous inputs from irrigation with treated water and land application of biosolids. PFAS can be taken up and accumulated in plants, raising a significant concern about food safety and human health. Amendment with geosorbents and carbonaceous adsorbents to PFAS-contaminated soil could be an effective approach to reduce the bioavailability and ecotoxicity of PFAS in the environment. However, currently there is no general framework available to guide the selection of appropriate sorbents or determination of amendment application rate to balance economy and environmental mitigation effectiveness. This study was conducted using the batch equilibration method to measure sorption of a series PFAS and their precursors by four types of amendment sorbents. Sorption and desorption isotherms of PFAS in water-soil systems amended with 0.5%, 1%, 2%, 5%, and 10% of selected sorbents (based on the soil weight) were measured to evaluate the effectiveness of the amendments in the immobilization of PFAS in soil matrices. The results obtained here will serve as the initial estimates of the cost-effective framework of the practice of amending geosorbents to PFAS-contaminated soils to limit PFAS movement and plant uptake in agricultural land.

On improving land model simulation of reservoir release and storage across the American Southwest

Ahmed Elkouk, Yadu Pokhrel, Lifeng Luo, Elizabeth Payton, Ben Livneh

As Earth System Models (ESMs) refine their focus on socially relevant issues such as water resource management, the importance of accurate simulation of reservoir release and storage grows. The simulation of human intervention including large reservoirs in the land model component of ESMs exhibits notable biases in highly managed regions. This work focuses on a novel application of the Community Terrestrial Systems Model (CTSM, also known as CLM) across the American Southwest — one of the most regulated regions in the world. To improve the hydrologic performance of land modeling in this region, we employ a multi-objective emulator-based optimization scheme for CTSM parameter estimation and evaluate reservoir operation algorithms in a river-floodplain hydrodynamic model (CaMa-Flood). The performance of CTSM in terms of natural flows — the inflows to reservoirs — which would exist without human interventions, is notably improved across the region. We evaluate reservoir

representation including generic and data-inferred reservoir operation rules to understand their impact on reservoir release and storage for integration into CTSM. Our overarching goal is to lower the barrier of applying state-of-the-science land models in highly managed regions to support sustainable water resource management.

Exploring Substate Amendments for Trichloroethene Biodegradation in Soils and Sediments

Mohsen Faghihinezhad, Alison M. Cupples

Background/Objectives. The overall rationale is to provide knowledge to enhance the aerobic remediation of the groundwater contaminant, trichloroethene (TCE), for oxic sites. Although anaerobic bioremediation has been successful for many chlorinated solvent sites, it has significant limitations. For example, it is unlikely to be employed at large oxic sites because of the requirement for highly reducing conditions and the associated cost of driving such large sites anaerobic. Also, the accumulation of the known human carcinogen, vinyl chloride, from the dechlorination process represents a significant risk, if complete dechlorination does not occur. Aerobic contaminant biodegradation has the added advantage that biodegradation can occur to low contaminant concentrations. The aim is to determine which microorganisms are associated with the most sustainable rates of co-metabolic biodegradation of TCE in environmental samples and this will be achieved by examining the fate of carbon from TCE using stable isotope probing (SIP).

Approach/Activities. Sediments collected from two contaminated sites and one agricultural soil were used in microcosm studies to examine the impact of different substrate amendments on TCE biodegradation rates. For each soil or sediment, four microcosms were amended with 13C labelled TCE, four were amended with unlabeled TCE and three remained as abiotic controls. The study involved two different substrates previously associated with TCE removal, propane and methane. TCE removal rates are currently being monitored and when approximately 75% of TCE is degraded, nucleic acids will be extracted from the microcosms. The extracted DNA will be subject to ultracentrifugation and fractionation to separate the 13C labeled DNA from background DNA. The fractions will then be subject to 16S rRNA gene amplicon sequencing. Additionally, the phylotypes associated with a group of key functional genes (propane monooxygenase, toluene monooxygenase, methane monooxygenase and ammonia monooxygenase) will be determined using a predictive approach.

Results/Lessons Learned. The removal of TCE is ongoing and is expected to be completed within a short time frame. Following this, DNA will be extracted and SIP sequencing data will be analyzed using Mothur, PICRUSt2 and RStudio. The molecular analysis is expected to be completed quickly, as these as commonly used methods within our research group. The data

generated on the key functional genes and active microorganisms will be used to design qPCR assays to test groundwater and sediment samples to determine if these microorganisms are present and active across contaminated sites.

Hydrophobicity of Apple Skin: Effects of Waxing and Washing on Interfacial Interactions with Viruses. A comparative U.S.-France-China study

Xunhao Wang, Katy Foss, Xuanfeng Wang, Julie Mendret, Geoffroy Lesage, Samuel D. Snow, Peng Chen, Volodymyr V. Tarabara

Depending on where you purchase your produce from, the surface of the produce can vary. When looking specifically at apples, the surface of the apple can change based on the producer's choice to leave the apple with its natural coating or add a wax coating on the surface to preserve the apple. After you purchase the apple from the producer, you then have the choice of changing the surface again by deciding to wash the apple before you consume it. These choices also affect the consumer who is eating the apple, as the apple's surface can have an impact on what viruses and other particles can stick to the apple and therefore enter your body when the apple is consumed. This research dives deeper into this to see how viruses interact with the skin of fuji apples in the U.S., France, and China and see if the production methods can have an affect on this from country to country.

Upcycling Polyolefin Waste for Sustainable Hot-Melt Adhesives: Advancing Circularity in Adhesive Production

Anurag Ganapathi, Mohamed Shaker, Muhammad Rabnawaz

The widespread use of virgin paraffin waxes combined with poly(ethylene-co-vinyl acetate) (EVA) in hot-melt adhesives (HMAs) has raised environmental concerns due to their reliance on non-renewable resources. This study aims to develop a more sustainable alternative by formulating partially recycled HMAs using upcycled waxes derived from mixed polyolefin waste. Through chemical recycling via pyrolysis, mixed polyolefins (e.g., high-density, low-density, linear low-density polyethylene, and polypropylene) were converted into waxes with high yields of up to 92%. These upcycled waxes were blended with EVA and gum rosin to produce HMAs, whose thermal properties and seal strength were evaluated against a commercially available HMA. Remarkably, the HMA containing upcycled waxes demonstrated comparable seal strength and thermal performance to its conventional counterpart, validating the efficacy of plastic waste upcycling in adhesive applications.

This research highlights a novel approach to mitigating plastic waste by promoting circularity and reducing reliance on virgin resources. From an environmental policy perspective, this innovation supports the transition toward a circular economy, aligning with global efforts to reduce plastic pollution and encourage sustainable waste management practices. By showcasing the potential of upcycled materials in adhesive production, the study provides valuable insights for both industrial applications and policy frameworks.

How much resilience is there in urban resilience plans?

Clara Graucob

There is growing recognition that climate change will significantly impact our cities, as well as interact with pre-existing issues in urban areas, such as socio-economic inequities, aging and inadequate infrastructure, and environmental pollution. Despite increasing interest in resilience planning to address these complex challenges, the integration of resilience principles into planning documents remains a challenge. This research analyzes 39 urban resilience plans adopted in U.S. cities above 100,000 inhabitants in relation to their implementation of the 7 Principles of Social-Ecological Resilience (Biggs et al., 2015). While the Biggs et al. principles are only one of several ways of explicating resilience, they are a useful way to link on-the-ground projects with a more conceptual framework of resilience.

Using qualitative coding by resilience scholars, preliminary analyses revealed a somewhat superficial engagement with resilience thinking, where planned actions were not grounded in resilience theory. Also, there seems to be a tendency to incorporate some aspects of the principles but not others.

Thus, our analysis points to the need to better translate the principles into guidelines for thinking about and planning actions to manage resilience. If resilience is to live up to its potential for urban governance, resilience thinking and its components as discussed in the literature need to be made more accessible and practical to urban planners.

Addressing Community Vulnerability to Dam-Induced Floods: A Case Study of the Bagré Dam

Phyllis Angemwin Gyang

Frequent spillovers from the Bagré Dam in West Africa pose significant risks to downstream communities, where flooding disrupts livelihoods and threatens vulnerable populations. This

research aims to explore the impacts of these dam-induced floods by developing a framework that integrates insights from both physical flood processes and human behavioral responses. By focusing on the interaction between natural flood events and community vulnerability, the study seeks to address critical gaps in current flood risk assessment and management strategies.

At this stage, the research emphasizes the identification of key factors influencing flood risk, such as the spatial extent of floods and the adaptive capacity of affected communities. The proposed framework will incorporate interdisciplinary perspectives, drawing from hydrology, social sciences, and environmental policy to better understand the relationship between floods and community resilience. This approach is designed to offer new insights into improving flood preparedness, emergency response, and long term adaptation strategies for communities at risk. Ultimately, findings seek to contribute to more comprehensive flood risk management solutions, that can support decisionmakers in crafting policies that enhance community resilience in the face of increasing environmental and social pressures.

Agroforestry in the Great Lakes: Assessing Landowner Intentionality and Land Use Practices

Parker Hopkins

This research investigates the extent and intentionality behind agroforestry practices in the Great Lakes region, specifically within Michigan, Ohio, and Wisconsin. While agroforestry is recognized for its environmental and economic benefits, such as biodiversity enhancement and soil conservation, there is limited understanding of landowner motivations in implementing these systems, nor is there a generally accepted spatial survey of practices on a national or sub-national scale. This study employs novel remote sensing techniques alongside landowner surveys and interviews to map agroforestry practices and analyze the deliberate choices behind their implementation, design, and maintenance. By examining the spatial patterns of agroforestry and linking them to landowner decisions, the research aims to provide insights into how intentional land use can promote ecological resilience and sustainable land management. The findings will contribute to policy discussions on better measuring and supporting agroforestry adoption in the lakes region, informing land use strategies that integrate environmental stewardship with agricultural productivity.

Organized Opposition and Support for Renewable Energy Systems in the Midwest

Daniel A Horowitz, Doug Bessette

As the size of renewable energy projects and the speed of development increase with our state and federal decarbonization targets, the role and influence of organized groups in supporting or opposing those projects continues to grow. This study utilizes data from the Sabin Center for Climate Change Law and Robert Bryce Report as a starting point to build a first-of-its-kind database of organized online support and opposition groups. The database includes group names, states, townships and counties, group and member counts, project and developer names, dates of events, and finally a number of hyperlinks including local ordinances and local news articles for further analysis. So far in our process we have recorded over 250 entries of organized opposition or support in the Midwest region, a number which grows on a daily basis. The goal of this database and studies is to better understand how developers and states alike can improve development processes and community outcomes, and provide community-acceptance researchers access to a growing body of opposition and support group data. The database currently focuses on wind and solar projects in the US Midwest, but work has begun to expand its reach across the US. Additionally, we are currently using the database to explore the relationship between project size and opposition, the types and locations of projects that receive the most opposition, and finally which developers have faced the most opposition.

Evaluation of Cation-Bridging Sorption of Per- and Polyfluoroalkyl Acids by Soils

Andrew Huang, Wei Zhang, Brian J. Teppen, and Hui Li

Per- and polyfluoroalkyl substances (PFAS) are a diverse group of widespread contaminants, and their potential threat could be essentially related to their environmental fate and sorption in soils. Sorption of PFAS by soils is affected by the presence of cations in soil and water; sorption could be enhanced by interacting with multivalent cations on soil surfaces. In this study, sorption of PFAS with carboxylic head groups and sulfonic head groups (PFNA and PFOS) by K+- and Ca2+-saturated soils was measured to evaluate the contribution of cation-bridging interaction in soils. To do so, we added several low molecular weight organic ligands, such as acetate, succinate, malonate, benzoate, o-phthalate, and phosphate, to reduce the numbers of the binding sites for PFAS. Several lines of evidence suggest the existence of cation-bridging interactions. 1) Much higher sorption was observed by Ca-saturated soils than that by K-saturated soils. 2) The presence of organic ligands could block a portion of Ca2+-bridging sites resulting in a decreased PFAS sorption. Both ligands and PFAS compete for the cation-bridging sites i.e. Ca2+ associated with soil surfaces. 3) PFAS with a sulfonic head group could form stronger interaction with Ca2+-soils compared to carboxylic group. A speciation model will be

developed to quantitatively describe the cation-bridging interaction between PFAS and Ca2+ on soil surfaces.

Do Charging Stations Care About the Electricity Rates?

Jae-Yu Jung

This paper investigates the relationship between electricity rate plans and the installation of EV charging stations. The insufficient availability of public charging stations is a major hurdle in the expansion of EV charging infrastructure. To address this, some utility companies have introduced electricity tariffs specifically for EV charging.

I constructed a zip code by quarter level panel using two primary datasets: (1) the number of EV charging stations in the contiguous state from 2015 to 2022, imported from the Monthly Energy Review, and (2) commercial electricity tariffs of investor-owned utility companies in the United States collected from the US Rate Database, webpages of utility companies and public utility commissions.

This study employs the local projection difference in differences method and the panel synthetic control method to estimate the impact of newly introduced EV-related electricity tariffs on EV charging station entries. These methods are particularly effective in the presence of staggered interventions and when dynamic effects are of interest. The results show that the introduction of EV-dedicated tariffs led to the installation of approximately one additional charging port.

This paper makes two contributions. First, it emphasizes the importance of the electricity costs in the EV charging station installation decisions. Second, it adds another implication to the existing literature on electricity rates and the profitability of charging stations.

EPA water quality standards and their influence on water quality

Saesol Kang, Molly Sears

Phosphorus pollution significantly impacts U.S. waterways, causing harmful algal blooms that affect aquatic life and human health. The 2017 EPA National Lakes Assessment identified phosphorus as the primary stressor in 45% of lakes. Despite the Clean Water Act's mandate for states to adopt numeric water quality standards for phosphorus, only 24 states and five territories had done so by 2024, indicating inconsistent implementation.

This study evaluates the impact of these standards on water quality across the U.S., using data from 3,406 river and stream sites between 1981 and 2022 from the Water Quality Portal. This research employs a fixed effects model and a synthetic control approach given the varied adoption periods of numeric standards by states and the uniqueness of watersheds. We control for the previous period's phosphorus levels, year and state fixed effects, temperature, and precipitation.

Findings reveal that water quality standards have varied effects across states. This research contributes to environmental science and policy by providing empirical evidence of the effectiveness of numeric water quality standards in reducing phosphorus levels. It offers insights into agricultural management and environmental health, underscoring the importance of stringent policy enforcement in pollution mitigation and public health protection.

System Thinking of Water Bankruptcy: A Systemic Approach in the Water-Food-Energy Nexus of Transboundary River Basins

Yousef Khajavigodellou

The Water-Energy-Food (WEF) nexus is an intricate framework used to examine resource interdependencies, particularly in transboundary river basins where the interplay between these sectors influences water management strategies. This research presents a comprehensive System Dynamics Model (SDM) approach to address water bankruptcy within the Nile River Basin (NRB), an area challenged by demographic pressures, resource scarcity, and climate variability. The study explores how the WEF nexus exacerbates water shortages and proposes integrated strategies for resource management. The model incorporates key variables such as population growth, energy consumption, and agricultural demands, using feedback mechanisms to assess the impacts of these factors on water availability. By simulating scenarios of varying water pressure, the model highlights the importance of cooperative policies, technological interventions, and adaptive management in mitigating water stress. This research underscores the significance of collaborative transboundary water agreements and efficient resource use to secure the long-term sustainability of the Nile Basin's water resources. The findings offer critical insights for policymakers and stakeholders to prevent water bankruptcy and promote resilience in complex river basins like the NRB.

Advancements in Hypersaline Wastewater Treatment: The Promise of Quasi-Liquid Surfaces to Reduce Salt Scaling

Mohammed Imran Khan, Bei Fan

Desalination addresses global freshwater shortages, but the byproduct, hypersaline brine, threatens ecosystems and health. Recovering valuable salts from this waste represents an economic opportunity. Zero Liquid Discharge (ZLD) desalination aims to eliminate liquid waste, producing both clean water and salts. However, current ZLD systems face challenges such as high energy consumption and low solar energy efficiency. This study presents a novel Quasi-Liquid Surface (QLS) to improve evaporation-based ZLD desalination by reducing salt adhesion and improving efficiency.

Under 1 sun illumination, hypersaline brine droplets on the QLS exhibited lower adhesion to salt crystals (less than 1 mN mg−1) compared to standard PDMS-coated surfaces (40 mN mg−1). The QLS's smooth surface inhibits salt nucleation directly on the substrate, promoting salt crystallization at the brine-air interface and forming dense, compact crystals. Additionally, as evaporation concludes, the liquid retreats from the QLS, minimizing contact and allowing easy detachment of salt crystals with airflow.

The results demonstrate that QLS-based evaporation enhances salt management in hypersaline wastewater, supporting ZLD principles. This approach offers a sustainable solution for treating saline wastewater, contributing to environmental sustainability and water resource conservation.

Marine heat waves under climate change and climate intervention

Lala Kounta, Lifeng Luo, Phoebe Zarnetske

Greenhouse gas emissions have increased rapidly, causing a rise of global mean temperature. The frequency of extreme events in the ocean such as marine heat waves (MHW) has increased, leading to numerous ecological disasters and socio-economic loses. Climate intervention has been proposed to reduce global mean temperature and may moderate climatic extremes, yet characterizing the impact on MHW has not been addressed. In this study we evaluate how future scenarios will impact MHWs in time and space. We compare a climate change scenario using the moderate climate change scenario, SSP2-4.5, with a climate intervention scenario ARISE-SAI-1.5, where stratospheric aerosols are injected at ~ 21km in 2035 to maintain the global mean surface air temperature near 1.5C above the pre-industrial level. Results show that climate intervention could reduce MHW duration and intensity globally. However, regionally, climate intervention generates heterogeneous results including increases in MHW duration and

intensity, with severe implications for marine life and fisheries. Investigating the potential impacts of climate interventions on MHWs at multiple scales is critical for informing climate policy and implementation planning as we approach major climate tipping points.

Forecasting Vertical Lake Water Temperature Profiles with a Process-Guided Deep Learning Approach

Xin Lan, Yue Deng

Lakes are sentinels of climate change because of their sensitivity to climate change. In-situ and satellite data revealed significant surface water warming in numerous freshwater lakes. However, deep water thermal dynamics remain poorly understood. Monitoring vertical water temperatures is crucial, as thermal stratification affects aquatic ecosystem dynamics. Such thermal gradients can potentially modulate species distribution and abundance by affecting metabolic rates, trophic interactions, migratory behaviors, and organism physiology.

Limited in-situ observational data and the constraints of remote sensing data only capture surface water information, which hindered comprehensive deep water monitoring. In addition, these data limitations impair the prediction accuracy of deep learning approaches, as they require extensive data. Finally, the computational demands and parametric uncertainties of physics-based models limit their application in water temperature prediction, especially for complex scenarios.

Thus, we employed a process-guided deep learning approach, integrating physics-based synthetic data pretraining with theory-driven regularization to enforce energy conservation, addressing the challenges above. We performed a comparative analysis of multiple deep learning architectures, such as Long Short-Term Memory Networks, Recurrent Neural Networks, and Transformers, to optimize our hybrid approach. Our method synergistically combines domain-specific knowledge with data-driven techniques, aiming to enhance predictive accuracy and physical consistency.

Factors Influencing Policy Termination: Cloud Seeding Program in Kansas

Pei-Jyun Lu, Mark Skidmore

While extensive literature explores policy adoption and technology diffusion, research on how policymakers decide to terminate policies and how these decisions are communicated to neighboring regions remains limited. This paper addresses this gap by examining the

termination of Kansas' cloud seeding program, providing insights for policymakers. The primary objective is to investigate the factors influencing the decision to terminate cloud seeding programs at the county level, contributing to the understanding of policy termination within the disaster risk management domain.

Kansas is recognized by the National Oceanic and Atmospheric Administration (NOAA) as one of the most hail-prone areas in the United States. Hailstorms in Kansas inflict significant damage, and cloud seeding has been regarded as a potential tool for mitigating this risk. Since 1972, the state and county governments have collaborated on cloud seeding programs for nearly four decades. The state government presented evidence suggesting a cost-benefit ratio of 37, indicating that every dollar invested could yield a return of 37 dollars in crop yield. Despite this substantial net benefit, many counties withdrew from the program, and by 2016, the state government suspended the program entirely.

This study employs a Logit model to analyze factors associated with cloud seeding program participation from 2002 to 2013 and a Cox proportional hazards model to evaluate factors influencing the termination decision-making process. The analysis tests four hypotheses derived from policy termination theory: fiscal stress, project efficacy, diffusion effects, and political ideology. The findings indicate that fiscal stress does not significantly impact termination decisions. However, perceptions of program effectiveness, based on recent experiences, appear to influence the termination decision. Additionally, the decisions of neighboring counties affect termination choices, aligning with policy diffusion theory.

Honest Brokering Isotopic Methods in Environmental Archaeology

Emily Milton

Reflexive institutional and scholastic ethics are important to the honest and transparent communication of research. My dissertation focuses on human dynamics in two diverse landscapes in southern Peru over the last 9,000 years, specifically, ecosystems in the high-elevation Andes and the hyper-arid Pacific coast. To conduct this work, I apply stable isotopic methods to ancient human, animal, and plant remains to reconstruct aspects of diet, culture, and geographic movement. So far data have revealed new insights about pre-colonization fertilization practices, high-elevation persistence, and long-term reliance in now-endangered seasonal ecosystems. Through my research, I have also witnessed how isotopic methods in archaeological contexts can be used, intentionally or otherwise, to perpetuate Western narratives and objectives. This talk will discuss major challenges for 'honest brokering' isotopic methods in environmental archaeology, and outline ways scholars can readjust to foster collaboration, challenge paradigms, and support climate monitoring.

Localizing Sustainable Development at Natural World Heritage Sites in Africa: Implications for Conservation and Socioeconomic Development of the OKapi Wildlife Reserve in the Eastern part of the D.R. of Congo.

Johnny Musumbu

The Africa continent displays exceptional cultural and natural sites considered to be of outstanding universal value that are important to present and future generations of all humanity (Rössler, 2010). However, it also accounts for 30 percent of sites on the list of sites in danger of the World Heritage (Turavinga, 2019) owing to diverse human activities and development. The 172 World Heritage Convention put forward the 2015 World Heritage Policy on Sustainable Development (WHPSD) that aims at "strengthening efforts to protect and safeguard the world's cultural and natural heritages to make them inclusive, safe, resilient and sustainable" (ICOMOS, 2017). This study proposes to research into the fit of the 2015 WHPSD provisions with the Convention, national laws, and broader sectorial policies that guide socioeconomic development in Africa, using the Okapi Wildlife Reserve (OWR) as a case study.

This research will be conducted in three phases. First, it will perform an institutional analysis of the fit of the 2015 WHPSD and the broader social, ecological, and institutional context of OWR in which it is found. Second, it will focus analytical attention to highlight the myriad social, cultural, and political influences that shape relationships between science, policy, and practice in the OWR. Third, it will use co-production to connect diverse societal actors to collaboratively produce knowledge, actions and societal change in the OWR.

Influence of the Madden Julian Oscillation on extremes precipitations and its state-of-art climate CMIP6 historical simulations over West Africa

Coumba NIANG; Lifeng Luo and Amadou T. Gaye

West Africa regions have been witnessing increasingly severe extreme weather events, particularly floods. Extreme events have important implications for rain-fed agriculture therefore the West Africa are particularly vulnerable to those events because of low adaptive capacity. However, the processes linked to the significant changes in climate over the regions in response to future warming is not well understood. This study aims to investigate the impact of Madden Julian Oscillation on the occurrence of extreme rainfall events and its state-of-art climate CMIP6 (Coupled Model Intercomparison Project Phase 6) historical simulations over

West Africa. The results show there is clear evidence that MJO influences rainfall pattern by favoring strong rainfall during the enhanced phase while the opposite is observed during the suppressed phase. In addition, the analysis shows that MJO exerts a large and significant impact on the probability of observing extreme precipitation. Looking at how CMIP6 models simulate the likelihood of extreme precipitation events, the analysis shows that the MJO continues to represent a great challenge for these latest generation GCMs. During enhanced MJO phases, only 1/3 of the models used show good skill in simulating the likelihood of extreme precipitation events however we noticed less coherency in the other ones.

Who's Going Green? Mapping Pro-Environmental Consumer and Political Behaviors

Natalie Overton

Understanding how individuals traverse the "behavior gap" - the gap between concern for the environment and acting on those environmental concerns - is the central goal for this working paper. Assessing Gallup Social Series Data from 2000-2022, with roughly 23,000 responses, I test the correlation between different types of environmental behaviors, reported self-identification with the "Environmentalist" movement in the US, and other demographic factors. I present a layout of the web of different kinds of pro-environmental behaviors spanning from consumer-oriented to political activism, portraying the correlations between each. This work contributes to our understanding of grouped behavior, predicting behavior, and policy implications for shaping environmental behavior.

Tourism and Species Invasion in a Warming Arctic

Michele Remer, Abigail Livingston, Jodi Coalter, Sydney Waloven, Jianguo Liu

In the past few decades, climate change has led to a loss of ice sheets, snow cover, permafrost, and glaciers across the Arctic. These rapid environmental changes are occurring during an increase in tourism and as a last chance to experience the Arctic in its present form. Accessing coastal tourism locations will also become easier because the decrease in ice sheets will open more pathways for shipping, which includes cruise ships and other passenger vessels, as well as vessels transporting goods and services for the tourism industry. However, tourism can lead to environmental damages, one of which is the spread of invasive species. Increased shipping

pathways and other transmission vectors of invasive species are projected to occur at the same time as this increased human activity. Because of the lack of data available for the Arctic, it is important to determine current knowledge on both topics before the climate warms further and tourism increases. Preliminary results from a scoping review will be discussed to determine the current state of research in this area. Recommendations for future research directions and potential policy ramifications will also be made.

PERCEPTION OF NON-ENERGY IMPACTS FOR INDUSTRIAL ENERGY EFFICIENCY MEASURES IN SMALL AND MEDIUM SIZED MANUFACTURERS IN THE MIDWEST

Andreana Louise Roxas; Kristen Cetin, PhD; Annick Anctil, PhD

The industrial sector accounts for a substantial amount of energy consumption in the United States. One strategy to mitigate this impact is to implement energy efficiency measures (EEM). However, economic barriers tend to hinder the implementation of such projects in a manufacturing facility, especially for small and medium-sized manufacturers (SMM) despite the available federal funding for these buildings. While most investment calculations for EEMs include energy and cost savings, it can be beneficial to consider non-energy impacts (NEI) – impacts beyond energy cost savings – in these reports and calculations to present a more accurate value for these projects. This study aims to identify strategies to make EEM projects more attractive for decision-makers to implement to close the gap of EEM implementation to support decarbonization policies. Results indicate that NEIs are important to manufacturers with the most cited NEIs being improved productivity, production reliability, and morale of workers. The results suggest that manufacturers generally believe there are NEIs associated with EEMs, some of which they also have observed post EEM-implementation. However, results also suggest while SMMs believe such NEIs exist, they may not have observed such benefits themselves, which may contribute to EEM-implementation skepticism, thus hindering efforts towards decarbonization.

Aging infrastructure and altruistic preferences: consumers' valuation for water and sewer policies

Sampriti Sarkar, Frank Lupi

Many water and sewer (WS) infrastructure in US is reaching end of its life. As infrastructure ages, it poses health and environmental risks to society. Along with aging infrastructure, water affordability for low-income households is another significant challenge. Although current WS

rates remain affordable for most consumers, rising rates are exacerbating affordability challenges for low-income households. However, most WS utilities do not have the necessary funds to address these challenges. In this study, we develop a choice-experiment for Michigan and Ohio residents to estimate the valuation of a policy that improves impact of aging infrastructure through infrastructure replacement and supports low-income households through a statewide affordability program. Given that altruistic preferences are likely to influence such decisions, we explore how altruistic preferences affect the marginal willingness to pay for the proposed policy attributes. Results indicate that respondents value improved impacts on health and environment through infrastructure replacement and valuation differs across income, altruistic preference, perceived status of respondent's own household, and their beliefs about beneficiaries of the support program. Considering these findings, we discuss policy implications. The insights from this study can inform academics, policymakers, and the broader public on designing effective policies to address both infrastructure and affordability issues.

A new toxicity testing framework: Interpreting complex PFAS mixtures for ecological risk assessment in Daphnia magna

Alexandra Sexton, Cheryl A. Murphy, Louise M. Stevenson, Roger Nisbet, Ferdinand Pfab, et al

Aqueous film forming foams (AFFF) commonly used in firefighting and on military bases are known to release a mixture of per- and poly- fluoroalkyl substances (PFAS) into the surrounding environment. The current methodology used in standardized toxicity testing cannot adequately evaluate the toxicity of mixtures, therefore, we are conducting modified standardized tests to observe lethal and sublethal toxicity (mortality, growth, reproduction) in Daphnia magna exposed to PFOS and a reconstituted PFAS mixture. Our goal is to determine if exposure to a PFAS mixture exhibits a different organismal and molecular-level effect than exposure to a single PFAS compound (perfluorooctane sulfonic acid, PFOS). The single-compound life cycle exposure to PFOS has been performed successfully, and the same modified OECD experimental methods will be applied to the subsequent PFAS mixture exposure. When exposed to aqueous PFOS, overlapping effects on survival and reproduction were observed that would not have been captured by standard acute or chronic toxicity testing parameters. With the development of this new complex mixtures testing framework, we hope to conduct prospective and retrospective risk assessment, reduce animal testing, and produce a new method to screen chemical mixtures that will inform hazard estimations and future remediation.

Spatial and Temporal Drivers of Wildfire Severity in Nepal: A Study with High-Resolution ECOSTRESS Data

Sandhya Sharma, Kyla Dahlin

2021 is considered one of the most crucial fire years in Nepal. By leveraging high-resolution ECOSTRESS data collected during the preceding year, as well as measurements from the fire season that runs from May to July, we aimed to better understand the dynamic changes in vegetation water stress, shaped by topography and spatial patterns, and their influence on burn severity. We also integrated MODIS land use/land cover (LULC) data and employed random forest modeling techniques and integrated predictors representing spatial autocorrelation and topographical features for an enhanced model.

Plant water stress was the dominant predictor of burn severity in Nepal, followed by spatial autocorrelation, aspect, and LULC. The predictability of burn severity varied significantly across different vegetation types and topographic classes, with high-elevation regions showing greater predictability. Open shrublands (land cover class 10) exhibited the highest predictability (R^2 = 0.66), where water use efficacy (WUE) was the leading predictor in very high elevation and medium-sloped areas. For woody savannas (land cover class 8) (R^2 =0.45) ET was the key predictor in very high elevation and gentle slopes.

Our results also highlighted the sensitivity of burn severity predictability to the time of day of ECOSTRESS acquisition. Afternoon WUE emerged as a key predictor for burn severity in open shrublands (R^2 = 0.59) and mixed vegetation types (R^2 = 0.38).

Incorporating the relative importance of factors in a wildfire prediction model can provide a more nuanced understanding of wildfire dynamics and aid in better forecasting by enhancing the model's accuracy, which is critical for improved emergency response planning and better management and allocation of resources.

Investigating Sustainable Irrigation Practices and Water Management in the Mississippi River Basin using Community Land Model

Aman Shrestha, Yadu Pokhrel

The Mississippi River Basin (MRB) is crucial for global food security, contributing to over $80 billion food economy. The region's agricultural practices vary significantly, with the eastern MRB largely dependent on rainfall, while the western MRB, particularly the High Plains Aquifer area, relies heavily on groundwater irrigation. Climate change and depleting groundwater necessitate changes in water management, impacting water-food-nutrient-ecological systems. This study

examines irrigation-hydrological cycle interactions under climate change using the Community Land Model version 5 (CLM5) at 0.05° resolution. An enhanced irrigation module incorporates drip, sprinkler, flood, and paddy irrigation methods. Irrigation withdrawals are validated against USGS monthly crop water use data. Preliminary results indicate improved simulation of irrigation water withdrawals and water balance components after the inclusion of varied irrigation techniques. Further analysis will provide insights on sustainable water management in the MRB's rainfed and irrigated areas. This research aims to inform adaptive strategies for maintaining agricultural productivity while preserving water resources in the face of climate change, contributing to long-term food and water security in this vital region.

Lead Contaminated Groundwater Exposes Residents to Health Risks in Makululu, Zambia

Tasha Siame, Kaampwe Muzandu

Groundwater contamination by lead occurs commonly in historically mined regions and presents health risks to exposed residents. Poor documentation of elevated lead levels in impoverished regions precludes the development of environmental contamination policies and interventions. This study investigates lead contamination and associated carcinogenic and non-carcinogenic health risks in Makululu, a large compound near the former lead mine in Kabwe City, Zambia. We analyzed 34 drinking groundwater samples from hand pump boreholes (n=21) and shallow wells (n=13). Lead concentration exceeded WHO and US EPA standards for safe drinking in 100% of boreholes (median=0.15 mg/L) and 77% of shallow wells (median=0.06 mg/L). Health risk assessments revealed that adults consuming borehole groundwater had an average daily dose of 0.005 mg/kg/day of lead exceeding WHO thresholds, with hazard quotients (HQ) indicating non-carcinogenic risks (HQ >1). Findings suggest that lead concentration in groundwater exceeds recommended safe drinking limits, and chronic exposure may lead to potential adverse health effects. While carcinogenic risk from elevated lead exposure remained within safe limits, other health risks warrant further examination. We shared findings with the Kabwe District Health Office and City Council to guide policies mitigating environmental pollution, enforcing water quality standards, and protecting public health in Makululu.

Advancing circularity among the built environment through the comprehensive study of the structural lifecycle, Domicology.

Jayla Simon, Kiera Tierney, Charlotte Peterson, Dr. Rex LaMore

Undergraduate and Graduate RA's at the MSU CCED have been engaged in extensive research to discover ways to advance 'Domicology' as a field of study. Interdisciplinary Domicological principles aim to reduce structural abandonment, blight and community degradation, and a perpetual cycle of carbon-emitting, waste-producing construction management practices. Domicological practices, such as Deconstruction, propose an alternative to demolition, diverting immediate and future environmental and community harms of structural abandonment, blight and community degradation, and a perpetual cycle of carbon-emitting, waste-producing construction management practices through circular practices, as well as generating revitalizing economic opportunity through net financial savings and encouragement of accessible secondary re-use market jobs.

The Domicology projects conducted this year regarding deconstruction policy feasibility, conducted through an analytical white paper titled 'Updated Guide to Construction and Demolition ordinances,' and effectiveness of public outreach and networking building, explored through the experiential construction of an adaptive Museum Exhibit, in partnership with the Smithsonian-affiliated MSU Museum, had the following findings: the lack of standardization of deconstruction policies highlights the importance of further testing city-wide ordinances and conceptualizing Domicological concepts more comprehensively is required to facilitate the collaboration necessary for obtaining a sustainable future, rooted in localized determination of zero-waste, regenerative, and equitable structural development and end-of-life management. The findings, particularly from the Domicolgoy Museum exhibit, have contributed to major interdisciplinary collaboration, such as a recent partnership with the EPA Region 5 Environmental Justice Office, aimed at fostering an extensive network, within which stakeholders in the public and private sectors may collaborate more efficiently under a domicological framework to close the gaps found in other Domicological research and achieve a sustainable value chain of production, supply, logistics and consumption of building materials.

Exploring Visitor Satisfaction in Urban Parks: Insights from Sentiment Analysis and Facility Usage

Musab Wedyan, Fatemeh Saeidi-Rizi

The paper aims to understand how specific park amenities and facilities influence visitor satisfaction and public perceptions, particularly in urban parks across Michigan. By analyzing

Google reviews, the study seeks to bridge the gap in knowledge regarding how park features shape user experiences. Using Natural Language Processing (NLP) techniques, the research extracted and analyzed 82,253 reviews to assess sentiment and the frequency of mentions related to various park amenities and activities. Temporal patterns were also explored to examine seasonal variations in park use.

The methodology involved using a binary coding system to assess the presence or absence of park amenities and performing sentiment analysis to determine the emotional impact of these features on visitors. A stepwise regression model further analyzed the relationship between the presence of amenities and overall visitor sentiment.

Based on the findings, the study suggests several policies for urban park design and management. Key recommendations include designing parks for seasonal use, incorporating diverse and well-maintained amenities such as playgrounds and picnic areas, ensuring accessibility for all users, promoting environmentally sustainable infrastructure, and using visitor feedback to guide park improvements. Additionally, it recommends separating conflicting activities, such as hunting from general recreation areas, to enhance visitor satisfaction and safety.

An analysis of previous decision frameworks for prioritizing contaminants in potable water

Kate Wernicke, Jade Mitchell

While public water system regulations are enacted to protect public health, they do not encompass all novel chemicals and microbial contaminants. The regulatory process for contaminants lags significantly behind the expeditious manufacturing rates of novel chemicals. To address this, water utilities need a faster approach to prioritizing the regulation and treatment of contaminants in drinking water to properly evaluate their adverse health effects. Previous research efforts in the prioritization of contaminants have been qualitatively analyzed and reviewed. Methods for prioritization have been examined for their ability to differentiate between prioritization classes, address uncertainty in their results, and their application. This analysis highlights relevant literature findings and identifies gaps in earlier published methods. Each previously published methodology has limitations to its application and its own strengths and weaknesses. Understanding these will aid in developing a novel risk-based prioritization framework for water utilities, particularly for emerging contaminants. There is no consensus on the best approach to prioritize chemical and microbial hazards in environmental media. Without adaptable approaches for addressing risks in potable water, public water suppliers are limited in their response to new conditions or contaminants that lack established regulatory limits.

Fostering trusting relationships between health agencies and citizens: Centering community vulnerability and increasing perceptions of awareness

Tiffany Williams, Joseph Hamm, Latifa Salangi, Adam Zwickle

Building trust is crucial for public agencies, particularly in efforts to address salient community concerns. This study experimentally tested a trust-building strategy with residents from two Michigan communities affected by environmental contamination. Participants were randomly assigned to either read a document highlighting the Michigan Department of Health and Human Services (MDHHS)'s understanding of community vulnerabilities or to a control group with no information. They then rated MDHHS on understanding, trustworthiness, and expectations, along with risk perception and personal awareness.

We hypothesized that the treatment group would perceive MDHHS as more aware of community concerns and trustworthy, without changes in risk perception or personal awareness. Results showed that the treatment group viewed the agency as more aware of community concerns, more caring, and better able to fulfill its responsibilities. However, there was no significant increase in perceptions of integrity, trust, or expectations, though effect sizes suggested a larger sample could yield significant results. Risk perception and personal awareness remained unchanged. By proactively addressing and approaching community concerns, agencies may be perceived as improving perceptions of their ability and benevolence and, in turn, potentially trust and positive expectations. These implications extend to the development of strategies aimed at improving trust and collaboration between public agencies and the public.

Evaluating Inequity in Drinking Water Violations in Metro Atlanta

Angelique Willis, MPH, MS, CertGIS, Richard Milligan, PhD, Sarah Ledford, PhD, and Chetan Tiwari, PhD

In the U.S., research highlights injustice in drinking water quality violations, revealing how disparities in clean water access are closely tied to socioeconomic and demographic characteristics. This interplay underscores a troubling pattern of environmental injustice, where marginalized communities often face significant challenges in accessing safe drinking water. However, there is a substantial gap in research regarding drinking water inequity stemming from socioeconomic and demographic characteristics in metro Atlanta, emphasizing the need for focused studies to understand and address these inequities. Therefore, this study examined the

interplay between socioeconomic and demographic factors and access to clean drinking water in metro Atlanta, focusing on public water systems under the Safe Drinking Water Act (SDWA). Utilizing regression models with average Social Vulnerability Themes from block groups contained in water service areas and SDWA water quality violations, a significant positive association was observed between community vulnerability and water quality violations ($p = 0.04$) after accounting for population size. Specifically, socioeconomic vulnerability and the population size of the service area significantly influenced water quality violations. Thus, these findings demand robust policies that directly confront vulnerabilities driving water quality violations, ensuring that all communities, especially the most marginalized, have equal access to safe drinking water.

Transport and Distribution of Per- and polyfluoroalkyl Substances in Soil Profiles from Land Application of Biosolids

Zhiliang Xu, Qianqian Dong, Jim Ippolito, Wei Zhang and Hui Li

A large portion of biosolids generated from wastewater treatment plants are applied to agricultural land for their plant nutrient values and as amendment to improve soil health. Many biosolids contain the elevated levels of emerging pollutants, especially per- and polyfluoroalkyl substances (PFAS). The repeated applications could lead to increasing PFAS accumulation in soils and leaching down to groundwater. In this study, we received soil samples collected at the multiple depth down to 180 cm at the sites receiving biosolids annually for eighteen years, as well as the corresponding wheat and corn grains produced at the sites. We applied EPA 1633 analysis method with target 43 PFAS to both soil and grain samples collected every six years. None of PFAS was detected in either wheat or corn grains. In the surface soil (0-5 cm), more than 20 targeted PFAS out of 43 compounds were identified and quantified at the levels of micrograms per kilogram of soil, which included legacy PFAS (e.g., perfluoroalkyl carboxylic acids and perfluoroalkyl sulfonic acids) and PFAS precursors (e.g., polyfluoroalkyl phosphate dieasters and perfluorooctane sulfonamidoacetic acids). Both long- and short-chain PFAS could migrate downwards to deep soil profiles but to the varying extents, with the latter group transport deeper in soil profiles. The smallest-sized PFAS selected in this study, perfluorobutanesulfonic acid, was found to leach down to the depth of 180 cm at several farming sites, indicating short-chain PFAS could demonstrate a higher mobility and contaminate the larger regions of the agricultural land.

An Integrated Methodology for Evaluating Climate Vulnerability and Resilience in Midwestern Rust Belt Cities: A Framework for Policy Development and Urban Planning

Zhicheng Xu, Wonmin Sohn, Jun-Hyun Kim

Midwestern Rust Belt cities, characterized by population decline and economic downturn, face increasing challenges in hazard management. Marginalized communities, affected by reduced municipal resources and limited tax bases, suffer from inadequate infrastructure and delayed recovery from climate-related hazards. In contrast to well-researched coastal cities, these depopulating cities with distinct environmental and socioeconomic vulnerabilities have been largely overlooked.

This study aims to: 1) develop a composite index to evaluate vulnerability and resilience to flooding and extreme heat; 2) validate and analyze internal correlations of these indexes; and 3) apply this framework to Detroit, MI, and Cincinnati, OH, to provide targeted planning guidelines. This methodology comprehensively assesses vulnerability and resilience, integrating qualitative insights from stakeholder workshops and surveys with quantitative analysis utilizing regression models to categorize high-risk areas and prioritize indicators.

Results demonstrated the framework's effectiveness in both cities, balancing immediate vulnerability reduction with long-term resilience efforts based on qualitative and quantitative assessments. Infrastructure emerged as critical for enhancing resilience in high-risk areas across all disaster management phases. Future policy orientations were also proposed for significant but unaddressed indicators, such as increasing accessibility to childcare facilities to reduce vulnerability and improving accessibility to educational facilities, parks, and trail networks to enhance resilience.

Advancing Flood Resilience through High-Resolution Hydrodynamic Modeling: Insights from the Middle Mississippi River

Muhammad B. Zafar and M.S. Phanikumar

Ecosystems, communities and infrastructure are affected significantly by the threat of flooding, necessitating proactive risk management strategies and comprehensive policy making. Traditionally, localized reactive approaches focused on post-event response, instead of preemptive regional measures, have been used to mitigate the threat of floods. However, these approaches can result in long term unintended negative consequences. With the incorporation of an unstructured mesh and topography and bathymetry data, a high-resolution hydrodynamic

model was developed for the Middle Mississippi River and its floodplains from St. Louis, Missouri, to Thebes, Illinois. The model demonstrated reliability and accuracy in replicating the data with a strong alignment with observed hourly discharge, water levels and flood inundation, making it a powerful tool for assessing the potential impacts of future river management strategies and environmental changes, such as levee construction, river channel modifications and other interventions. The research offers new insights into the interplay between hydrodynamics and landscape alterations. It can also be used for practical recommendations for flood management and policy development to enhance flood resilience and sustainable water management policies. Additionally, the model's flexible framework allows for localized nested modeling making it useful for both regional assessments and targeted policymaking at local scales. This study underscores the importance of integrating scientific modeling with policy to develop adaptive, science-based strategies for flood resilience and sustainable water management.

Between the Lines: A Critical Discourse Analysis of Chinese Climate White Papers

Qucheng Zhang

China has been publishing its official annual climate change white papers since 2008, but they are not investigated thoroughly by scholars. In this study, the 15 white papers (2008-2022) are critically analyzed with discourse-historical approach.

Firstly, immanent critique is conducted to discover the inconsistencies, (self-) contradictions, paradoxes and dilemmas in the climate white papers. Then, socio-diagnostic critique is conducted to embed the discourse in the historical, political, and environmental contexts. Finally, prognostic critique is conducted to seek the improvement of the discourse.

The findings show that economic development has been overshadowing carbon emission as a key concept in the white papers, but the relative importance of the emission issue has increased. Plus, there is an increasingly stronger emphasis on the control and design from the top officials, especially on the ideas and speeches of Xi Jinping. Lastly, the role of non-governmental organizations in climate governance has been gradually downplayed.

This study contributes to the study of Chinese official climate change communication by revealing the underlying logic of the annual climate change white papers. This study also contributes to Chinese climate communication by calling for more support and representation of civil climate actions in the official climate discourse.

Tracking Chlamydia and Syphilis in the Detroit metro area by molecular analysis of environmental sample

Liang Zhao, Heidy Peidro Guzman, Irene Xagoraraki

This study describes one of the first studies applying wastewater surveillance to monitor Chlamydia and Syphilis and back-estimate their infections based on bacterial shedding and wastewater surveillance data. Molecular biology laboratory methods were optimized, and a workflow was designed to implement wastewater surveillance tracking Chlamydia and Syphilis in the Detroit metro area (DMA), one of the most populous metropolitans in the U.S. Untreated composite wastewater samples were collected weekly from three interceptors at Great Lakes Water Authority that services the DMA, and from street manholes that service three neighborhood sewersheds in Wayne, Macomb, and Oakland counties. Centrifugation, DNA extraction, and ddPCR methods were performed and optimized targeting Chlamydia trachomatis and Treponema pallidum that cause Chlamydia and Syphilis, respectively. Limit of Blank and Limit of Detection were determined experimentally for both targets. Both targets were detected and monitored in wastewater between December 25th, 2023, and April 22nd, 2024. The magnitude of C. trachomatis and T. pallidum concentrations were observed higher in neighborhood sewersheds compared to interceptors. Infections of Chlamydia and Syphilis were back-estimated through an optimized formula based on shedding dynamics and wastewater surveillance data, which indicated potentially underreported conditions with the clinical data as a benchmark.

Thank you!

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