RUTGERS
New Jersey Climate Change Resource Center

New Jersey Climate Change Research Symposium 2023
Detailed Agenda

8:30 AM	Check-in and light breakfast (Multipurpose Room-1st Floor)
9:00 AM–9:15 AM	Welcome (Multipurpose Room-1st Floor)

9:30 AM–10:45 AM

CONCURRENT SESSIONS A

A1 Panel: Climate Impacts on Agriculture and Renewable Energy in New Jersey (Multipurpose Room-1st Floor)

- **Dave Specca**, Rutgers University (lead panelist)
- **Dave Robinson**, Rutgers University. New Jersey Climate Change History and Projections
- **Tim Shelford**, Rutgers University and Cornell University. Anaerobic Digestion Converts Biomass Waste into Useful Energy
- **Daniel Ward**, Rutgers University. Observation of Climate Impacts on New Jersey Agricultural Trends
- **Dunbar Birnie**, Rutgers University. Utility-Scale Photovoltaic Arrays and Possible Adaptation for Agricultural Compatibility

The combination of global warming, politics, and economics have resulted in an exploding interest in renewable energy sources. In addition to offshore wind energy, New Jersey has opportunities to generate substantial amounts of solar and biomass energy. Governor Murphy recently announced that the target date for all of New Jersey's electricity to be produced from renewables was moved from 2050 to 2035. But New Jersey is a small state with a high population density, making it challenging to find enough space for the generation of renewable energy. Biomass energy can be produced from farm products (manure, crop residue), as well as from other types of biomass (e.g., food waste). Often prime agricultural land is targeted as a desirable location for solar energy. In order not to lose too much farmland to energy production, combining the two might be a reasonable solution. This approach is termed agrivoltaics or dual-use solar farming. Both agrivoltaics and biomass energy production will be discussed.

9:30 AM–10:45 AM

A2: Oral Presentations. Theme: Coastal Climate Change Resource and Infrastructure Impacts and Local Responses (Room 202 - 2nd Floor)
Moderator - Peter Rowe, New Jersey Sea Grant Consortium

- **Alex Fiore (presenter), USGS. Groundwater Levels, Aquifer System Compaction, and the Effects of Sea Level Rise in Coastal New Jersey**

Groundwater plays an important role in assessing effects of sea level rise (SLR) on natural

resources and critical infrastructure in coastal areas. SLR is a rise of hydraulic head, the effects of which propagate throughout the overall hydrologic system including the onshore unconfined aquifer. SLR creates a corresponding water-table rise, decreasing the depth to water below land surface. Recent studies by the U.S. Geological Survey (USGS) used groundwater flow modeling to simulate this relationship between SLR and coastal groundwater in New Jersey. Results indicate that shallowing water tables due to SLR will likely create emergent wetlands in areas previously occupied by other habitats, including low-lying inland areas away from the shoreline where habitat destruction from a rising water table may precede surface inundation from SLR itself. Additionally, encroachment of salt marsh habitats into existing freshwater wetlands is associated with SLR causing fresh groundwater to discharge further inland, allowing the lens of saline groundwater under salt marshes to advance laterally into the uplands. Exacerbating this effect is the role of land subsidence due to aquifer system compaction (ASC), which amplifies the apparent rate of SLR. Groundwater pumping from confined aquifers such as those in the New Jersey Coastal Plain decreases porewater pressure in the aquifer and confining unit, compressing the sediments and decreasing overall aquifer and confining unit thicknesses, which causes the land surface to subside. Preliminary measurements of ASC by the USGS indicate the rate of downward vertical motion of land surface may exceed the rates of sedimentation depending on local conditions. Thus, the groundwater depth in the unconfined aquifer may be decreasing at a higher rate compared to the rate absent any effects of ASC, and the subsequent effects of this coupled SLR-groundwater table rise on coastal areas may occur at faster rates than previously considered.

9:30 AM–10:45 AM

• Tiana Noelani Thorp (presenter), University of Delaware. Adaptation Solutions and Resilience Pathways for Saltwater Intrusion Threats to New Jersey Infrastructure

Co-authors: Jennifer McConnell, University of Delaware; A.R. Siders, University of Delaware

Saltwater intrusion (SWI) – where saline water is introduced to a system (i.e., aquifers, soil, buildings) via processes like sea level rise – is becoming a severe and prevalent problem among coastal communities as climate change causes sea levels to rise. Sea level rise (SLR) in coastal New Jersey is currently causing SWI threats like natural system destruction and food infrastructure degradation. Further, SWI has compromised confined aquifers in several locations, including Raritan Bay and Cape May County. While experts know saltwater intrusion will occur, there is less consensus on how saltwater intrusion might affect coastal residents, ecosystems, and infrastructure. This research investigates the current literature on saltwater intrusion and infrastructure globally, focusing on adaptation solutions and resilience pathways for documented threats. Through a systematic review utilizing the Web of Science database, 164 papers were selected and evaluated via keyword search. Threats were identified for ten infrastructure types: agriculture (food infrastructure), drinking water, energy, inland waterways, natural systems, ports, public/private buildings, stormwater, transit, and wastewater. Each threat is presented with an accompanying adaptation solution and/or resilience pathway identified in the literature, focusing on New Jersey coastal communities. Additionally, relevant actors are identified for each solution and pathway with an indication if these measures are in-practice or mandated identified regions.

9:30 AM–10:45 AM

• Jenny Shinn (presenter), Rutgers University. Living Shoreline Implementation in Delaware Bay New Jersey: Case Studies, Progress and a Research Perspective

Co-author: Dave Bushek, Rutgers University

Living shorelines have become a popular tactic to increase coastal resilience as part of climate adaptation strategies. In contrast with traditional hardened shoreline stabilization measures, living shorelines utilize nature-based features and incorporate ecological principles to create more robust, natural habitats that reduce erosion. Projects are implemented near or at the water-land interface with the primary goal of stemming erosion to prevent land loss and protect adjacent infrastructure or habitats. Many projects also seek to accelerate sediment accretion to assist marshes in maintaining proper elevation for growth, assist in the formation of dunes, or reclaim lost land or wetland habitats. Construction materials are often biodegradable, but frequently contain multiple components that are composed of both natural and artificial materials. The degree of hard structure utilized varies according to needs and the level of energy impacting the site, but the goal is always to provide an ecologically functional shoreline. Implementation costs are comparable to or less than hard structures and require annual maintenance as one might need to maintain any other living landscape. Haskin Lab researchers are working with several collaborators to evaluate how and where living shorelines may be effective in Delaware Bay, NJ to protect infrastructure and the loss of wetlands to sea level rise and increased storm activity. This presentation will discuss three living shoreline projects of varying scale and age with a focus on lessons learned from implementation, monitoring, and recent research results. A new Rutgers-led multi-institutional living shoreline project will also be highlighted: Reefense – A Mosaic Oyster Habitat for Coastal Defense. The Reefense framework integrates structure design with ecosystem engineering and adaptive biology into the development of “reef-mimicking structures to mitigate the coastal flooding, erosion, and storm damage”

9:30 AM–10:45 AM

• Laura Steeves (presenter), Rutgers University. Changing Environmental Conditions and the Atlantic Surfclam (*Spisula solidissima*): Multi-stressor Laboratory Experiments and Off-shore Observations

Co-author: Daphne Munroe, Rutgers University

The Atlantic surfclam (*Spisula solidissima*) is a widely distributed and economically important species, being found in waters along the Atlantic coast north of Cape Hatteras and the most fished clam species by weight in the United States. However, changing ocean conditions (primarily temperature) are driving shifts in surfclam habitat both northward and offshore. Growing surfclams in aquaculture farms presents an opportunity to support surfclam production with a unique product that would not compete with fished surfclam (i.e., a steamer sized clam ~55mm). Although aquaculture farms are often established in protected coastal areas, farming in the open ocean presents an opportunity to farm shellfish where space is less competitive, water quality is often higher, and where species naturally occur. However, strategic site selection of aquaculture farms in the open ocean requires consideration of both current and predicted future environmental conditions that will promote the successful growth and survival of targeted species. For this research, we are collaborating with fishing industry partners to provide information about the potential for surfclams to be cultivated at commercial scales in the open ocean. Further, to examine how changing ocean conditions in potential aquaculture areas may impact surfclam survival and growth rates, we will use laboratory experiments to observe surfclam

performance at ambient and stressful levels of temperature and carbonate chemistry (reflective of ocean acidification). This research will provide information about the potential to produce surfclams in offshore aquaculture farms, and the ability of surfclams to survive and grow in changing oceanographic conditions.

9:30 AM–10:45 AM

A3 Panel: Scholarship, Climate Action, and the Role of Universities (George H. Cook Room-1st Floor)

- **Angela Oberg**, Rutgers University (lead panelist)
- **Robert Kopp**, Rutgers University. Climate Grant Universities
- **Kevin Lyons**, Rutgers University. Resilient Supply Chains
- **Mark Rodgers**, Rutgers University. Leveraging Analytics to Design Pathways to Eliminate Scope 2 Emissions
- **Angela Oberg and Zoe Byham**, Rutgers University. Institutional Change to Advance Climate Action in Higher Education

As the state university of New Jersey, Rutgers has an opportunity and an obligation to help lead the State to a more just, sustainable, and resilient future; in so doing, we can build a model for community-engaged climate leadership in higher education that can serve as a guide for other public universities around the country and the world. Thus the theme of linking activities on campus to the broader goal of climate-positive, equitable economic development – the socially equitable transformation of New Jersey's economy to one that is powered by clean, renewable energy, produces net-negative carbon emissions, and is resilient to climate and related impacts and shocks – should be fully integrated into Rutgers' climate strategies.

This panel brings together 4 speakers championing the reality that Rutgers can have its biggest impact on the climate crisis by becoming a model for how a large, public university can work across disciplines and sectors to accelerate transformative, science-based climate action.

Climate Grant Universities (Robert Kopp)
With cues from the successful land grant model, the United States should establish a system of universities to democratize access to climate knowledge and aid efforts to tackle the climate crisis. Land-grant universities, together with the associated agricultural experiment stations and cooperative extension services, have played a crucial role in democratizing scientific knowledge and addressing intertwined educational, environmental, economic, and democratic challenges within the USA. Indeed, they have arguably pioneered the idea of "usable science." Today, the urgent challenges of the Anthropocene demand a more robust relationship between scientific research and on-the ground action, strong networks sharing local lessons globally, and channels for injecting global, long-term perspectives into the noise of short-termism. The land-grant experience provides lessons for "Anthropocene universities" seeking to tackle these challenges, including the importance of (1) establishing or expanding university-based boundary organizations akin to cooperative extension, (2) incentivizing the integration of engagement into the university's research, teaching, and service missions, (3) centering values of democracy, justice, equity, and inclusion in engagement, and (4) cooperating across institutions and sectors. Given the urgency of fully engaging academic institutions as players and connectors in the real-world challenges of addressing climate change and biodiversity loss, there is little time to waste.

Resilient Supply Chains (Kevin Lyons)
Since we will be capturing and analyzing a significant amount of local supply chain and buy local data, we will be able to determine and report on our New Jersey climate change impacts (e.g., analyzing local business and manufacturing sourcing strategies versus national/global). This information will be displayed at a State, County and regional level using Urban Heat Map technology built into our Local Supply Chain Resiliency Big Data Analytics dashboard. We are conducting collaborative research and development efforts to support a broader environmental mission and build economic resilience; the project team is utilizing ad hoc tools to investigate the environmental impact studies of industry activities, such as the transport of goods global vs. internal to NJ. Specifically, we plan to quantify and visualize the degrees of environmental impacts related to the industry goods movement and manufacturing activities.

Leveraging Analytics to Design Pathways to Eliminate Scope 2 Emissions (Mark Rodgers)
Rutgers University's Office of Climate Action and Rutgers Climate Institute are working to achieve their goal of eliminating Scope 2 emissions and adopting a Climate Action Plan. To achieve this, they aim to implement a multi-period, constrained investment planning model to determine which electricity generation technologies the University should invest in for a long-term horizon. They plan to investigate scenarios, such as physical capacity limitations, budget constraints, and demand reduction strategies, and then create feasible investment plans. After this, an economic dispatch model will be formulated and solved to operate these capacity investments to achieve 24/7 clean energy consumption throughout the University. These efforts are a critical component in leveraging the University's academic, operational, and economic resources to tackle climate change and promote a cleaner future.

Institutional Change to Advance Climate Action in Higher Education (Angela Oberg, Zoe Byham)
As higher education institutions look to advance climate action on their campuses, they face many of the same kinds of challenges as other large, complex organizations. Current scholarship indicates that success of a university's sustainability efforts relies on commitment from all members of the campus community: students, faculty, staff, and administrators. However, current research in this area focuses on the roles of faculty, students, and administration, with little attention on staff. This work draws on interview data with operational management staff to understand the organizational factors that have contributed to the success and failure of sustainability initiatives on campus. Including the perspectives of operational staff to this body of work is an important addition to the conversation.

11:00 AM–12:15 PM **CONCURRENT SESSIONS B**

B1 Panel: Usable Climate Science For New Jersey Communities (Multipurpose Room-1st Floor)

- **James Shope** (lead panelist), Rutgers University. A New Heat Vulnerability Index for New Jersey
- **Roger Wang**, Rutgers University. Mapping the Past and Future Flooding in New Jersey: A GIS Based Model
- **Lucas Marxen**, Rutgers University. Hazard Vulnerability Data for New Jersey
- **Marjorie Kaplan**, Rutgers University. Putting it All Together for NJ Communities

Communities in New Jersey are at the front lines of planning for and responding to climate change-mediated impacts and thus in need of usable science. To respond to this need, several recent data sets, analyses and tools have been developed to better understand and plan for climate risks to New Jersey communities. A Heat Vulnerability Index for New Jersey can help identify which communities may be more at risk to heat and what factors contribute to their vulnerability. Height Above Nearest Drainage is being explored as a framework for creating current and future flood depth maps for New Jersey. Coastal and inland flooding, precipitation temperature data, heat hazard data, and tax parcel data are integrated with population profiles, built infrastructure, critical assets, health-related and natural and working land to provide composite snapshots for New Jersey municipalities and counties, as well as statewide. Together these data and tools can guide land use, hazard, and other community-based planning in New Jersey.

11:00 AM–12:15 PM

B2 Oral Presentations. Theme: Citizen and Community Assessment, Policy, and Responses to Climate Change (Room 202-2nd Floor)
Moderator - Laura Kerr, Stevens Institute of Technology

- **Bernadette Baird-Zars (presenter), Rutgers University. Advancing Equitable Partnerships: Frontline Community Visions for Coastal Resiliency Knowledge Co-Production, Social Cohesion, and Environmental Justice in NJ/NY**

Co-authors: Aya Morris, independent researcher; Victoria Sanders, NYC Environmental Justice Alliance; Paul Gallay, Resilient Coastal Communities Project; Jackie Klopp, Center for Sustainable Urban Development; Annel Hernandez, New York City Council; Lexi Scanlon, independent researcher

Community-based organizations (CBOs) in frontline coastal communities grapple with social and environmental injustices compounded by climate change risks. In response, CBOs have developed deep expertise in climate adaptation tailored to their local communities. Yet these groups are often effectively excluded from resilience planning processes that are top-down and involve perfunctory and often performative consultations. This paper asks: What do community leaders seek from adaptation planning, and how do they recommend such processes be improved? Drawing on the experiences of ten CBOs in coastal New York and New Jersey, the majority representing BIPOC environmental justice communities, this article advances community-driven priorities for coastal resilience planning outcomes and processes. We conducted structured 60- to 90-minute interviews with ten CBO leaders between February and March 2022, collaboratively completed an iterative content analysis of the interview data and community plans, and workshopped core findings in multiple sessions and conversations with participating CBOs. CBO leaders had consensus on resilience planning priorities: they oppose top-down approaches where planners bring a predetermined agenda, and seek true partnership through a relational approach that values grassroots perspectives to co-produce equitable and just strategies to address climate risk. Recommendations for decision-makers center on the need to build on existing community-led plans, resource community capacity for empowerment in planning processes, act with transparency to foster trust, partnership and co-planning with communities, and self-evaluate their own practice. Lessons for researchers seeking to support community empowerment in resilience planning include the need to establish lasting and mutually supportive relationships with community partners to enable knowledge co-production.

11:00 AM–12:15 PM

- **Fred Traylor (presenter), Rutgers University. New Jersey Residents Public Opinions on Energy Decarbonization and Climate Engineering**

Co-authors: Rachael Shwom, Rutgers University; Steven Brechin, Rutgers University

What do residents of New Jersey and surrounding areas think about climate change, decarbonizing the electric grid, and climate engineering? How do these align with current decarbonization policy? How do these align with what other Americans think? In this study, we assess public opinion of NJ, NY, and PA residents and how they compare to the rest of the US. We also explore how various survey sampling approaches, including online survey panels and crowdsourcing techniques like Amazon Mechanical Turk, impact results in the face of declining survey response rates.

11:00 AM–12:15 PM

- **Michel Boufadel (presenter), NJIT. ARez: GIS-Based Software for Community and Infrastructure Disaster Resilience Quantification**

Co-authors: Firas Gerges, Princeton University; Hani Nassif, Rutgers University; Eli Bou-Zeid, Princeton University; Rayan Assaad, NJIT

Major efforts have been dedicated in New Jersey to prepare for climate change. These include vulnerability maps and specific actions at various locales. We have advocated for relying on quantitative resilience as a unifying theme for various stakeholders. We propose herein a framework for quantifying resilience of a region. Two main approaches are currently being pursued to evaluate resilience. The first approach is the "community resilience" developed by social scientists, planners, etc. and attempts to capture community resilience, using numerous pre-disaster attributes to describe the functioning of a community. The approach subsumes that pre-disaster attributes can predict the community resilience to a disaster. An example is the number of people with college degrees within a community, because it has been observed that the higher the number the more resilient the community is. The second approach adopted for infrastructure resilience, mostly by engineers, focuses on robustness, redundancy, resourcefulness, and rapidity. This approach has been used for systems that are operated by highly skilled personnel, and where the actions are of engineering type and are limited. For example, replace a girder in a bridge, repair a downed wire, or drain a flooded road. We combined the two approaches, focusing on certain attributes/elements of each approach. This led to the development of the ARez (Area resilience) metric to quantify resilience. ARez combines the resilience measures of five sectors: energy, health, natural ecosystems, socioeconomics, and transportation. ARez provides an accurate picture of a region's resilience and identifies the elements that require investment/action, which is highly valuable for resilience planning and decision-making. ARez can be enhanced by incorporating specific elements of each region such as tending to underserved communities and increasing societal equity.

11:00 AM–12:15 PM

- **Brooke Maslo (presenter), Rutgers University. Creating Flood-Resilient Landscapes in New Jersey Communities**

Co-authors: Jeremiah Bergstrom, South Dakota State University School of Design; Kathleen Kerwin, Rutgers University; Shelbie Nath, South Dakota State University School of Design

Floods pose significant risk to human health and infrastructure in the landscapes where

people live. In communities near the ocean, flooding and flood risk are often associated with catastrophic coastal storms, such as hurricanes and nor'easters. In New Jersey, we often think about Hurricane Sandy and the damage to life and property it caused. However, flooding is not just a coastal problem, nor is it only caused by severe storms. On the contrary, flooding has impacted nearly all of New Jersey's 565 municipalities. To address flooding concerns, New Jersey has implemented several initiatives to acquire flood prone properties through buyout programs. Removal of properties from within flood zones immediately promotes flood resilience by protecting human health and safety and reducing the risk of damage to personal property and infrastructure resulting from flood events. However, at least three new challenges emerge from buyout initiatives. Properties purchased with federal or state dollars must be managed as public open space, and they are deed restricted to protect against alterations that would reduce the landscape's capacity to absorb flood waters. Maintaining newly acquired areas using conventional techniques that are appropriate for park-like settings (i.e. mowing) adds an unsustainable burden on public staff and financial resources and is not a feasible long-term management approach for many communities. Similarly, leaving the properties alone and allowing "nature to take its course" also is not a viable option. These challenges can be overcome through an ecologically centered landscape resilience approach that combines principles of engineering, ecology, and landscape architecture with social science to transform acquired properties into public assets. However, existing guidelines or best practices do not currently exist. We have published a primer that will serve as a guide for creating flood-resilient landscapes across the communities of New Jersey. Although much of this work focuses on landscape transformation of buyout areas, the information contained here applies to any landscape resilience project regardless of size or jurisdiction.

11:00 AM–12:15 PM

B3 Oral Presentations. Theme: Changes to Tropical Storms and Wave Climatologies along the New Jersey Coast (George H. Cook Room-1st Floor)
Moderator – Thomas Herrington, Monmouth University

- **Reza Marsooli (presenter for Muhammad Hajj), Stevens Institute of Technology. Climate Change Impact on Storm Surge Along NY/NJ Coastlines Using Machine Learning**

Co-authors: Mahmoud Ayyad, Stevens Institute of Technology; Reza Marsooli, Stevens Institute of Technology

To develop and plan more resilient coastal areas, the impact of climate change on storm surge return periods resulting from tropical storms (TC) must be quantified. Because the number of low-probability historical storms is limited, synthetic storms are needed to predict return periods of low-probability events. Here, we study the change in return period curves of storm surge levels using synthetic over historical (1980-2000) and future (2080-2100) periods under Representative Concentration Pathways 8.5 greenhouse gas concentration scenario. Four global climate models are used to generate more than 8,000 synthetic TC. We consider 57 locations along the New York and New Jersey coastlines. We utilize machine learning (ML) to alleviate the high computational power required by the coupled high-fidelity hydrodynamic (ADCIRC) and wave (SWAN) models to predict the storm surge levels including the effect of wind-generated waves. The ML model is trained using a data set that includes all hurricane categories and generated using the ADCIRC+SWAN model. The trained ML model is then used to predict the storm surge levels from the historical and future periods data sets. The predicted levels are used to generate the corresponding return period curves for the two periods. The results show an increase

in future flood hazards along the southern coastline of New Jersey and inside Jamaica, Raritan, and Sandy Hook bays, while a decrease in storm surge levels is noted at further inland locations and along the Long Island coastline because the deviation of TCs tracks over these regions.

11:00 AM–12:15 PM

- **Reza Marsooli (presenter), Stevens Institute of Technology. Hurricane-Induced Wave Climate Change and its Impact on Extreme Coastal Erosion Hazards along New Jersey Barrier Islands**

Co-author: Mohammad Jamous, Stevens Institute of Technology

Sandy beaches and dunes along New Jersey barrier islands are susceptible to erosion and overtopping caused by extreme waves from the Atlantic Ocean. Changes to extreme wave climatology would impact the physical vulnerability of these beach-dune systems and, in turn, communities and infrastructure that are protected by these systems against flooding. This talk presents the results of our recent research on climate change impacts on wave hazards due to major hurricanes off the coast of New Jersey and the coastal erosion hazards to beach-dune systems along the barrier islands. The effects of sea level rise and hurricane climatology change on wave hazards are quantified using a high-resolution coupled hydrodynamic and spectral wave model. A validated hydrodynamic-morphodynamic model is then utilized to quantify the effects of changes in hurricane-induced wave climatology on extreme coastal erosion hazards along the barrier islands.

11:00 AM–12:15 PM

- **Maria Venolia (presenter), Stevens Institute of Technology. Climatology of Wind-Generated Wave Families off the New Jersey Atlantic Coast**

Co-author: Reza Marsooli, Stevens Institute of Technology

Climatology of wind-generated waves off the New Jersey Atlantic Coast consists of both extreme waves which can cause intensive erosion, flooding, and structural damage on the NJ Atlantic coast as well as long-term mean wave conditions which reshape beaches and shorelines. Given that the sea surface can be perceived as a complex state of superposition of various wave systems, the conventional approach of using integrated wave parameters such as significant wave height for wave climate analysis can be misleading in situations where the sea surface simultaneously consists of multiple wave systems. Thus, analyzing families of different wave systems in the direction-frequency spectrum provides more meaningful and accurate information. This work quantifies temporal variability and trends in the climatology of different wave system families observed over a 20-year historical period at the National Data Buoy Center buoy 44025 located off the Northeastern coast of New Jersey. The two-dimensional frequency-direction wave spectrum is first constructed using raw buoy data following the Maximum Entropy Method approach. The wave spectrum is then partitioned, and the dominant wave systems are determined by spectral statistics, according to the occurrence distribution of spectral partitions, allowing the identification of predominant wave families. Since each wave family has a different meteorological origin, they carry unique characteristics (i.e., significant wave height, direction of propagation, spectral wave density, etc.) based on spatial formation and duration of propagation prior to arrival at the study site. The results of the spectral partitioning are statistically analyzed, seeking to quantify long term trends and variability in the characteristics of each identified wave family. This is performed on monthly, seasonal, and yearly level scales aiming to quantify partition contribution to the bulk sea-state climatology. Additionally, the correlation between seasonal wave family variability and various climate indices, e.g., the North Atlantic Oscillation Index, is investigated.

11:00 AM–12:15 PM

• Mohammad Jamous (presenter), Stevens Institute of Technology. Physics-based Modeling of Sea Level Rise Impact on Extreme Wave Hazards Along Sandy Coasts

Co-author: Reza Marsooli, Stevens Institute of Technology

Extreme wind-generated waves pose significant hazards to coastal communities and infrastructure along the Atlantic Ocean coast of New Jersey. The destructive forcing of waves could cause severe beach and dune erosion, wave overtopping, and hinterland flooding. As global warming leads to an increase in the mean sea level, the adverse effects of extreme waves will increase as deeper coastal waters will result in larger waves reaching the shoreline and breaking more violently on sandy beaches and dunes. Using scenario-based simulations, we use a coupled hydrodynamic-wave-morphodynamic numerical modeling approach to show the extent to which sea level rise impacts coastal erosion, wave run-up on beaches and dunes, and wave overtopping at three study sites along the barrier islands of New Jersey. Simulations are carried out for Hurricane Sandy under the present-day mean sea level and two future sea level rise scenarios. The results suggest substantial impacts of sea level rise on coastal erosion and flooding levels and how commonly-used flood hazard assessment approaches that neglect morphological changes during extreme events could miscalculate the effects of sea level rise on flood hazards.

1:15 PM–2:30 PM

CONCURRENT SESSIONS C

C1 Panel: NJDEP's Approach to Climate Change Science and Policy (Multipurpose Room-1st Floor)

- **Josephine Bonventre**, NJDEP (lead panelist). Revisiting the 2020 New Jersey Scientific Report on Climate Change and the 2022 Climate Change Impacts on Human Health & Communities Addendum
- **Kirk Raper**, NJDEP. New Jersey Precipitation Patterns: Past, Present, and Future
- **Alec Ayers**, NJDEP. Healthy New Jersey 2030: Prioritizing Community Health through Identifying and Mitigating Risks Imposed by Climate Change
- **Nathaly Agosto Filión**, NJDEP. Statewide Planning for Extreme Heat Resilience: Leveraging Agency Coordination to Accelerate Adaptation Action

Responding to the threat of climate change is one of the main priorities of the New Jersey Department of Environment Protection (NJDEP) and Governor Murphy's administration. In June 2020, the NJDEP released a report summarizing the best available science and existing data about current and anticipated effects of climate change on New Jersey. The report covered greenhouse gas emissions, temperature, precipitation, ocean acidification, and sea-level rise and how changes to them will impact our air quality, water resources, agriculture, forests, wetlands, as well as the plants and animals that live in our ecosystems. In September 2022, in partnership with the New Jersey Department of Health (NJDOH), the NJDEP released a supplement to the original report that described the direct, indirect, and wide-ranging influences of climate change on human health and communities. Negative health impacts include exacerbated respiratory conditions and cardiovascular disease in vulnerable populations, heat-related stress, an increased risk of diseases borne by mosquitoes or ticks and contaminated food and water supplies, and cumulative mental health stressors. The overall purpose of these reports is to help State and local decision-makers understand both the significant and extensive impacts of climate change as well

as the comprehensive and forward-thinking responses that are required by all levels of government, economic sectors, and communities, to prepare for the climate impacts that New Jersey cannot avoid. There are many ongoing efforts within the NJDEP focused on studying, preparing for, and mitigating the impacts of climate change on New Jersey and its residents. Recently, the NJDEP partnered with the New Jersey State Climatologist and the Northeast Regional Climate Center to better understand changing precipitation patterns in New Jersey. The studies summarized past observational data, modernized estimates for present extreme precipitation, and projected future extreme precipitation estimates using downscaled climate model data. Overall, New Jersey has consistently gotten wetter, with annual totals increasing by 7%. By adding 19 years of data to NOAA Atlas 14, extreme rainfall estimates increased by up to 10%. Future projections indicate that precipitation intensity will increase into late century, with 1% annual chance storms (colloquially referred to as "100-year storms") increasing by as much as 50%. More frequent events (e.g., 50% and 10% annual chance storms) are expected to increase in amount by 5% to 15% on average by the end of the century. Leveraging the information from the NJ Climate Report's Health Addendum, NJDEP again partnered with NJDOH as part of its Healthy New Jersey 2030 Initiative to further investigate and prioritize worsening or emerging community environmental issues from New Jersey's changing climate through a public health lens. The NJDEP-led workgroup identified five key issues—air quality, water quality, extreme heat, flooding, and zoonotic diseases—and then considered actions needed to address these areas at a community level. Understanding that each of New Jersey's communities are unique in the environmental threats they face and their capacity to both mitigate and recover from local impacts, the recommended actions and identified strategies for participating groups were designed to add authority and remove barriers to meaningful public health protections. From a policy perspective, New Jersey's Chief Climate Resilience Officer serves as the vice-chair of the New Jersey Interagency Council on Climate Resilience (Interagency Council), a committee of 22 state agencies working to integrate climate resilience into their policies, programs, and regulations to address critical climate threats to New Jersey. The NJDEP Office of Climate Resilience provides staffing and facilitation support to advance the work of the Interagency Council. In October 2021, the Interagency Council adopted the statewide Climate Change Resilience Strategy including recommendations to promote the long-term mitigation, adaptation, and resilience of New Jersey's economy, communities, infrastructure, and natural resources throughout the State. The next evolution of operationalizing these recommendations is the development of a series of Resilience Action Plans (RAPs). The first RAP will focus on Extreme Heat, not only its impact to human health, but its effects on all aspects of the State including transportation and energy infrastructure, agriculture and forestry, wildlife habitats and migration, and social equity. The Extreme Heat RAP, expected for public review in August 2023, will layout state agencies' ongoing, and near- and long-term actions to improve the State's resilience. The NJDEP's work is informed by a multidimensional understanding of the growing and continued threat of climate change, from reviewing permits for areas with increasing flooding risks, to addressing changes to habitat conditions and species responses, to warning the public about changing air quality conditions. The NJDEP supports the State's comprehensive strategy to both reduce emissions of climate pollutants that fuel global warming and to proactively plan for the future in a myriad of ways.

1:15 PM–2:30 PM

C2 Panel: MACH: Integrating Real-World Climate Adaptation Decision Needs with Cutting Edge Climate Science (Room 202-2nd Floor)

- **Lisa Auermuller**, Rutgers University (lead panelist)
- **Robert Kopp**, Rutgers University. MACH Overview: Guiding MACH Research with Real-World Decision Needs
- **Yifan Wang**, Rutgers University. Modeling Hazards and Quantifying Exposure
- **Clint Andrews**, Rutgers University. Municipal Level Finance
- **Sara Belligoni**, Rutgers University. Understanding Household Level Decision Making

The "wicked problem" that climate change poses to coastal communities will require many great minds working alongside local residents, officials, and professionals to better understand the options available to decrease their risk. To assist with these types of complex decisions, Rutgers University and 12 other institutions created the Megalopolitan Coastal Transformation Hub, or MACH (pronounced 'mock'). MACH is a part of a network of research hubs, located around the country, funded through the National Science Foundation's Coastlines and People program. MACH's mission is to support decision making to manage climate-change-related risks through research focused at the intersection of natural and human systems. These collaborations are rooted in core principles regarding equitable community participation in and co-production of climate solutions.

The researchers that make up MACH bring together expertise in a broad range of disciplines. Over the five years of the grant – and potentially continuing beyond – MACH is focusing on challenges explicitly faced in the urban megaregion that spans Philadelphia, New Jersey, and New York City. By collaborating with each other and with local residents, officials, and professionals, MACH researchers aim to advance the holistic understanding of both coastal dynamics and decision making in order to address the complex risks posed by climate change here and around the world.

Participating in MACH gives researchers the opportunity to be useful to potential partners while advancing both basic and applied science. Research partners gain access to best available science now while contributing to the longer-term advancement of the state of scientific understanding. Through this co-generation of knowledge, all participants gain wisdom and contribute to the management of growing climate risks. This panel will review MACH's progress, to date, and explore how co-production of knowledge with decision makers has shaped the direction and integration of MACH's research themes.

1:15 PM–2:30 PM

C3. Oral Presentations Session. Theme: Emerging Approaches for Assessing Climate Change and Climate-Mediated Impacts (George H. Cook Room-1st Floor)
Moderator – Nick Procopio, New Jersey Department of Environmental Protection

- **Xiang Ren (presenter), Rutgers University. Downscaling Impacts of Climate Change on Air Quality across the Contiguous United States Using a Flexible Bayesian Ensemble Machine Learning Framework**

Co-authors: Zhongyuan Mi, Rutgers University; Ting Cai, Rutgers University; Christopher G. Nolte, EPA; Panos G. Georgopoulos, Rutgers University

Machine learning has been recognized as an effective tool for downscaling large-scale climate models and weather forecasting. However, applications involving downscaling impacts of climate change on ambient air pollution are rare. A climate-driven air quality downscaler can improve the accuracy and spatial resolution of atmospheric chemistry transport models, that is essential for local/regional climate impact and environmental justice analyses. In this study, a Bayesian Ensemble Machine Learning (BEML) framework, that integrates thirteen learning algorithms, was developed for downscaling 12 km x 12 km CMAQ (USEPA Community Multiscale Air Quality model) estimates of ozone daily maximum 8-hr averages to census tract level, across the contiguous US. The ensemble model was constructed using the data from 2011 and its flexibility/transferability was tested by evaluating the performance for other years (2012-2017) without re-training. The historically trained and evaluated model was then used to downscale CMAQ outputs for a future year scenario-based simulation (2051) that considers effects of variations in meteorology associated with an RCP8.5 climate change scenario. To facilitate interpretation of "black-box" modeling, the Shapley value metric from coalitional game theory was applied to characterize the climate drivers of local concentration gradients. The results indicate that climate impacts on ozone concentrations vary substantially in different regions, where significant increases may occur in the Northeast, Central and East North Central US by the mid-21st century. The historical performance and model transferability as well as the physical interpretation examined in the present study lend support for a wider application of machine learning in climate-driven air quality downscaling.

1:15 PM–2:30 PM

- **Georgios Kelesidis (presenter), Rutgers University. Enhanced Radiative Forcing by Black Carbon Nanoparticles**

Co-authors: David Neubauer, ETH Zurich; Liang-Shih Fan, Ohio State University; Ulrike Lohmann, ETH Zurich; Sotiris Pratsinis, ETH Zurich

The climate models of the Intergovernmental Panel on Climate Change list black carbon (BC) as an important contributor to global warming based on its radiative forcing (RF) impact. Examining closely these models, it becomes apparent that they might underpredict significantly the direct RF for BC, largely due to their assumed spherical BC morphology. Specifically, the light absorption and direct RF of BC agglomerates are enhanced by light scattering between their constituent primary particles as determined here by the Rayleigh–Debye–Gans theory interfaced with discrete dipole approximation and recent relations for the refractive index and lensing effect. The light absorption of BC is enhanced by about 20% by the multiple light scattering between BC primary particles regardless of the compactness of their agglomerates. ECHAM-HAM simulations accounting for the realistic BC morphology and its coatings reveal high direct RF = 3–5 W/m2 in East, South Asia, sub-Sahara, western Africa, and the Arabian peninsula. These results are in agreement with satellite and AERONET observations of RF and indicate a regional climate warming contribution by 0.75–1.25 °C, solely due to BC emissions. This indicates that it is essential to account for the detailed agglomerate structure of BC to quantify its contribution to global warming. In this regard, a novel platform for the generation of aircraft-like BC emissions is developed to enable the characterization and mitigation of the climate impact from aviation, i.e. a major contributor to air pollution in New Jersey.

1:15 PM–2:30 PM

- **Jiyang Zhang (presenter), Rutgers University. A Bioengineered 3D Mini-ovary Enables a High-throughput Female Reproductive Toxicity Screening Platform and Identifies Ovarian Disrupting Effects of Climate Change-Related Mycotoxin Zearalenone**

Co-authors: Tingjie Zhan, Rutgers University; Yingzheng Wang, Rutgers University; Daniela D. Russo, MIT; Alex K. Shalek, MIT; J. Julie Kim, Northwestern University; Brittany Goods, Dartmouth College; Qiang Zhang, Emory University; Shuo Xiao, Rutgers University

Accumulating evidence reveals that climate change impacts women's reproductive health, including emerging environmental stressors and contaminants in New Jersey, such as extreme heat, harmful algal bloom (HAB) toxins, and mycotoxins. Identification of their female reproductive impact is challenging due to the low throughput of animal models and the lack of in vitro models that faithfully recapitulate hallmark of reproductive functions and possess scalability. We established a 3D hydrogel encapsulated in vitro follicle growth (eIVFG) system which recapitulates key ovarian functions, including follicle maturation, hormone secretion, and ovulation. Using single-follicle RNA-sequencing analysis, we demonstrated that such mini-ovary preserves key ovarian genes and signaling. We further used a closed vitrification system to demonstrate that cryopreservation of follicles via vitrification conserves ovarian functions at morphological, hormonal, and molecular levels, enabling us to establish a high-content ovarian tissue biobank and a high-throughput female reproductive toxicity screening platform. We have used this platform to test various chemicals including bisphenol analogues, flame retardants, per- and polyfluoroalkyl substances (PFAS), and climate change-related HAB toxins and mycotoxins. Zearalenone (ZEA) is a major mycotoxin produced from Fusarium fungi. The contamination of ZEA in food crops (corn, wheat, and grain) has been steadily increasing due to global temperature rise and worsening storage conditions. ZEA has been shown to exhibit estrogenic effect to disrupt female reproduction. Using our mini-ovary model, we found that environmentally relevant exposure levels of ZEA exhibited a non-monotonic dose-response (NMDR) effect on ovarian hormone secretion. At 1 μM, ZEA significantly increased estrogen and testosterone secretion, whereas ZEA at a higher level of 50 μM reduced their secretion and inhibited follicle development and ovulation. Together, we demonstrates that a 3D mini-ovary enables a high-throughput female reproductive toxicity testing of climate change-related environmental contaminants and other stressors; the mycotoxin ZEA exhibits non-monotonic ovarian disrupting effects to impair female reproduction.

1:15 PM–2:30 PM

- **Zorimar Rivera-Nunez (presenter), Rutgers University. Prenatal Mycoestrogen Exposure and Fetoplacental Function**

Co-authors: Carolyn Kinkade, Rutgers University; Anita Brinker, Rutgers EOSHI; Brian Buckley, Rutgers EOHSI; Jessica Bruner, University of Rochester Medical Center; Richard Miller, University of Rochester Medical Center; Carolyn Salafia, Placental Analytics; Thomas G. O'Connor, University of Rochester Medical Center

Zearalenone (ZEN) is an estrogenic mycotoxin or 'mycoestrogen' that contaminates global grain crops. Worldwide consumption has resulted in detectable concentrations of ZEN and its metabolites, including the synthetic version alpha-zearalanol (ZER), in human populations. Despite experimental evidence of endocrine disruption by ZEN, there is limited investigation about human health impact. The aim of this study was to examine markers of fetal growth following prenatal exposure to ZEN. Placental samples were

collected from participants (n= 240) in the UPSIDE cohort (Rochester, NY). Mycoestrogens were analyzed using HPLC-MS and values were log-transformed. Birth and placental weights were obtained from medical records and direct measurement; fetoplacental ratio (FPR) was calculated by dividing birthweight by placental weight. Generalized linear regression models were used to examine ZEN, ZER, and total mycoestrogens (sum of ZEN, ZER and their metabolites) in relation to fetal and placental size, adjusting for covariates. ZEN and its metabolites were detected in 82% of placentas (median ZEN: 0.013 ng/g). Lower FPRs were associated with placental concentrations of ZER (-0.45, 95%CI: -0.74,-0.16) and total mycoestrogens (-0.26, 95%CI: -0.42, -0.10). Although not statistically significant, placental ZEN (-31g, 95%CI: -115, 53) and ZER (-83g, 95%CI: -205, 40) were associated with lower birthweight and ZEN was associated with lower FPR (-0.19, 95%CI: -0.47, 0.08). No associations with placental weight were observed. Results from this first epidemiological study of prenatal mycoestrogen exposure and child health suggest that ZEN and its metabolites may alter placental efficiency, resulting in lower birthweight. These findings were fundamental for our current and future work examining mycoestrogen exposure in pregnant women recruited from New Brunswick, NJ.

2:45 PM–4:00 PM

POSTER SESSION (MULTIPURPOSE ROOM)

- **Aleksunes, Lauren. Rutgers University. Placental Barrier and Climate Change-Associated Toxin Exposure During Pregnancy**

Co-author: Ludwik Gorczyca, Rutgers University

During pregnancy, the placenta limits the maternal-to-fetal translocation of xenobiotics. This barrier is established in part by the presence of efflux transporters, such as the breast cancer resistance protein (BCRP/ABCG2), which actively extrude compounds from the placenta back towards the maternal circulation. Zearalenone (ZEN) is an estrogenic fungal-derived toxin and reproductive toxicant found in the food supply. ZEN exposure is anticipated to increase with fluctuating temperatures and weather events associated with climate change. ZEN has been identified as a substrate of BCRP/Bcrp in the placenta. In the present study, we sought to 1) assess the impact of prenatal ZEN administration on placental development and signaling and 2) determine whether placental Bcrp genotype influences responses to ZEN. Bcrp heterozygous mice were mated to generate all three Bcrp genotypes (wild-type, heterozygous, knockout) in utero. Dams received vehicle or ZEN (1.25, 3.75 µg/kg/d; 5 ml/kg) absorbed into soy-free peanut butter from gestational day 6 to 17. Changes in expression of markers of syncytialization (Catenin ß1, Cebpa, Gcma), spongiotrophoblasts (Ascl2, Hand1, Tpbpa, Cx31.1, Igf2, Pcdh12), giant trophoblasts (Prl-2c2, -3b1, Ctsq, Plap), placental barrier uptake transporters (Oatps), efflux transporters (Bcrp, Mdr1a, Mdr1b, Mrps), as well as antioxidant defense (Nrf2, Ho-1, Sod1, Sod2) were quantified by qPCR. Treatment with ZEN enhanced maternal weight gain, decreased placental weight and area, and increased the number of resorptions. Moreover, ZEN administration globally down-regulated mRNA markers of syncytiotrophoblasts, spongiotrophoblasts, and giant trophoblasts in wild-type fetuses up to 90% while increasing expression of Erα. Treatment of dams with ZEN down-regulated placental Bcrp mRNA expression in wild-type fetuses by up to 63%. Moreover, ZEN exposure differentially regulated placental transporter expression including down-regulation (Oatp2b1, Oatp4a1, Mdr1b, Mrp4) and induction (Oatp5a1) in wild-type fetuses with little to no change in Bcrp heterozygous and knockout placentas. ZEN globally down-regulated antioxidant defense genes by 32-57% in placentas from wild-type and heterozygous fetuses. Together, these

data suggest that prenatal ZEN exposure alters the placental development, differentiation, and barrier homeostasis during pregnancy.

2:45 PM–4:00 PM

- **Asok, Eshwanth. Environmental Impact Assessment for RAFT: Reconfigurable Array of High Efficiency Ducted Turbines for Hydrokinetic Energy Harvesting**

Co-author: Roger Wang, Rutgers University

Conventional hydropower technology uses high dams to create potential heads to generate power, which greatly impact the ecosystem and often involve migration of communities and heritage sites. There is a hope to harness the kinetic energy of rivers or ocean currents to generate renewable power to minimize the environmental and social impacts. Hydrokinetic turbines can be used with zero head as they use the force of moving water to turn the turbines placed directly in river, estuaries, coastal waters which in turn drive the electrical generators that produce power. This study focuses on horizontal axis turbines as it involves relatively low rotational speed of the blades. Funded by the Department of Energy ARPA-E program, this project is examining the environmental impact to harvest hydrokinetic energy from lower Mississippi region, i.e. Baton Rouge, LA. According US Energy Information Administration, tidal waves churn around 2.64 trillion Kilowatt hours of untapped energy which is equivalent to 66% of US electricity generated in 2020. Tidal energy wave turbines developed by Verdant power are the notable current ocean energy technology in market but are in experimental study phase near Roosevelt Island, East River, New York (Roosevelt Island Tidal Energy Project (RITE)). Although this wave energy technology is in its early stages of testing and deployment, it has got green signal from New Jersey Legislature as they passed a bill last year for study and deployment of these ocean energy technologies for their 2050 net zero mission. Furthermore according to this Bill A4483 Aca (1R) passed by the first state to show support for ocean energy, it directs BPU to establish wave and tidal energy generation goals and take other action to establish NJ as nationwide leader in ocean energy. Our project's application can be further extended to enhance the progress of New Jersey's ocean power quest and collaboratively achieve zero emission at faster pace.

2:45 PM–4:00 PM

- **Bennes, Brandon. SUNY Stony Brook. How Wealth Inequality and Vulnerability Differences Affect Mitigation and Adaptation in a Collective Risk Dilemma**

Co-authors: Reuben Kline, SUNY Stony Brook; Oleg Smirnov, SUNY Stony Brook

Because of global mitigation's nature as a non-excludable public good, there has been a consistent worry for decades that emphasizing local adaptation might lead to free riding in global climate change mitigation efforts due to political pressures, particularly in the less vulnerable, more prosperous democracies of the developed world. In local terms, with the impacts of climate change increasingly becoming apparent, New Jersey and other communities across the globe are facing a dilemma: should they spend effort and resources on climate change mitigation or adaptation to climate change? This project employs an experimental economics approach to understand how people navigate this tradeoff and which factors influence their choices. This design is a collective-risk social dilemma variant of a threshold public goods game in which participants can choose to invest in public insurance that reduces the probability of group disaster (mitigation), private insurance, which reduces the disaster's impact on them personally (adaptation), or in their private pool. We further extend this model by measuring the effect of inequality and lower initial vulnerability on the willingness to invest in mitigation vs. adaptation,

utilizing a 2 x 2 treatment design implemented with MTurk and experimental laboratory samples. While it is well established in the literature that cooperation collapses under conditions of differential risk and greater inequality as participants invest more in their private pool rather than in mitigation, we ask whether it is also the case under these conditions that participants are inclined to invest more in adaptation, or private insurance, than mitigation, as has been previously assumed.

2:45 PM–4:00 PM

- **Braasch, Joseph. Rutgers University-Camden. Arthropod Diversity Research across Spatiotemporal Scales: The Promise of Rodent Paleomiddens**

Co-authors: Maura Tapia-Rozas, Universidad de Chile; Claudio Latorre, Pontificia Universidad Catolica de Chile; Millaniyage Udari Hansika Peiris, Rutgers University-Camden; Olivier Dézerald, French National Institute for Agriculture, Food and Environment; Angélica González, Rutgers University-Camden

Paleological records are increasingly important to the study of ecology, allowing for an expanded temporal scope and the establishment of historic biodiversity baselines. Yet, arthropods are underrepresented in the study of paleoecology, despite their importance for plant demography, community assembly, and ecosystem scale processes in modern systems. Small herbivore paleomiddens are one of the best repositories of ancient arthropod assemblages, with a global distribution and remains as old as 50k years. To synthesize the current state of work using arthropod remains from rodent paleomiddens, we conducted a literature search and compiled a database of all published studies reporting arthropod remains. Through an integration of a qualitative review and quantitative analyses, we identified three areas in which paleomidden arthropods can be used to address fundamental ecological questions. We found that although studies of paleomidden arthropod assemblages have almost exclusively been used to support vegetative and climatic reconstructions, these resources could be leveraged to study ancient trophic webs, the role of climate and biotic interactions in the production of biodiversity, and the mechanistic relationships between environmental change and arthropod community composition. Yet, for such studies to be successful, we found that increased sampling of both ancient and modern arthropod assemblages will be necessary before direct links can be drawn between these temporally distant communities. Additionally, standardized sampling methods need to be established before studies can confidently model changes in community assemblage over space and time. Lastly, we found that low taxonomic resolution could limit our analytic ability to identify shifts in community diversity and composition over both small and large spatiotemporal scales. Our review highlights how insights from community ecology and new technologies can be leveraged to improve the inferential scope of paleomidden arthropod research as a new frontier in ecology.

2:45 PM–4:00 PM

- **Campbell, Michael. Rutgers University. In Vitro Uptake of Microcystin-LR Toxin in Human Placental Cells**

Co-authors: Xia Wen, Rutgers University; Shuo Xiao, Rutgers University; Lauren Aleksunes, Rutgers University

Microcystins are a class of cyanobacterial toxins released from harmful algal blooms (HABs). One of the most common microcystin congeners is microcystin-LR (MC-LR). MC-LR requires active uptake into cells in order to cause toxicity. Within the liver, MC-LR is primarily transported into hepatocytes by organic anion-transporting polypeptides

OATP1B1 and OATP1B3 leading to hepatotoxicity. With an increase in the incidence of HABs in both marine and freshwater ecosystems due to the global temperature rise and eutrophication, there is growing interest in evaluating the ability of microcystins to also act as reproductive toxins. In the current study, we sought to determine whether MC-LR can enter human placenta cells. For this effort, intracellular accumulation of MC-LR (0.1, 1, 10 μM) was compared between HepG2 cells, a human liver cancer cell line, and JAr cells, a human choriocarcinoma cell line using western blotting. A concentration-dependent increase in microcystin-LR accumulation was observed in both HepG2 and JAr cells after 6 hours. Interestingly, there was greater accumulation of MC-LR in JAr cells compared to HepG2 cells after 6 hours. This research ultimately aims to elucidate the role of transporters in the fate of microcystins as reproductive toxins by identifying the OATPs involved in placental uptake of MC-LR after exposure as well as the potential toxicity of microcystins to human placenta cells. Supported by T32ES007148, R01ES029275, P30ES005022, R01ES032144 and the Grover Fellowship.

2:45 PM–4:00 PM

- **Francesco, Nat. Rutgers University. Sustainability Culture within American Universities**

This poster discusses sustainability culture among American universities. This research assessed 28 universities throughout the country. By analyzing each institution's published database, my research reflects the comparison between institutions, cultural trends regarding sustainability, and how Rutgers can become more sustainable. To organize this information, I recognized the following universities with the most impressive sustainability publications: Temple University, University of Maryland, Ohio State, Penn State, and CSU Sacramento. After identifying these institutions, I discuss their published environmental reports, efforts toward sustainability on campus, and the physical presentation of their website. After identifying these components, I discuss what Rutgers should implement, publish, and improve to establish sustainability on campus. Toward the end of my research, I discuss why it is imperative to use some of these universities as "Climate Role Models" and lead the State of New Jersey through the climate crisis.

2:45 PM–4:00 PM

- **Garyantes, David. Robert Wood Johnson Medical School. Addressing the Impact of Climate Change on Human Health and the Practice of Healthcare within the RWJMS Curriculum**

Co-authors: Anisha Tyagi, Robert Wood Johnson Medical School; Catherine Chen, Robert Wood Johnson University Hospital

There is ample evidence that environmental factors such as temperature, pollutants and disease vector habitats affect human health. In response to the impact of global climate changes on environmental aspects of human health, many Northeastern medical schools including Icahn School of Medicine at Mt. Sinai, Columbia Vagelos College of Physicians and Surgeons, and Hackensack Meridian School of Medicine have added environmental health components to their medical school curriculum. Still, there is no consistent curriculum for environmental education in medical schools. In one survey, only 18.1% of family medicine residents had been trained to give an environmental history. Prior to this academic year, RWJMS did not currently have any time dedicated specifically to environmental health topics. This project aimed to address this gap in environmental health competency training for Robert Wood Johnson medical students, with particular regard for environmental pollutant exposure in patient populations. The presentation, given on April 11th, 2023, included an overview of environmental health and information about the changing climate of New Jersey. We chose to dive into one

example of environmental health to illustrate how physician practice can be influenced by knowledge of the patient's environmental risks. This example is obstructive lung disease and its relationship with pollution. The relationship between pollutant exposure and demographic factors such as economic status and race was also explored during this presentation, given to first-year medical students at RWJMS, as part of their Spring 2023 "Physicianship" course. Data was collected from students before and after the environmental health presentation, including information on student attitudes about environmental health and student knowledge about the specific topics covered in the presentation.

2:45 PM–4:00 PM

- **Kinkade, Carolyn. Rutgers University, School of Graduate Studies. Gestational Exposure to the Mycoestrogen Zearalenone and Associations with Serum Estrogen Concentrations**

Co-authors: Lauren Aleksunes, Rutgers EMSP; Anita Brinker, Rutgers EOHSI; Brian Buckley, Rutgers EOHSI; Susan Groth, University of Rochester Medical Center; Pamela Ohman-Strickland, Rutgers SPH; Thomas O'Connor, University of Rochester Medical Center; Emily Barrett, Rutgers SPH; Zorimar Rivera-Nunez, Rutgers EOHSI

Background/Aims: Zearalenone (ZEN) is a fungal-derived toxin found in global food supplies including cereal grains and processed foods. In the U.S., zeranol, a synthetic derivative of ZEN, is administered to livestock as a growth promoter. Because the chemical structure of ZEN, zeranol, and metabolites closely resembles 17β-estradiol (E2), they interact with estrogen receptors α (ER-α) and β (ER-β) resulting in their designation as 'mycoestrogens'. In animal models, gestational exposure disrupts estrogen activity and impairs fetal growth. In the current study, we evaluated the relationship between mycoestrogen exposure and circulating estrogens in healthy pregnant women. **Methods:** Serum and urine samples were collected in each trimester from pregnant participants in the UPSIDE study (Rochester, NY, n=208). We used high performance liquid chromatography and high-resolution tandem mass spectrometry to measure total urinary mycoestrogens (ng/ml) and serum estrogens (pg/ml) (estrone (E1), estradiol (E2), estriol (E3)). Multivariable linear models were fitted for each timepoint (1st and 2nd trimesters) using specific gravity adjusted, log-transformed mycoestrogen concentrations in relation to log-transformed estrogens, adjusting for covariates. We additionally considered effect modification by fetal sex. **Results:** ZEN and α-zearalenol (α-ZOL) were detected in >93% and >72% of 1st and 2nd trimester urine samples (ZEN median: 1st 0.098 ng/ml, 2nd 0.114 ng/ml; and α-ZOL median: 1st 0.104 ng/ml, 2nd 0.143 ng/ml). No significant associations between 1st trimester mycoestrogens and estrogens were observed. In the second trimester, ZEN and α-ZOL were positively associated with E1 (ZEN β:0.0803, 95%CI: 0.0004, 0.1602, α-ZOL β:0.1239, 95%CI: 0.0351, 0.2128), with stronger associations observed in pregnancies with female fetuses. **Conclusion:** Preliminary results indicate that mid-pregnancy mycoestrogen concentrations are associated with higher serum E1 concentrations. The next steps in this analysis include evaluation of 3rd trimester associations, longitudinal models, and evaluation of birth outcomes.

2:45 PM–4:00 PM

- **Korczakowski, Lauren. Rutgers University. Why Needs Assessments are Crucial to Creating an Equitable Plan for Climate Change Resilience in Communities**

Based on the 2022-2023 Franklin Township Community Health Assessment, I want to show how environmental social workers can support communities to conduct needs assessments in order to create an equitable plan for climate change resilience in communities. As a Masters of Social Work intern at Sustainable Jersey, I assisted with the survey collection, focus groups, and data analysis that informed Franklin's

Community Health Assessment. This poster will examine the importance of : a) understanding the needs of diverse community members; b) learning environmental challenges impacting residents and their health; c) identifying communication gaps, and d) creating inclusive communication channels to ensure that all residents are informed and have the opportunity to become engaged. This presentation will provide an overview of demographic diversity in Franklin Township, the findings of the health assessment, GIS environmental hazards mapping, and how this data is being used to create an equitable, climate change resilience action plan.

2:45 PM–4:00 PM

- **Lazofsky, Abigail. Rutgers University. Optimized Extraction and Analysis Methods Using Liquid Chromatography-Tandem Mass Spectrometry for Zearalenone and Metabolites in Human Placental Tissue**

Co-authors: Anita Brinker, Rutgers EOHSI; Ruby Gupta, Rutgers SPH; Emily Barrett, Rutgers SPH; Lauren Aleksunes, Rutgers School of Pharmacy; Zorimar Rivera-Nunez, Rutgers SPH; Brian Buckley, Rutgers EOSHI

Zearalenone and its metabolites, a group of endocrine disrupting mycotoxins, have been linked to adverse reproductive health effects. They cross the placental barrier, potentially reaching the fetus. In this study, we adapted and optimized our protocol previously used for urine to measure these mycotoxins in human placentas. We combined a supported liquid extraction step using Chem Elut cartridges with solid phase extraction on Discovery® DSC-NH2 tubes. The optimized extraction efficiencies were between 68-80% for all metabolites. Analysis was performed by UHPLC-HRMS using a Betasil™ Phenyl-Hexyl column eluted with a gradient of acetonitrile-methanol-water. The chromatography method separated all analytes in under 15 minutes. Validation experiments confirmed the method's sensitivity, with LODs ranging from 0.0055-0.011 pg/mg tissue. The method was linear over a range of 0.0025-1.5 pg/mg tissue with R2 values ≥ 0.994. Precision and accuracy calculations ranged from 8.5-26.7% and 13.4-65.8% respectively. The method was then successfully applied to a subset of placenta samples (n = 25) collected from an ongoing prospective birth cohort. Interestingly, 92% of the samples contained at least one measurable zearalenone metabolite, providing initial indication of potentially widespread exposure during pregnancy.

2:45 PM–4:00 PM

- **Nichols-O'Neill, Shane. Montlcair State University. Centennial Barrier-Inlet Evolution and Coastal Management: Lessons from Undeveloped and Developed Phases at Barnegat Inlet, New Jersey**

Co-author: Jorge Lorenzo Trueba, Montclair State University

Barrier islands are long, thin, and dynamic landforms that provide unique ecological habitats and recreational areas and protect coastal communities from storm damage. Highly developed barrier islands, located throughout New Jersey's coast, host tourism infrastructure and private housing that provide central economic value. Over the past century, increasing volumes of sand have been used to replenish the New Jersey coastline, most of which occurring over the past two decades. Maintaining this level of investment to "hold the line" may not be sustainable due to the effects of climate change, sea-level rise and coastal communities' potential lack of ability or willingness to cover the costs. To inform decisions related to a potential reduction in coastal engineering investment, an understanding of past, more dynamic barrier island behavior is required. We couple historical map analysis and a process-based numerical model to determine the natural

and anthropogenic effects that controlled Long Beach Island (LBI), a barrier island in southeastern New Jersey, alongshore evolution from 1839-1940, prior to major coastal engineering projects. Alongshore map analysis of the Island Beach (IB)-Barnegat Inlet (BI)-LBI barrier-inlet system indicates that LBI's shift from rotational nature to overall retreat coincided with small-scale coastal engineering efforts at BI, beginning in the 1860s. We combine these results with a morphodynamic model that accounts for natural and anthropogenic effects to quantify barrier-inlet system evolution over centennial timescales. Our model uses an idealized barrier-inlet-barrier geometry including four reservoirs that represent updrift and downdrift barriers, tidal deltas and various sediment fluxes that connect these reservoirs. Initial results suggest construction of small-scale jetties at LBI's northern tip altered both local and system-wide sediment transport indicating LBI behaved quite differently prior to coastal engineering and suggesting that even limited coastal engineering can have major effects on the regional coastline response over decadal and centennial timescales.

2:45 PM–4:00 PM

- **Peiris, Millaniyage Udari Hansika. Rutgers University. Effects of Altered Precipitation on the Structure of Ecological Communities: Preliminary Results from an Ongoing Meta-analysis**

Co-author: Angélica L. González, Rutgers University-Camden

Climate change is a growing threat to global biodiversity and the functioning of ecosystems. Changes in climate increasingly alter precipitation patterns. These events can affect community structure by altering species richness, diversity, evenness, and shifting species interactions. These effects can vary among taxonomic groups and trophic levels, however our understanding of the mechanisms underlying these distinct responses is limited. To date, synthetic studies on the effects of precipitation changes have been largely focused on their effects at the organismal level or on specific ecosystem processes. Synthesis work on community-level responses to altered precipitation has been limited to selected trophic groups from particular habitats. To elucidate general community-level responses as well as disentangle context-dependent responses to altered precipitation, we conducted a meta-analysis focused on plant and animal communities. We hypothesized that altered precipitation will affect community structure, with decreased precipitation (magnitude and frequency) reducing species diversity, abundance, and evenness, and vice versa. We conducted a literature search in the Web of Science (WOS) Core Collection Database to create a global database of precipitation effects on community metrics. Our results showed that most studies were conducted in North America (48.28%), Asia (34.48%), and 17.24% in Europe. We found significant decreases in plant and soil invertebrate diversity in response to decreased precipitation. However, we did not observe significant effects of increases in precipitation. These results suggest that the magnitude and frequency of decreased precipitation negatively affects plants and soil invertebrates differently by decreasing diversity. Increased precipitation can positively or negatively affect communities according to their trophic position and optimal conditions. These approaches can be used to identify and address knowledge gaps in community-level responses to precipitation changes. Our findings can be applied to real-world conservation, and policymaking as changes in community structure and functions are likely to affect ecosystem services and human well-being.

2:45 PM–4:00 PM

- **Shukaitis, Jennifer. Rutgers University. New Jersey Leaves No Bite Behind: A Climate Curriculum for 5th Graders Focused on Food Waste Reduction**

Co-authors: Virginia Quick, Rutgers University; Amy Rowe, Rutgers University; Sara Elnakib, Rutgers University; Jeanine Cava, Rutgers University

Food production accounts for approximately 16% of the United States' energy use, nearly 50% of U.S. land use, and 67% of freshwater consumption, yet an astounding 40% of America's food supply is wasted annually, with the majority of that food waste ending up in greenhouse gas-emitting landfills. In 2017, the New Jersey Legislature passed S3027, the Food Waste Reduction Act which established a statewide goal of reducing food waste by half by the year 2030. NJ was also the first state to require public schools to include climate change education in the K-12 curriculum. The New Jersey Leaves No Bite Behind project has created an Environmental Education program centered on food waste reduction targeted towards 5th graders. This pilot curriculum, coupled with administrative support for changes made in the school environment, can meet the need for the climate change education requirement while prompting action to meet the state's goal for reducing food waste by 50% by the year 2030. The evaluation of the curriculum is currently underway with 2 intervention and 2 control schools. Pre-programming food waste audits were performed in the school cafeterias along with assessing student food waste knowledge, attitudes and behaviors via paper/pencil surveys. This was followed by teaching of the curriculum in the intervention schools. Post-intervention food waste audits and surveys will be conducted this spring to determine the effectiveness of the program in reducing food waste behaviors. The control schools will receive the intervention after the pilot study. The curriculum consists of six lessons with lesson plans for teachers, interactive activities, challenges for students, and games to play both in the classroom and at home. The lessons cover essential earth knowledge, getting to know the food system, food waste in the food system, environmental impacts of food waste, food miles, and composting.

2:45 PM–4:00 PM

- **Sonty, Sukrut. Rutgers Robert Wood Johnson Medical School. Assessment of Climate Health Education at Robert Wood Johnson Medical School with the Planetary Health Report Card**

Co-authors: Catherine Chen, Robert Wood Johnson Medical School; Daniel Scalia, Robert Wood Johnson Medical School

There is a strong link between climate change and health. To foster a climate resilient population, healthcare professionals must anticipate and treat conditions from kidney stones to asthma in new contexts. Therefore, we are examining the extent of climate education at Robert Wood Johnson Medical School (RWJMS) using the Planetary Health Report Card (PHRC), an international effort to evaluate medical schools on planetary health instruction. The information collected includes the following categories: planetary health education, interdisciplinary research, community outreach, student-led initiatives and campus sustainability. Each category contains up to 22 metrics that are assigned a score based on the degree to which each is fulfilled. One example of a metric is "Does your medical school curriculum address the relationship between extreme heat, health risks, and climate change?" Through this effort, we highlighted how students learn about the devastating effects of our changing environment on vulnerable populations. We also identified gaps in the curriculum where topics such as One Health and environmental justice were not addressed. We have begun to embed student-led, climate-specific topics

in pre-clinical lectures to fill curricular gaps. We plan to use this report to guide a more complete, longitudinal integration of climate health education at RWJMS. The PHRC allows RWJMS to join the international report on the efficacy of over 75 medical schools in preparing climate-responsive future physicians. We are the first school in NJ to undergo this curricular evaluation.

2:45 PM–4:00 PM

- **Tyagi, Anisha. Rutgers Robert Wood Johnson Medical School. Environmental Health Curriculum for RWJMS: Healthy Benefits of Healthy Food**

Co-authors: David Garyantes, Robert Wood Johnson Medical School; Catherine Chen, Robert Wood Johnson Medical School

Introduction: "Healthy Plate, Healthy Planet" is a public module that provides educational material on simple dietary shifts that optimize personal and planetary health. While most physicians believe they should provide basic nutritional information to patients, only 8% of physicians who participated in a survey reported having expert nutrition knowledge. Across medical schools, there are no standards for integration of nutrition into medical training. In addition, environmental health education is largely lacking in the US. It is critical that medical schools begin integrating sustainable healthcare education competencies so students can identify synergies between promoting a healthy environment and the co-benefits to human health. **Methods:** First year medical students enrolled at RWJMS were assigned the module as homework. The 10-minute module covers planet friendly foods and small shifts in individual diets to reduce climate change, such as switching from eating farm-raised fish to wild-caught shellfish. Pre and post surveys were 14 questions in length and administered via Qualtrics. Comfort level, attitude, and knowledge on counseling patients for environmental co-benefits of friendly diets were measured. **Results:** 25 students completed the pre survey and 19 students completed the post survey. Paired t-test was used for students who completed both tests. Results identified statistically significant changes in being able to answer questions about sustainable diets from pre to post surveys. When comparing comfort in discussing dietary recommendations with patients, scores increased from a 44.5% pre-survey average to 67.3% post-survey average. **Conclusion:** Integration of an environmental health module into the preclinical curriculum improved student attitudes, knowledge, and comfort discussing dietary recommendations with patients. Integrating environmental health material into existing health system courses may be more practical than creating a block solely dedicated to environmental health. Further research should be pursued on the long-term impact on physician behavior of incorporating environmental health into medical student curriculum.

2:45 PM–4:00 PM

- **Wang, Hao. Rutgers University. Mitigation of Urban Heat Island Using Multi-Functional Pavement Materials**

This presentation will discuss the potential of using multi-functional pavement materials in alleviating urban heat island (UHI) effect. Two engineered solutions of using thermal modified asphalt pavement and porous concrete pavement are investigated using numerical simulation and laboratory tests. Using reflective pavement surface to mitigate UHI may be effective for an open street but become ineffective for the street surrounded by high buildings. However, high conductivity pavement could be another effective solution. On the other hand, permeable concrete pavement causes slightly greater heat output on sunny days but much smaller heat output on rainy days to the near-surface environment, as compared to conventional concrete pavement. The study findings show the potential of using innovative built infrastructure to combat climate change induced challenges.

2:45 PM–4:00 PM

• Wozniak, Matthew. Rutgers University. Effects of Fire Management on the Structure and Function of Aquatic Ecosystems

Co-author: Angélica L. González, Rutgers University

As wildfires become more frequent and intense under climate change, prescribed fires are becoming a common tool to reduce the fuel load of forests. Understanding this method's impacts on ecosystem structure and functioning is vital to making ecologically informed management decisions. Many forest ecosystems are interconnected to aquatic ecosystems through the exchange of energy and resources. Little is known about how prescribed burning impacts aquatic systems linked to forests. To better make future fire-management decisions, understanding not just how forests are affected through burning, but also how linked aquatic systems are responding to this management process will be necessary. Our research goals are to compare how aquatic systems respond to forest fires. Specifically, we asked: (1) how is aquatic community composition and structure affected by forest burning? and (2) how are key ecosystem processes such as organic matter decomposition impacted by forest burning? To answer these questions we used artificial aquatic microcosms to experimentally replicate natural aquatic ecosystems. The microcosms were placed within forest plots, which had sections recently burned as well as fire-excluded sections. **Results/ Conclusions:** Our results showed that community structure and ecosystem function varied between burned and not burned forests. Burned sites generally exhibited lower decomposition rates, lower average abundance and lower average diversity. Our results suggest that the impact of prescribed fire as a management tool affects community structure and ecosystem functioning of terrestrially linked aquatic systems, and that these responses could be dependent on factors such as the fire history of the managed forest. This information could prove invaluable for forest managers who want to make ecologically sound prescribed burning decisions.

2:45 PM–4:00 PM

• Wu, Gaoyuan. Princeton University. Enhancing the Resilience of Coastal Bridges: The Influence of Box Girder Geometry on Wave Forces via Numerical Simulations

Co-author: Maria Garlock, Princeton University

The potential increase of the intensity and frequency of natural disasters led by climate change indicate higher risks for coastal communities. For instance, hurricanes and tsunamis result in elevated water level and strong waves, which is devastating to the infrastructure near coastline such as coastal bridges. Coastal bridges may be removed from the pier or collapse when subjected to wave forces. To investigate the possibilities of modifying bridge geometries to mitigate the vulnerability of coastal bridges, a numerical study via smoothed particle hydrodynamics (SPH) is conducted herein. Specifically, we study the different geometries of box girder bridges and their influence on wave forces, including the maximum uplift force and the maximum horizontal forces. Different wave characteristics and elevated heights of bridges are considered. The numerical scheme via SPH is first validated by existing data from previous studies and it is then implemented for a parametric study. It is shown that the angle difference between the web and the bottom flange plays a significant role in the magnitude of the wave forces. The results provide insights on how box girder bridges should be designed for coastal hazard mitigation, which can further facilitate future research on innovative design of coastal bridges.

2:45 PM–4:00 PM

- **Zhan, Tingjie. Rutgers University. Exposure to Climate Change Related Harmful Algal Bloom Toxins Adversely Impacts Female Ovarian Functions and Reproduction**

Co-authors: Yingzheng Wang, Rutgers University; Pawat Pattarawat, Rutgers University; Jiyang Zhang, Rutgers University; Eunchong Kim, Rutgers University; Delong Zhang, Rutgers University; Saurabh Chatterjee, University of South Carolina; Ji-Yong Julie Kim, Northwestern University; Geoffrey I. Scott, University of South Carolina; Qiang Zhang, Emory University; Shuo Xiao, Rutgers University

Harmful algal blooms (HABs) are the excessive growth of cyanobacteria, knowns as "blue-green algae," in both marine and fresh waters. The frequency and severity of HABs have been steadily increasing due to the climate change-related global temperature rise and eutrophication. Humans are exposed to toxins released from HABs via contaminated drinking water, food, and recreational activities. Women living in coastal regions with more HABs have been reported to experience a higher risk of infertility and irregular menstrual cycles than women living inland, indicating the possible female reproductive toxicity of HABs toxins. Here, we used ex vivo mini-ovary model and in vivo mouse models to investigate impacts of microcystins (MCs), the most widely distributed HABs toxins, on the ovary. Mouse ovarian follicles were exposed to six common MC congeners (MC-LF, LY, LA, YR, RR, and LR) at 0.01-5 μM during gonadotropin-stimulated follicle maturation. All six MCs concentration-dependently compromised follicle ovulation and reduced progesterone secretion. Mechanistic investigations revealed that MC-LR, the most common MC congener, significantly inhibited protein phosphatase-1 and downstream signaling in granulosa cells, causing decreased expression of follicle maturation-related genes. We further used a mouse superovulation model to treat mice with 10 μg/kg MC-LR via intraperitoneal injection during the follicle maturation window. After ovulation induction, MC-LR treated mice had significantly decreased ovulated oocytes, confirming that MC-LR interferes with gonadotropin-dependent follicle maturation to block ovulation. We then conducted a more human relevant exposure experiment by treating young adult female mice with 10 μg/kg MC-LR via daily oral gavage for 6 weeks. Compared to control group, mice treated with MC-LR had 50% fewer corpus luteum, indicating defective follicle ovulation. Together, our study demonstrates that exposure to environmentally relevant levels of MCs compromise ovarian follicle maturation to result in ovulation failure, suggesting potential risks of climate change-related HABs toxins on women's reproductive health.