At What Point Managed Retreat?: Habitability and Mobility in an Era of Climate Change

Event Schedule

Tue, Jun 20, 2023

2:00 PM

1A) Climate Induced Human Migration: Engagement and Professional Development for Practitioners and Communities (panel)

2:00 PM - 3:30 PM, Jun 20

Room 555

Climate change brings a plethora of challenges and opportunities to communities. In this session, we will explore how to match educational resources with practitioners and communities facing the need to relocate due to climate change impacts. We will discuss the same for communities preparing to receive new populations due, at least partially, to climate change, recognizing that other push and pull factors impact the decision to move. Panelists will include community leaders, Sea Grant, Climigration Network, and the American Society of Adaptation Professionals (ASAP). Panelists will share approaches, processes, experiences, and thoughts on shifting ownership of - and power over - relocation decisions to community residents and how to discuss climate risks and adaptation options with community residents to support effective decision-making. Sea Grant will present different programs used to assist communities discuss climate-induced challenges to their ability to safely remain in their homes, such as scenario planning, train-the-trainer, community science as well as others. This will include findings from the Research Coordination Network, People on the Move in a Changing Climate program. Insights from a recently funded Climigration project involving practitioners and community leaders will be shared. ASAP will share information on their training programs for practitioners which highlight the latest tools, methods, and resources to assist communities facing climate-induced human migration. Following presentations we will engage the audience in a dialog about additional needs for trainings, engagement approaches, and tools for addressing climate impacts on communities.

Speakers

Katherine Bunting-Howarth

M

Mona Behl
Associate Director
Georgia Sea Grant

D

Debra Butler
Executive Director
American Society of Adaptation Professionals

K

Kristin Marcell
Director
Climigration Network

R

Rebecca Jim
Tar Creekkeeper and Executive Director
LEAD Agency

1B) Envisioning a permanent, proactive managed retreat program in New York State.(World Cafe)

2:00 PM - 3:30 PM, Jun 20

Broadway Room

Earlier this year, New York State (NYS) voters approved the Environmental Bond Act, a historic $4.2B allocation to prepare for the worsening impacts of climate change. The bond includes a dedicated $250M for a voluntary flood buyout program. Against this backdrop, we are proposing a session that will leverage the knowledge of NY/NJ resilience practitioners, government officials, community leaders, and academics to envision a proactively administered, permanent managed retreat program that coordinates the full services of a state government to transform coastal communities.

As part of this session, we will envision how managed retreat can move from a siloed and reactive program to an overarching public program that moves beyond purchasing homes and considers broader societal goals (e.g., workforce development, designing receiving cities, and increasing the affordable housing stock). Our ultimate goal is to produce recommendations for the design of a managed retreat program that is permanently integrated within the NYS government and that comprehensively considers the process from property acquisition through disposition and support for receiving communities. We will produce a policy brief with recommendations and considerations for designing such a program and deliver it to the Deputy Director of Policy in the New York State Governor's Office. The main question we will consider is, how can we best coordinate resources across NYS agencies to design a comprehensive, proactive, and permanent managed retreat program?

To address the overarching goals of this session, we propose the following discussion questions within five broad topic areas:

Program Design and Coordination: What services should be provided as part of a permanent managed retreat program? Which agencies within NYS should be considered in the design of a permanent managed retreat program? What are existing mechanisms that can facilitate coordination among these state agencies? Should new mechanisms be considered? How would a community-based managed retreat program differ from a single-home retreat program?

Risk Mapping: What risk mapping capabilities exist within the state or broader academic communities? What criteria should be considered for identifying eligible communities for relocation? What criteria should be considered to identify potential receiving communities?

Stakeholder Identification: Which stakeholders need to be considered to administer a successful program (e.g. municipal governments, non-profit and community organizations, land banks etc.)? How can the state support community-driven buyouts/ organizing? How can the state provide information to communities within these discussions (e.g. legal issues, ownership, titles. etc.)?

Post-Relocation: What should happen to the land afterwards/ who has ownership? What purposes can the land serve (e.g. parks, ecosystem restoration, etc.)? Which agencies would need to maintain the land? How will contaminants be removed?

Environmental/climate justice: How can managed retreat programs best serve disadvantaged communities? How should disruption to the social fabric of communities be considered? Can receiving communities become an opportunity to foster economic and social resilience (e.g. workforce development, housing counseling, etc.)?

Speakers

Nadia Seeteram
Postdoctoral Research Scientist
Columbia University

Linda Shi
Assistant Professor
Cornell University

David Burgy
Director of Strategy and Development
NYS Office of Resilient Homes and Communities

Kelly Leilani Main
Executive Director
Buy-In Community Planning

Anjali Fisher
Project Program Manager
King County Washington

Jane Brogan
Disaster Recovery Program Director
APTIM

Courtney Wald-Wittkop
Manager, Blue Acres Program
NJDEP

1C) Adaptive Mind for Coastal Professionals- A Training in the Psychosocial Skills for Managed Retreat

2:00 PM - 3:30 PM, Jun 20

Satow Room

Please note this training will be in-person only. The confluence of accelerating climate change and sea-level rise, more frequent and severe coastal disasters, widespread systemic injustice and oppression, and any number of additional environmental, social, economic and public health challenges (such as the COVID 19 pandemic) is creating an unprecedented set of challenges for coastal professionals. Our research to date suggests that along with vulnerable individuals and communities, those working to address these crises – including through the difficult adaptation strategy of managed retreat - are at high risk of burn-out. The climate resilience workforce must perform its essential work in the context of repeated trauma and constant change, high complexity and pervasive uncertainty. They feel inadequately trained to facilitate, navigate and in fact lead communities through the transformative and all-too-often traumatic changes awaiting them. These conditions have pushed many professionals to the brink of despair and exhaustion as they struggle to confront their own and collective grief as well as a host of other emotional responses even as they remain committed to advancing their critical work. The Adaptive Mind project focuses on supporting the people who do this work by understanding, fostering and strengthening the psychosocial skills and capacities of those who work in these challenging settings of intersectional crises. Presenters will share an overview of the project, discuss results from initial research to characterize the challenges and experiences of climate change professionals, and – drawing on pilot trainings completed to date - give attendees a taste of the Adaptive Mind training.

Speakers

Susanne Moser
Director, Climate Change Science & Policy Hub
Susanne Moser Research & Consulting

Kristen Goodrich
Coastal Training Program Coordinator
Tijuana River National Estuarine Research Reserve

Elizabeth Rohring
Retired
National Sea Grant Office

1D) Supporting Our Places and People as Climate Impacts Drive Population Movement: A Session on Managed Retreat (panel)

2:00 PM - 3:30 PM, Jun 20

Cinema

Human populations have always been on the move, seeking ideal conditions for the wellbeing of their communities. Today many communities are facing repetitive flooding, land loss, and increasing exposure to catastrophic storms, forcing them to question whether it is feasible to remain in the places they and generations before them have called home. Panelists in this session will help elucidate the current and future realities of coastal communities in Louisiana; complexities of climate-driven migration and impacts on these vulnerable communities; and lessons learned in the development of a Resilience Strategy with the Grand Caillou/Dulac Band of Biloxi-Chitimacha-Choctaw Tribe.

Session Chair: Camille Manning-Broome, President/CEO, Center for Planning Excellence

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Speakers

Shirell Dardar
Environmental and Human Rights Advocate and Cultural Preservationist
Grand Caillou/Dulac Band of Biloxi-Chitimacha-Choctaw

Pamela Jenkins
Professor Emeritus
The University of New Orleans

Kim Marousek
Director of Planning
Center for Planning Excellence

Robert Habans
Economist
The Data Center of Southeast Louisiana

4:00 PM

2A) Building a Better Buyout: Recommendations from Practitioners and Participants (panel)

4:00 PM - 5:30 PM, Jun 20

Practitioners, community members, researchers, and advocates have long observed challenges with federally-financed home buyout programs. At the same time, demand for buyouts is growing in many areas and current programs and funding sources will not be able to meet communities' and individuals' needs for relocation support. Between late 2021 and late 2022, NRDC, in partnership with FEMA, CH Consulting, the Climigration Network, and The Nature Conservancy, convened two workshop series—one with buyout practitioners and program managers, and one with buyout participants and community leaders—to discuss these shared challenges and identify practical recommendations for making buyouts faster, easier, and fairer.

In this session, we will share outcomes from the year of conversations with buyout practitioners and participants, including key recommendations from each group and highlighting areas of alignment.

Speakers

Anna Weber
Senior Policy Analyst
Natural Resources Defense Council

Kristin Marcell
Director
Climigration Network

Maggie Osthues
Program Manager
Climigration Network

Shameika Hanson
Climate Adaptation Specialist
The Nature Conservancy

Carri Hulet
Principal
CH Consulting

Joseph Tirone A seasoned real estate specialist, staunch community advocate, and former political candidat

Jose Regalado
Assistant Director, Building Department
City of Miami

2B) Climate Change Implications for Conflict Zones, Displaced Persons, Refugees, Slums Residents, and Other Involuntary Immobile Populations (World Cafe)

4:00 PM - 5:30 PM, Jun 20

Please note this session will be in-person only and limited to 25 participants. Please contact the session organizers to attend this session. Climate change exacerbates preexisting habitability challenges that affect the most socially vulnerable and traditionally underserved populations worldwide. Hundreds of millions of people are currently trapped in limbo (involuntarily immobility) in precarious conditions, especially following conflict- and disaster- induced displacement. Often non-local, populations with limited mobility are at risk to exposure from unprecedented, and compound climatic hazards such as riverine flooding, drought, temperature extremes, and wildfires.

This world café format workshop – including both short expert presentations and breakout discussions – examines the environmental justice and equity implications of climate change from the perspective of exposure of marginalized communities worldwide that are not sufficiently documented and given voice to manage retreat. The session will address challenges and opportunities at local, regional, and global scales in humanitarian monitoring, governance, and legal issues to improve conditions of displaced persons, refugees, slum residents, prisoners, and other involuntarily immobile populations in the context of climate change. The world café discussion is guided by four themes along the lines of from evidence to action:

- Drivers and impacts of compound risk and vulnerability

- Challenges and obstacles (>> participants collect a set of key 'road blocks')

- Guard rails to shape opportunities ahead

- Equitable, just, and actionable policy implications

Session organizers: Cascade Tuholske, Lisa Thalheimer, Fabien Cottier, Andrew Kruczkiewicz, Carolynne Hultquist

Speakers

Fabien Cottier
Postdoctoral Research Scientist
Columbia University

Andrew Kruczkiewicz
International Research Institute for Climate and Society, Columbia Climate School

Lisa Thalheimer
Climate Economist
United Nations University

Cascade Tuholske
Asst. Professor
Montana State University

Carolynne Hultquist
Adjunct Research Associate
CIESIN

CANCELLED - 2C) Interactive session: Developing a scenario game to navigate coastal managed retreat

4:00 PM - 5:30 PM, Jun 20

PLEASE NOTE THIS SESSION HAS BEEN CANCELLED. REBECCA WILL HOST AN INFORMAL SESSION AT ANOTHER TIME DURING THE CONFERENCE. DETAILS WILL BE POSTED ON THE WHOVA COMMUNITY BOARD.

Speaker

Rebecca Bicksler
PhD Candidate
University of Nottingham

6:00 PM

3) Habitability, Loss & Damage, and Climate Justice

6:00 PM - 8:30 PM, Jun 20

Auditorium

6:00 PM - 7:30 PM Welcome and Panel Discussion
7:30 PM - 8:30 PM Reception

Speakers

Radley Horton
Lamont Research Professor
Lamont-Doherty Earth Observatory, Columbia Climate School

Alexander Halliday
Founding Dean
Columbia Climate School

Tallant Burley
Senior Policy Advisor
New York City Mayor's Office of Climate & Environmental Justice

Alex de Sherbinin
Deputy Director
CIESIN, Columbia Climate School

Jola Ajibade
Associate Professor
Portland State University

David Wrathall
Associate Professor
Oregon State University

Kamal Amakrane
Managing Director
Global Centre for Climate Mobility

Wed, Jun 21, 2023

8:30 AM

4A) Utilizing a Whole-Of-Government Approach to Address Community-Driven Relocation (panel)

8:30 AM - 10:00 AM, Jun 21

Auditorium

The White House launched a Community-Driven Relocation Subcommittee as part of the White House National Climate Task Force in August 2022. This Interagency Subcommittee is co-led by the Federal Emergency Management Agency (FEMA) and the U.S. Department of the Interior (DOI). This subcommittee convenes federal agencies to explore key considerations, issues and strategies for community partnerships to support voluntary movement away from high-risk regions.

Interagency efforts include a new Voluntary Community-Driven Relocation program, led by the Department of the Interior, to assist tribal communities severely impacted by climate-related environmental threats. The U.S. Department of Housing and Urban Development developed a Climate Resilience Implementation Guide which provides a step-by-step guide to scoping community-driven relocation as a solution to multiple climate hazards. These efforts are only a part of the story in the Biden Administration’s strategy to advance the country to build climate resilience.

Representatives from the White House, Federal Emergency Management Agency (FEMA), Department of the Interior (DOI), and Department of Housing and Urban Development (HUD) will engage in an in-depth discussion on the range of hazard mitigation efforts utilized by the federal government to take deliberate, meaningful, and equitable actions to protect communities from the climate crisis.

Speakers

Krystal Laymon
Federal Emergency Management Agency

Lori Cary-Kothera
Director of Climate Adaptation and Resilience
White House Council for Environmental Quality

Victoria Salinas
Associate Administrator for Resilience
Federal Emergency Management Agency

Maria Wiseman
Senior Policy Advisor to the Assistant Secretary - Indian Affairs for Climate and the Environment
U.S. Department of the Interior

Kristin Fontenot
Director, Office of Environment and Energy
U.S. Department of Housing and Urban Development

4B) African Experience with Managed Retreat and Climate Mobility

8:30 AM - 10:00 AM, Jun 21
Satow Room

Climate Resettlement and Livelihood Transformation in Rwanda: The Case of Rweru Model Green Village

- Lisa Dale, Columbia University
- Jola Ajibade, Associate Professor of Geography, Portland State University

This study examines whether the resettlement of communities in rural Rwanda is transformative for residents and in what ways. Using the case study of the Rweru Model Green Village and drawing on Regional Political Ecology and Sustainable Livelihoods Frameworks, we show that voluntary resettlement as an act of transformation is mediated by proximate, regional, and global factors as well as human and non-human actors that shape the process and outcome for community wellbeing and livelihood sustainability. Our semi-structured interviews with households resettled in the Rweru village revealed the double-edged nature of transformation. We observed a positive dimension which involved increased access to modern facilities and social services for two remote island communities. However, new and potentially severe livelihood constraints also emerged due to variations in climatic conditions in the originating and resettlement sites in addition to intra-community inequalities and changing market conditions exacerbated by the Covid-19 pandemic. These findings suggest resettlement as a form of transformative adaptation requires careful navigation of the complex interactions and shifts in local, regional and global political economy.

Evidence of Erosive Effects of Household Shocks on Livelihoods and Migration in East Africa

- Julia Blocher, Project Lead, Potsdam Institute for Climate Impact Research
- Roman Hoffmann, Research Scholar, The international Institute for Applied Systems Analysis (IIASA)
- Helga Weisz, FutureLab Leader/ Professor, Potsdam Institute for Climate Impact Research (PIK)/ Humboldt University in Berlin

This presentation present final results from a statistical analysis - conducted in the methodology development stage of the HABITABLE (EU Horizon 2020) project - of the cumulative impact of different types of shocks on migration, considering both environmental and non-environmental events. Previous research has shown how different types of shocks can affect migration differently, but without fully considering the impacts of the co-occurrence and accumulation of different shocks over time. Using panel models and longitudinal data from the Tanzania National Panel Survey (TZNPS) between 2008 and 2013, we show that environmental and non-environmental shocks are closely related and can influence migration patterns over time. Our findings indicate substantial migration impacts of environmental shocks on migration when we distinguish different contexts and different shock types. The impacts are particularly strong for shocks that have occurred within 24 to 36 months prior to the interview date. Results are more concise in models controlling for the occurrence of previous shocks, highlighting the need to consider the wider temporal context and to account for potential dependencies in the occurrence of shocks over time. Moreover, we find evidence that co-occurring shocks can reinforce each other, increasing the effects on mobility. This research contributes to current understandings of migration as a “last resort” and expands our conceptualization of habitability to include non-environmental factors. The presentation will also comment on observations from research in five African countries for the on-going HABITABLE (EU Horizon 2020) project, to which this study has contributed.

Weather shocks, crop price and migration in West Africa: Insights from high-frequency largescale surveys

- Fabien Cottier, Postdoctoral Research Scientist, Columbia University
- Alex de Sherbinin, Deputy Director CIESIN and Senior Research Scientist, Columbia University
- Richard Seager, Lamont Research Professor, Columbia University
- Elizabeth Leong, Graduate student QMSS, Columbia University
- Elizabeth Nguyen, MA candidate, Climate & Society, Columbia University

How do weather shocks and food security influence human migration in West Africa? Despite a growing literature on environmental migration, research on the influence of the environment on migration has remained stymied because of a lack of high-quality empirical data, in particular when it comes to South-South migration, such as in West Africa. In fact, systematic data on migration in Africa primarily come from censuses, whose quality and frequency vary significantly from one country to

the next. Here, we draw on novel data collected by the International Organization for Migration (IOM) from a network of migrant transit nodes throughout West African based on random rolling surveys of migrants. Unlike migration data derived from censuses, these data make it possible not only to examine the effects of weather shocks on permanent international migration, but also compare it to seasonal and internal migration. Using these unique data, we examine to what extent drought and food price shocks influence migration in West Africa. We show that migration in the region is indeed influenced by weather shocks, with seasonal and short-distance migration more so than permanent long-distance migration.

Humanitarian Urbanism: How Multiple Risks of Climate Change and Land Degradation Overburden Cities in the Edge of Sahara

- Aliyu Barau, Professor, Bayero University Kano

Many arid sub-Saharan African countries are experiencing slow-onset processes - droughts and desertification – which are the main drivers of cross-border population displacements. This paper examines the experiences of Kano City in Northern Nigeria with respect to how Tuareg migrants create humanitarian urbanism characterised by poor and unsecured shelter system. This development creates new burdens on urban areas and governments that are already dealing with multiple urban sustainability crises. It is clear that appropriate policies are lacking between governments of the affected countries in matters concerning the plights of environment migrants from their places of origin into foreign cities and towns. This study has further strengthen the notion that in the drylands of Sub-Saharan Africa, droughts and desertification may not be the only triggers for population displacement, it is possible that conflicts associated with dwindling resources and worsening poverty will also complicate how climate change will expel people to cities. Finally, it is important to stress that it is crucial for developing countries to embrace the Nansen Initiative and integrate it with shelter targets of the SDGs in order to streamline protection of environmentally displaced persons. This study strongly argues that such initiatives should accord more attention to urban areas with a view to seeing how they can accommodate environmental refugees without compromising sustainability and their rights to the city.

A Field Perspective on Urban Climate Migration Governance

- Susan Ekoh, Researcher, German Institute of Development & Sustainability

About half of the world's population is estimated to inhabit cities, with projections showing growth in the future (OECD/EU Commission, 2020). In Africa, 44% of the population is estimated to live in cities (UNCTAD e-Handbook of Statistics, 2021). Climate change is likely to influence the demography of cities (OECD/EU Commission, 2020) as people migrate to cities (see: Adri & Simon, 2016; Chawla, 2017), but also from cities (see: Hauer, 2017), and within cities (see: Ayeb-Karlsson, 2021). Cities play a critical role in both migration (Thouez, 2020; Pejic, 2021) and climate change governance (Castán Broto & Westman 2020) and this is increasingly being recognized. Hence, the intersection of urbanization, climate change and migration becomes even more vital to consider (DePaul, 2012; Rana & Ilina, 2021), especially for major cities in Africa that accommodate economically and socially vulnerable populations. According to Schraven et al., (2019), the intersection of climate induced-mobilities are complex and governance across the two critical issues is not well coordinated. To contribute to this relevant area of research, this paper adopts a political economy analysis approach to interrogate the politics, power and interests that shape urban climate migration governance. Through expert interviews with political and social actors in two West African cities, the paper assesses the determinants of urban climate migration governance. Emerging results show that attention to the issue of climate-induced migration in Accra and Dakar, is still in its infancy. Limited resources and capacity means that cities rely on partnerships with external donors and networks to support the design and implementation of climate migration policies and programs. Furthermore emerging findings suggest the need for better coordination across levels of governance and actors in the area of climate-induced human mobility. These results are relevant for stakeholders and policy makers working in the area of climate migration governance, given the role that migration plays in climate adaptation for many individuals and communities.

Keywords: human mobility, climate adaptation, urban governance, coastal cities

References:

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Castán Broto, V., & Westman, L. K. (2020). Ten years after Copenhagen: Reimagining climate change governance in urban areas. Wiley Interdisciplinary Reviews: Climate Change, 11(4), e643.
Chawla, A. (2017). Climate-induced migration and instability: the role of city governments. OEF Research: one earth future, 02.
DePaul, M. (2012). Climate change, migration, and megacities: addressing the dual stresses of mass urbanization and climate vulnerability. Paterson Review of International Affairs, 12, 145-162.
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Schraven, B., Adaawen, S., Rademacher-Schulz, C., & Segadl, N. (2019). Human mobility in the context of climate change in Sub-Saharan Africa: trends and basic recommendations for development cooperation.
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Speakers

Lisa Dale
Lecturer
Columbia Climate School

Julia Blocher
Project Lead
Potsdam Institute for Climate Impact Research (PIK)/ Humboldt University in Berlin

Fabien Cottier
Postdoctoral Research Scientist
Columbia University

Aliyu Barau
Professor
Bayero University Kano

Susan Ekoh
Researcher
German Institute of Development & Sustainability

4C) Receiving Communities

8:30 AM - 10:00 AM, Jun 21
Room 555

Understanding climate migration receiving communities through a migration systems framework

- Kathryn McConnell, Postdoctoral Research Associate, Brown University Population Studies and Training Center (presenting)
- Elizabeth Fussell, Professor of Population Studies and Environment and Society, Brown University Population Studies and Training Center

Climate change scholars and practitioners are increasingly arguing for greater attention to “climate migration receiving communities” - the geographic destinations to where migrants move. Two primary typologies of receiving communities tend to dominate current discussion of climate migration destinations: sudden-influx receiving communities, in which a rapid-onset event results in the movement of a large number of migrants to the same destination, and self-branded receiving communities, in which destinations actively describe themselves as climate havens in a bid to grow their population. While an important starting point, we argue that these conceptualizations of “receiving community” are overly narrow, limiting our understanding of the ways that many, diverse communities are and will be influenced by climate change through in-migration. Many of the influences of climate change on destinations will likely be subtler and less immediately visible than sudden-influx and self-branded sites. Future research on receiving communities can do three things to advance a more robust understanding of receiving communities: (1) draw on a migration systems framework, (2) attend to less-visible cases that are neither sudden-influx nor self-branded, especially those related to slow-onset environmental changes, and (3) always consider “climate migration” in the context of larger population trends.

Climate-Induced Human Migration in the Great Lakes Region

- Katherine Bunting-Howarth, Associate Director of New York Sea Grant and Assistant Director of Cornell Cooperative Extension (presenting)
- Andrea Harder, University at Buffalo

Changing atmospheric conditions and environmental processes will continue to impact the habitability of coastal communities throughout the United States. By the end of the century upwards of 13 million U.S. residents could be displaced as a result of sea level rise (Hauer et al., 2016). The Great Lakes region is often described as a future climate destination due to its northeastern and midwestern location, an abundance of freshwater resources, and room to accommodate growth following post-industrial population declines.

Despite increased reference to the link between climate change and human mobility (which includes displacement, migration, and planned relocation), there is a lack of knowledge regarding how climate-induced population shifts will impact socio-economic and ecological processes in both sending and receiving communities, what will be required to adapt to those impacts, and how we can ensure the resilience of our communities.

PEople on the MOve in a Changing Climate (PEMOCC) was funded by the National Science Foundation (NSF) to highlight the current state of knowledge on climate-induced human migration, provide the scientific infrastructure that is required to conduct place-based research, and develop context-specific strategies and solutions in collaboration with coastal stakeholders. A Great Lakes regional workshop, hosted by New York and other Great Lakes Sea Grant Programs, was held in Buffalo, NY June 1-3, 2022. Policymakers, researchers, educators, and experts from a variety of backgrounds gathered to discuss the unique climate migration-related opportunities and challenges that are anticipated in the Great Lakes region. This presentation will present outcomes of the regional meeting including data and research gaps, strategies for education and engagement, and policy needs.

Receiving: Addressing Climate Gentrification in Real Estate

- Lian Plass, Senior Manager, Urban Resilience, Urban Land Institute

Climate gentrification, a phenomenon characterized by growing real estate investment and spiking prices in areas with lesser risk to climate change impacts, is anticipated to affect communities more and more in the coming years. Most agree that

gentrification can both benefit and harm communities, and recent ULI publications have emphasized the importance of creating conditions for “gentrification without displacement”. Just as gentrification on its own can be a double-edged sword, climate gentrification too presents both opportunities and challenges for both vulnerable populations and new residents. As housing and goods and services become more expensive, competition for public resources increases, and community character changes in concert with demographics, private sector stakeholders and public officials may experience difficulty navigating a changing development landscape.

Understanding how to facilitate equitable growth, prevent disinvestment, and protect and preserve existing communities is critical in addressing the issue of climate gentrification. This can be a complex task, as new residents bring with them new demand for housing and public services, as well as competition for resources. Private sector stakeholders and public officials may face difficulties in navigating a changing development landscape and turning new sources of demand into opportunities to revitalize, protect, and preserve existing communities.

The report on which this session proposal is based will be published in March, and will serve as a primer on climate gentrification for public officials, developers, and investors seeking actionable solutions in the face of climate change within the communities in which they work (see session outline below). This session will highlight the report’s key takeaways, including the fact that climate gentrification can occur due to international, inter-state, regional, and local movement of people, and that gentrification-driven displacement can be caused by a range of factors, some of which can be difficult to attribute directly to social, economic, and environmental factors—both direct and indirect. It also emphasizes the importance of considering both the ways in which new development might influence these factors in vulnerable communities and alternatives that can help to mitigate adverse impacts.

In addition to highlighting these key takeaways, the session will also discuss regional and local factors contributing to climate-related displacement pressures in locales such as Philadelphia, Miami-Dade County, Boston, Northern California, and New York City, alongside ongoing measures to combat adverse impacts. This session will delve into the findings and methodology of the report, providing a comprehensive overview of the issue of climate gentrification in the real estate industry. It will discuss the impacts of new residents on housing and public services, changing demographics, and threats to longtime residents. We will also explore strategies for facilitating equitable growth, preventing disinvestment, and protecting and preserving existing communities.

Policy and Governance Solutions for Receiving Communities

- Ira Feldman, Founder & Board Chair, Adaptation Leader

This presentation will focus on the challenges that "receiving communities" or "climate havens" will increasingly face in North America due to climate-induced migration in the U.S. and Canada. The legal, policy, and governance dimensions of internal displacement are only now slowly coming into focus. Much more study and planning will be needed.

The presenter, Ira Feldman, and his not-for-profit Adaptation Leader are already setting the research and policy agenda for receiving communities and developing support services for communities that -- willingly or unwillingly -- are viewed as climate havens. Some communities are encouraging in-migration; other receiving places are not viewing the prospect of newcomers due to climate displacement as a positive.

Adaptation Leader established an interdisciplinary working group on receiving communities in 2022, which assessed the potential for domestic displacement and considered a range of path-forward options. These options, much like climate adaptation itself, are context dependent. The team is developing solutions for both under-populated urban settings and rural greenfield solutions.

While recognizing the serious humanitarian concerns associated with the international migration of climate refugees, the Adaptation Leader team is focusing on the urgent need to prepare for internal displacement. Few have given serious thought to receiving communities, and, as a result, we are woefully unprepared. This presentation will position the receiving communities discussion as the "back end" or "flip side" of managed retreat a conversation that has received inadequate attention to date.

This presentation will explore the interplay between local, state, regional, and national governance and the prospect for interstate arrangements, federal policy, and legislation. The presentation will evaluate the potential role of public-private partnerships in addressing internal displacement. Finally, the presentation will give voice to the perspectives of current residents in perceived climate havens, including gentrification and other equity concerns.

The complexity of the receiving communities conversation will require the engagement of multiple disciplines and skill sets to build capacity. While ad hoc efforts are essential to developing leading practices and standards, this presentation will posit that a more coherent policy-based approach must guide the next phase of pilot projects and regulatory test beds for receiving communities.

This presentation will share the recommendations from the Adaptation Leader working group and preview a forthcoming article to be published by the Environmental Law Institute.

The Northeast as Climate Refuge? Migration Histories and Future Prospects

- Linda Shi, Assistant Professor, Cornell University

As climate impacts intensify across the United States, scholars and policymakers increasingly anticipate in-migration into the Northeast due to the perception and reality that this region has more water, more undeveloped land, and cooler temperatures. How ready is the region for in-migration given existing housing and infrastructure needs, the state of public and nonprofit institutional support systems, and societal openness to migrants? We respond to these questions by sharing early findings from the NOAA-funded planning project, A Northeast Safe and Thriving for All (NEST), which aims to help NOAA assess if it should fund a regional partnership on climate migration in the Northeast. We will highlight how communities in the region have responded to migrants in the past. Examples include the Great Migration of French Canadians to Maine, Great Migration of African Americans to New York, deindustrialization and depopulation across the region, refugee resettlement in Lewiston and Buffalo, and COVID-19 migration. Drawing on literature reviews and interviews and workshops with key stakeholders, we reflect on what historic and ongoing struggles to care for existing and new residents means for future in-migration into the Northeast. We also show how most climate, economic, and housing policies in the Northeast currently do not anticipate these challenges. We close by discussing examples of communities that are working to encourage economic growth, address housing unaffordability, and attract future climate movers, and what that suggests for future policy development.

Speakers

Kathryn McConnell
Postdoctoral Research Associate
Brown University Population Studies and Training Center

Katherine Bunting-Howarth

Lian Plass
Senior Manager, Urban Resilience
Urban Land Institute

Ira Feldman
Founder & Board Chair
Adaptation Leader

Linda Shi
Assistant Professor
Cornell University

4D) Environmental Justice and Equity

8:30 AM - 10:00 AM, Jun 21
Cinema

The challenges for Managed Retreats in South Asia: Evidence from Sundarbans and Kuttanad

- Ajmalkhan Areethala, Postdoctoral Fellow, Harvard University

Managed Retreat as an idea has not yet reached most of the underdeveloped and climate vulnerable regions in the world such as South Asia. As countries that have long coastal regions and vulnerable fishing communities, the managed retreat is certainly important for these countries and communities. My paper asks what are the challenges to managed retreat in South Asian countries that are not only climate vulnerable but has large populations of indigenous and fishing communities, and how and why concepts like managed retreats will have to be redefined in such regions. This paper focuses on two distinct climate-vulnerable regions in India, the world's largest area of mangrove forests in the Bay of Bengal and the Kuttanad region in the Indian Ocean where rice cultivation takes place below the sea levels as part of the Globally Important Agricultural Heritage System. Based on the ethnographic fieldwork among the indigenous and lower caste communities in these two sites, I demonstrate the peculiar changeless faced by the most vulnerable communities where they negotiate between the changing climate, the state led disaster management and climate adaptation projects, and their community adaptation (survival) strategies informed by both the indigenous knowledge and science. My paper argues that managed retreats in such locations need to take the local contests, communities (indigenous and lower caste), and their ecological relations and vulnerabilities into consideration. Hence, the managed retreat needs to be indigenized for South Asia.

Racial Disparities in U.S. Climate Migration

- Gabriela Nagle Alverio, Duke University
- Dr. David Leblang, Ambassador Henry J. Taylor and Mrs Marion R. Taylor Endowed Professor of Politics, University of Virginia

In the wake of Hurricane Katrina, 56 percent of Black Louisianans did not return to New Orleans, instead migrating to other parts of the state and region. Since then, a narrative around U.S. climate migration has become prevalent, suggesting that in the face of climate impacts White populations will stay in place and Black populations will be forced to migrate. To date, several studies have analyzed aggregate climate migration patterns across the U.S. and others have assessed climate migration patterns by race at the case study level. However, no research that examines the prevailing notion about climate migration patterns by race across the U.S. exists. Our paper fills this gap by utilizing county-level flood and migration data to analyze migration patterns by racial group. Results suggest that the prevailing Katrina narrative is entirely inaccurate: Black populations are trapped in the face of floods, while White populations are more likely to migrate after a flood. We conduct sub-analyses based on geographic features including coastal vs. non-coastal; urban vs. rural; and FEMA or First Street flood plain vs. non-flood plain. Racial disparities in migration persist even when taking these variations into account. In order to assess potential mechanisms for this outcome, we analyze the effect of FEMA funds on out-migration. We find that as FEMA funds increase, Black out-migration increases while White out-migration decreases, suggesting a potential climate gentrification effect. This trend, however, flips in coastal counties. Though we are unable to definitively say why these disparities exist, we conduct an in-depth literature review on likely mechanisms, including FEMA policies, flood insurance, and on-going systemic racism in the real estate market.

Projecting Health Impacts of Changing PM2.5 Emission Profiles Due to Climate Migration

- Chris Whitehead, Lead, air compliance practice, ESI

Managed retreat is a controversial topic. So is climate migration, but both are very real responses to decades of nearly unmitigated fossil fuel consumption and associated atmospheric warming. Whether we like it or not future populations will not be living precisely where we currently live. Land will be lost to coastal flooding, sea level rise, wildfire, drought, and a litany of other related causes. On top of the losses in viable land, population is projected to boom in coming decades. It stands to reason that distances from major emission sources (Title V facilities) will shrink over time. These major sources are governed by the projected annual emissions of criteria contaminants and if applicable hazardous air pollutants (HAPs). Any new permitting or major revisions will have to go through air dispersion modeling to project impacts to any local sensitive receptors. PM2.5 emissions have been directly linked to childhood asthma and multiple other respiratory illnesses. The EPA recently proposed a revision to the PM2.5 national ambient air quality standard, down from 12 micrograms/cubic meter to 8 or 9 micrograms. This change is projected to reduce early deaths related to respiratory illness by 4X.

My presentation will detail energy justice work that I have been doing for the Philadelphia and Southern New Jersey region. Using Philadelphia as a case study, I will model potential managed retreat scenarios in InMap. As the city's population grows and gets more consolidated, what will that do to projected PM2.5 impacts in the area? If we can project a future issue, we can also project a range of solutions.

Environmental Justice is Racial Justice

- Aviva Rahmani, Ghostnets
- Charlene Stevens, Arcade Project

Conventionally, environmental justice and Earth rights are addressed separately. Art, however, can envision problems more holistically. This panel will address a range of research and arts practice, from the Marshall Islands to Vinalhaven, Maine to deconstruct the boundaries between disciplines and make the statement that the reasons we are discussing managed retreat are because we have neglected both our social and ecosystem failures. We will present a range of responses to the current crisis based in work.

Speakers

Ajmalkhan Areethala
Postdoctoral fellow
Harvard University

Gabriela Nagle Alverio
J.D.-Ph.D. Candidate
Duke University

Chris Whitehead
ESI

AVIVA Rahmani
Ghostnets

M Charlene Stevens
Arcade Project

10:00 AM

Poster Session

10:00 AM - 10:30 AM, Jun 21

Auditorium

Today's actions for future solutions: Undergraduate students' perspectives on climate change communication

- Taylor Vahey, Bryant University
- Cathy Qi, University of Washington

Climate change is arguably the most dire and urgent issue facing our world today. The impacts of increased carbon dioxide emissions are far reaching and will require the collaboration of many players in society to mitigate the effects and adapt. Businesses need to transition their strategies to operate sustainably, education systems need to prioritize teaching climate change, and scientists need to better communicate their research with the general public so there is broad support for climate action. We present an undergraduate student perspective on learning, communicating, and leading campus actions in the era of climate change.

Climate change education is vital in communicating scientific facts to college students. To create the cultural shift and behavior changes necessary to protect the environment and to adapt to the new climate, students need to learn accurate and updated factual information about climate change. The United Nations is also advocating for schools to provide climate education to their students to prepare them for lives and careers in the midst of a warming environment. Information needs to be relevant and actionable within the daily lives of students for them to retain information and change behaviors. Research also shows that teachers want to inform their students about climate change, but may hesitate if they do not feel qualified. As students, we will discuss the current challenges in learning about climate change in college. For example, graphical representations of the human caused increases of CO2 can be best understood by comparing CO2 changes in the past and projected future. Students need to realize that since climate change is unprecedented through human history, examining the geological record and temperature fluctuations of the Earth will help students to comprehend both the rate and magnitudes of the change and its impact. Experiential learning is an effective tool to engage students in a solution based way. As undergraduate students who have learned about climate change through an experiential learning program, we advocate for all higher education institutions to incorporate opportunities for students to get hands-on encounters with sustainability and climate change. By collaborating with school alumni and like-minded corporations, educators have the opportunity to engage and communicate with diverse groups including women, minority, and international students. As the effects of climate change have been felt disproportionately on a multitude of locations, having students from geographically diverse areas of the world involved in thinking about the potential solutions to this global issue is necessary and urgently needed today. Having a diverse group of minds involved in the learning process of climate change is one way to mitigate climate injustices. Vulnerable groups most affected by climate change should have the knowledge and understanding from scientists to know where to relocate in the future as certain locations become increasingly dangerous, exposed to extreme weather and destruction. There is a strong demand from young students to be exposed to more climate education and to be involved directly in seeking solutions, in order to prepare them for their future careers in the 21st century. In the near future, we believe that all job opportunities will have climate related components. We will discuss results from interviews conducted through our current research through Bryant University and the Harvard Radcliffe Institute involving over 50 Bryant alumni with careers involving sustainability. We will outline data on what concepts and skills are most important to learn at the undergraduate level to prepare for work in these fields. We argue, through our own experience, survey data, and interviewing with alumni, that college education is critical in planting the seed for the preparation of the lives of the next generation to enhance their climate change resilience.

High tides mean high time: using landscape architecture to facilitate successful climate migration through managed retreat

- Emma Cervinka, Bachelor of Landscape Architecture Candidate, 2023, University of Guelph

Climate change has been identified as a major issue to be addressed by landscape architects in the 21st century. The UN's Sustainable Development Goals aim to protect the environment and human livelihood, prompting landscape architectural bodies to commit to sustainable design practices. A growing solution is 'managed retreat' – "the coordinated movement of people and assets out of harm's way." (Siders, 2019) This research aims to identify how landscape architects can synthesize design interventions that address sociocultural and environmental issues of managed retreat. A review of academic journals and grey literature, seven key informant interviews, and two North American case studies, will be conducted to investigate the role

of landscape architects in climate migration. The review will conclude that managed retreat requires place-based design and identify key practices for landscape architects to employ, using Hurricane Fiona as an example. The principles will contribute to the growing knowledge on sustainable climate migration. The final project will employ the guidelines established throughout the thesis project to suggest the implementation of managed retreat in an at-risk community along the waterfront in Boston, MA.

Rethinking Relocation and Resilience: Understanding How the Pushes and Pulls of Place Shape Relocation Decisions in the Greater Houston and New Orleans Regions

- Abbey Hotard, Texas A&M University at Galveston

Resilience to disasters is determined by the web of resources and abilities that build resistance and adaptive capacity. Adapting to future hazards involves making tradeoffs across a range of personal and community capital assets for resilience. Household relocation decisions, in particular, depend on the interplay of "push" (e.g., crime, hazards) and "pull" (e.g., employment, social ties, natural amenities) factors that affect quality of life within a community. These push and pull factors are manifestations of the interactions between community and personal capital assets for resilience. Past research has demonstrated that hazard-driven relocation decisions are influenced by perceptions of existing community conditions. This research expands upon that understanding by highlighting the interaction between personal assets and perceptions of community assets during relocation considerations to provide an assessment of resilience particularly among residents preferring to remain in coastal communities.

Planetary Neighborscape: A Reparations Framework for Climate Migration

- Ari Vamos, Graduate Student, Landscape Architecture, University of Pennsylvania Weitzman School of Design
- Aaron O'Neill, Graduate Student, Landscape Architecture, University of Pennsylvania Weitzman School of Design
- Jun Lee, Graduate Student, Architecture, University of Pennsylvania Weitzman School of Design

Planetary Neighborscape was developed for Matthijs Bouw's fall 2022 University of Pennsylvania design studio on climate migration in the Netherlands. While the original studio prompt focused on movement from the country's urban west to its rural east in the face of sea level rise, we expanded our scope to engage climate migration at a global scale. Drawing on both scholarly and activist calls for climate reparations, our design proposal explores a scenario in which former colonial powers such as the Netherlands and Germany facilitate climate migration from former colonies such as Indonesia and Namibia. This scenario reimagines the rural Dutch tradition of naoberschap, or neighborly responsibility and mutual aid, as an expanded transnational solidarity in the face of the climate crisis. By landing this scenario in Dinxperlo, a small farming community on the eastern Dutch-German border, we explore what physical and social infrastructures might be necessary to both successfully resettle climate refugees and address challenges faced by the receiving community, including drought and a shrinking agricultural economy. The design proposal is based around three key elements: modular climate refugee housing, bio-based material production to support this new construction, and sustainable land management to increase groundwater storage and prevent drought. Alongside the physical design, we worked through a phased social process that would build relationships and consensus between sending and receiving communities before migration begins. The physical infrastructure takes the form of a distributed vocational school campus that trains both existing residents and new arrivals in bio-based material production, modular construction, and sustainable forestry and agriculture. We designed 3 campus sites: a refugee welcome center and language hub in the center of Dinxperlo, a construction training and refugee housing site, and a sustainable land use education park. Each site layers a range of uses across interior and exterior space, blending productive, educational, cultural, and social functions to imagine how people from disparate communities might live and work together. Our proposal pays particular attention to how climate refugees could build lives in a new place and make the built environment their own. A modular housing system allows a range of configurations based on different family sizes and kinship networks, as well as supporting self-built expansion and customization over time. Climate refugee-led productive and didactic landscapes decenter conventional Dutch water engineering and make space for the Dutch to learn from other ways of living with water. Finally, flexible public spaces create room for both collective celebration and collective grief. Through this interdisciplinary collaboration between architecture and landscape architecture, we hope to give built form to what are often abstract calls for climate reparations. By envisioning a possible future of mutual solidarity and abundance, we argue that climate reparations are both an ethical obligation and a necessity for survival–for former colonies and former colonizers alike.

Weighing the Costs and Benefits of Climate Adaptation

- Melissa May, Senior Planner, Resilience Practice Leader, SSFM International

In the face of rising sea levels and increasingly extreme, unpredictable weather patterns, government agencies are confronted with daunting challenges in planning for future investments in infrastructure and development. Climate adaptation involves difficult choices with vast social, economic, and environmental repercussions. The vulnerabilities and the urgency to adapt are well documented in many areas. What is needed next are solutions and action. Climate adaptation requires a rigorous, replicable, and defensible decision-making framework for identifying and vetting different solutions for vulnerable areas. The adaptation pathways approach is being utilized worldwide to enable agencies to evaluate climate adaptation options based on feasibility, costs and benefits, and community acceptance. These solutions may range from a "do nothing" approach, to engineered solutions that protect or harden existing infrastructure, to managed retreat that relocates vulnerable infrastructure and development out of harm's way. The adaptation pathways approach evaluates these options over different timescales and levels of climate impact, ultimately identifying "pathways" of short, mid, and long-term solutions and trigger points at which increasing impacts and/or costs make it necessary to move to the next phase. These adaptation pathways provide a sound basis to guide investment and secure funding for implementation. Cost-benefit analysis and other types of economic analysis are critical inputs into the development of climate adaptation pathways. This involves analyzing the hard costs associated with design and construction of different solutions, as well as the societal and environmental costs, including the ecological, economic, and societal benefits provided by intact beaches and coastal ecosystems, and the costs associated with their potential loss.

Timber Urbanism: Assessing the carbon footprint of mass-timber, steel, and concrete structural prototypes for peri-urban densification in the Hudson Valley's urban fringe

- Eleni Stefania Kalapoda, Architect & Urban Designer, Columbia GSAPP

The current fossil-fuel based urbanization pattern and the estimated human population growth are increasing the environmental footprint on our planet's precious resources. To mitigate the estimated skyrocketing in greenhouse gas emissions associated with the construction of new cities and infrastructure over the next 50 years, we need a radical rethink in our approach to construction to deliver a net zero built environment. This paper assesses the carbon footprint of a mass-timber, a steel, and a

concrete structural alternative for peri-urban densification in the Hudson Valley's urban fringe along with examining the updated policy and the building code adjustments that support synergies between timber construction in city making and sustainable management of timber forests. By quantifying the carbon footprint of a structural prototype for four different material assemblies—a concrete (post-tensioned), a mass timber , a steel (composite) and a hybrid (timber/steel/concrete) assembly applicable to the three new building typologies of the IBC 2021 (Type IV-A, Type IV-B, Type IV-C) that range between a nine to eighteen-story structure alternative—and scaling-up that structural prototype to the size of a neighborhood district, the paper presents a quantitative and a qualitative approach for a forest-based construction economy as well as a resilient and a more just supply chain framework that ensures the wellbeing of both the forest and its inhabitants.

Labor Mobility as Climate Adaptation Strategy in the Pacific

- Limon B. Rodriguez, Johns Hopkins University School of Advanced International Studies (SAIS)

Vulnerable to climate change, the Pacific Island countries (PICs) face an existential threat. In fact, in response to rising sea levels, a set number of citizens from Fiji, Kiribati, Tonga, Tuvalu, and Samoa are provided access to permanent migration to New Zealand annually. Projected to be submerged in the future, citizens from PICs are being prepared for labor markets in Australia and New Zealand through labor mobility. Labor mobility, particularly, circular migration, serves as a rampway through which workers are equipped with technical and vocational skills to access labor markets in host countries and with soft skills to enable their integration, especially when their home countries may no longer be habitable. To manage the risk of decreasing domestic employment opportunities as a direct impact of climate change, labor mobility as an adaptation strategy is recognized in policies of PICs (e.g., Tuvalu's National Labour Migration Policy Report, Kiribati's Joint Implementation Plan on Climate Change, Vanuatu's National Policy on Climate Change and Displacement).

My paper focuses on two labor mobility schemes between Australia and PICs: the Seasonal Worker Programme (SWP) and the Pacific Labour Scheme (PLS). Kiribati is an example of why these schemes are linked to climate adaptation. The SWP, for instance, did not originally include Kiribati because travel costs are high, but since it is one of the first projected countries that will be submerged, it was included in the program to enable its people to move to Australia voluntarily. More broadly, these schemes are a climate adaptation strategy in the Pacific because they: a) generate financial and social remittances to cope with impacts of climate change; b) lower population pressure on climate-stressed environments and natural resources; and c) reduce the number of people supported in home countries thereby exerting less pressure on household food stocks. For example, financial remittances are used for building climate-resilient houses, installing water pumps and water tanks given droughts and intrusion of saltwater, improving seawalls, and purchasing solar panels. And social remittances enable transfer of agricultural skills, such as pruning which was applied to breadfruit trees which were previously not producing fruits because of drought and salty water. These benefits present opportunities to: a) train migrant workers in and connect them with agricultural extension services in home and host countries; b) offer agricultural certifications because some migrant workers are interested in training on salt-tolerant crops which can be applied in home and host countries; and c) partner with agricultural training centers in PICs (e.g., Rural Training Centers in Solomon Islands).

However, these schemes can be maladaptive if they shift the costs of adaptation to migrant workers and their home countries, including through: a) transfer of unsustainable agricultural practices (e.g., use of synthetics chemicals in fertilizers and pesticides); b) abuse (e.g., underpayment and non-payment of wages); and c) high social and emotional costs (e.g., poor mental health due in part to homesickness, marital dissolution). While measures are being carried out to resolve these issues, such as payment of minimum hourly rates, improved employer portability, and bringing families of longer-term workers, my paper recommends the following: a) delivery of agriculture training on safe and effective use, and benefits and risks of transfer of synthetic chemicals to farms; b) latching agricultural labor mobility onto work placements or farm tours on organic and protected cropping farms and farmer exchanges; c) improved regulation of recruitment practices; d) involvement of diaspora in governance and support structures; e) creation of opportunities for permanent residency; and f) climate financing mechanisms, notably, the Readiness Resources from the Green Climate Fund, and funding from multilateral development banks and international organizations for financial sustainability.

Modeling climate change impacts on habitability and mobility dynamics in Kiribati

- Emily C. Nabong, PhD Candidate, The University of Sydney

In 2020, the United Nations Humans Rights Committee shared a landmark decision stating that a person cannot be returned to a country where climate change impacts create exposure to life-threating risks. In this legal case, however, the I-Kiribati applicant was denied refuge as the committee argued that there is not yet an imminent risk to life by living in Kiribati. In this study, we explore the topic of imminent risk to life by evaluating changes in habitability and its effect on future migration patterns in Kiribati. We build from a Sustainable Livelihoods Framework to assess how climate change affects existing interactions between factors (i.e. human, natural, physical, social, and financial) and leads to loss in habitability. Using a system dynamics approach, we aim to find tipping points in habitability and key drivers of migration in Kiribati as well as evaluate how the time scale and magnitude of migration changes under different representative concentration pathways. With these results, we contribute to conversations of habitability and imminent risk for future climate displaced people.

Speakers

Taylor Vahey
Bryant University

Emma Cervinka
MUD Candidate 2024
University of British Columbia

Abbey Hotard
Texas A&M University

Ari Vamos
Graduate student in the Department of Landscape Architecture
University of Pennsylvania Weitzman School of Design

Melissa May
Senior Planner, Resilience Practice Leader
SSFM International

Eleni Stefania Kalapoda

Limon Rodriguez
Doctoral candidate
Johns Hopkins University School of Advanced International Studies (SAIS)

Emily Nabong
PhD Candidate
The University of Sydney

10:30 AM

5A) Migration as adaptation or maladaptation

10:30 AM - 12:00 PM, Jun 21
Room 555

Environmental shocks and migration among climate-vulnerable populations in Bangladesh

- Jan Freihardt, PhD Candidate, ETH Zurich

Various studies predict large environmental migration flows due to climate change, yet the ex-post empirical evidence for such migration is inconclusive. I examine the causal link between environmental changes and migration drawing on the theoretical framework of the need, desire, and ability to move of affected populations. The analysis relies on original survey panel data of 1700 households residing along the Jamuna River in Bangladesh, an area heavily affected by environmental changes, in particular floods and riverbank erosion. Controlling for individual level characteristics such as gender, age, risk attitudes, and migrant networks, I relate respondents' perception of riverbank erosion and floods (need), migration aspirations (desire) and education/occupation/wealth (ability) to their likelihood to move away from their place of origin. I find that erosion significantly increases the propensity to migrate, while flooding has a significant effect only if it leads to severe and irreversible impacts. These findings have significant policy implications by underlining the nuanced relationship between different types of environmental shocks and migration, which should be reflected in policies aiming at supporting populations-at-climate risk.

Translocal social resilience dimensions of migration as adaptation to environmental change

- Harald Sterly, Senior Scientist, University of Vienna (presenting)
- Patrick Sakdapolrak, University of Vienna
- Marion Borderon, University of Vienna

There is growing recognition of the potential of migration to contribute to climate-change adaptation. Yet there is limited evidence to what degree, under what conditions, for whom and with which limitations this is effectively the case. We argue that this results from a lack of recognition and systematic incorporation of socio-spatiality – the nested, networked and intersectional nature of migration-as-adaptation. Our central objective is to utilize the translocal social-resilience approach to overcome these gaps, to identify processes and structures that shape the social resilience of translocal livelihood systems, and to illustrate the mechanisms behind the multiplicity of possible resilience outcomes. Translocal livelihoods constellations anchored in rural Thailand as well as in domestic and international destinations of Thai migrants serve as illustrative empirical cases, based on data that was gathered through a multi-sited and mixed-methods research design. Our contribution highlights the role of the distinct but interlinked situations and operational logics at places of origin and destination, as well as the different positionalities and resulting vulnerabilities, roles, commitments and practices of individuals and households with regard to resilience. Based on the empirical results, we distill a generalized typology of five broad categories of resilience outcomes which explicitly considers socio-spatiality. Our approach helps to grasp the complexity of migration-as-adaptation and to avoid simplistic conclusions about benefits and costs of migration for adaptation – both of which are necessary for sound evidence-based migration-as-adaptation policymaking.

Climate Change, Migration and Adaption in Oceania

- Juliette Budge, Resilience Researcher, Climate Resilience Collaborative, University of Hawaii, Manoa

Pacific island countries and territories are being increasingly affected by rising temperatures, more intense tropical cyclones, sea level rise (SLR) and storm surge, drought and changing rainfall patterns, and coral bleaching. Continued SLR may increase marine inundation of coastal roads, port facilities, coastal wetlands and groundwater systems. Island communities are located at the intersection of intensifying storm runoff and rising ocean waters. Atolls are especially exposed to the effects of SLR in the form of shoreline erosion, inundation, and saltwater intrusion into fresh groundwater. Several studies explore climate driven impacts and other environmental factors on the resilience of low-lying islands.

Currently climate change does not rank as a top motivation for movement from smaller islands to higher ground-those drivers are more likely to be education, employment and healthcare. However, in Oceania there are indicators that tell of quickly approaching environmental shifts that will most likely increase human movement in this region. There is robust data on climatic changes happening in the Pacific. The research provides critical information for understanding the timing and magnitude of climate change impacts on atoll islands that will result in significant, unavoidable geopolitical issues if it becomes necessary to abandon and relocate low-lying island states. And islanders are facing an existential threat, but the narrative is more complex than climate change forcing migration. It asks us to consider adaptive strategies beyond the geography of their home islands.

Islands in Oceania are often described as highly vulnerable and lacking adaptation options. These descriptions neglect the fact that Pacific Islanders, by many different metrics, are leading climate action and combining their systems of knowledge with more western science to create relevant climate solutions. The reluctance to recognize the many ways Oceanic communities adapt and build resiliency demonstrates the beginning of a cognitive bias that is limiting to sustainable climate solutions for everyone.

This bias becomes more entrenched when the topic of migration is considered. Moral obligations aside of who caused climate change and who is suffering from its consequences-the narrative around climate migration has long been sensationalized and scandalized. Some worst-case scenario projections of sea level rise estimate that globally 2 billion people will be forced to relocate by 2100. These fearful discourses create the foundations in receiving communities for anti-immigrant sentiments and policies.

Previous research has demonstrated that fundamentally, Pacific Islanders do not want to be portrayed as refugees. While the term “environmental refugees” has been used in global discussions, and sometimes to describe migrants in Oceania, it is not representative of their status, nor experiences. The term removes any agentive characteristics from the islanders. This element of forced migration associated with refugee status is problematic and considered undesirable, both for sending and receiving communities. The drivers of migration in Oceania are diverse, and the historical choices for movement are equally varied. As many islanders and observers would point out, migration has always been a part of their society and culture. This is evidenced in resettlement in search of better food sources and the traditional practice of voyaging, as taught by Papa Mau.

Despite migration being considered an agentive choice, any island nation government will explain, it is not their first choice for their people when addressing climate change. Individuals often do not want to leave their customary lands. In this research we use the Compacts of Free Association, the migrants who move under its obligations to them, and the receiving communities to understand how climate change and adaptation are interconnected to movement in Oceania.

Planning for Climate Mobility: From Informed Decisions to Collective Action

- Sarah Rosengaertner, Global Knowledge & Practice Lead, Global Centre for Climate Mobility (GCCM)

This presentation will focus on the work of the newly established Global Centre for Climate Mobility (GCCM) generating evidence and mobilizing collective action to address the impacts of climate change in some of the most vulnerable countries and world regions (Africa, Greater Caribbean, Pacific) where people are already compelled to move due to climate impacts and entire nations face certain displacement this century. Their situation cannot be accounted for with the tools of migration governance, including planned relocation alone. Larger questions of climate justice and climate adaptation, economic transformation, preserving cultural heritage and identity, and maintaining statehood arise. The presentation will discuss findings and lessons learned from the GCCM's work with regional organizations and national and local governments, the UN, stakeholders, and the scientific community to build knowledge on regional climate mobility dynamics, develop policy blueprints and a community of practice, and ultimately foster political momentum for addressing climate mobility and people's right to remain in place as the local, national, regional and global collective action challenge that it is.

Trapped by climate change? Linking migration aspirations to actual moves among a climate-vulnerable population in Bangladesh

- Jan Freihardt, PhD Candidate, ETH Zurich

While the academic literature agrees that climate change will alter migration patterns, it has been inconclusive about how it will do so. For examining how environmental changes translate into migration, one needs to consider both migration aspirations and the ability to move of affected populations. I investigate which factors condition whether environmental changes lead to actual moves by collecting primary survey panel data of 1700 households residing along the Jamuna River in Bangladesh. I assess baseline migration aspirations of a population at risk of being affected by riverbank erosion and floods. Re-interviewing the same population after erosion and floods have materialized, we can assess whose aspirations turned into actual moves and whose did not. We find that migration materializes only for a small fraction of those who had expressed a desire to move at baseline. Socioeconomic status and social networks are important conditioning factors influencing an individual’s ability to move. Our findings have significant policy implications since they provide guidance how to support the most vulnerable parts of populations at risk of becoming trapped in unfavorable environmental conditions.

Speakers

Jan Freihardt
ETH Zurich

Harald Sterly
Senior Scientist
University of Vienna

Juliette Budge
Resilience Researcher
Climate Resilience Collaborative, University of Hawaii, Manoa

Sarah Rosengaertner
Global Lead, Knowledge & Practice
Global Centre for Climate Mobility

5B) Institutional and Legal Aspects of Managed Retreat

10:30 AM - 12:00 PM, Jun 21

Satow Room

What is moved in a retreat and who moves these activities? What planners need to know

- Karen O'Neill, Associate Professor in Human Ecology, Rutgers University
- Heather Fenyk, President, Lower Raritan Watershed Partnership

Because coasts are socially and economically vital regions, retreat from a coastal site could affect many human activities and uses that involve many institutions. Retreats therefore extend beyond the scope of coastal management and land use planning. Planners are integrated into these two professional practices. They increasingly recognize that coastal change requires the full range of planning approaches, including national and regional spatial planning, housing policy, workforce development, and economic development.

To consider these needs, we asked what activities and uses are being moved from coasts, and who is moving them? To answer these questions, we did a desk analysis of sixty cases of coastal retreat around the world, focusing on moving projects that institutions sponsored. Sponsors take on some or all responsibility to fund or organize a retreat or relocation (Hino et al., 2017). Sponsors may aim to meet a broad institutional aim, such as managing hazards, and in many cases they may also aim to assist people who retreat. We analyzed what uses and activities were moved, which types of institutions became sponsors, and whether the mix of institutions changed over the course of the project.

The analysis found that sponsors included various government bureaus and other institutions, depending on what was being moved. For instance, several projects that moved people from eroding communal lands were sponsored by the clans that managed those lands; these projects were joined later by government agencies that clans solicited for funding and logistical help. In another case, a highway agency and a coastal management agency relocated an eroding road and removed nearby houses, with compensation and aid to the owners.

Nearly all moving projects used the institutions at hand. That is, only a few projects were sponsored by institutions created for the purpose of promoting coastal adaptation. For all other projects, the sponsoring institutions were built to serve other purposes and had to change in some fashion to take on the retreat project. There were several patterns of change. First were sponsors like municipalities and coastal agencies that were historically devoted to using coasts intensively. After years of pursuing practices that unintentionally created hazards, these institutions tried a different approach, at least at one coastal site, by sponsoring a retreat. Second, some institutions had little experience managing coastal sites but sponsored a site retreat when conditions affected their operations, including parks agencies, agricultural agencies, a nuclear agency, tribal governments, and water and electric utilities. Third, some humanitarian organizations sponsored retreats to help people at those sites, as an extension of their other aid work. Fourth, other humanitarian services gave ad hoc support when problems emerged; most typically, social services agencies or disaster aid organizations that did not originally sponsor the retreat stepped to help people who were displaced by a project and unable to manage their own relocation.

Theories aim to explain why institutions like these are stable but also why they might change (Acemoglu and Robinson, 2008; Clemens and Cook, 1999). It is important to promote changes in institutional aims for vulnerable sites by investigating how previous retreats have managed to move multiple activities affecting multiple institutions. Ad hoc approaches to retreat are likely to be delayed, disruptive, and risky (Hanna et al., 2020). We reflect on the results of this analysis by applying principles of planning practice that could promote changes in coastal institutions likely to sponsor retreats.

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Institutional transition in managed retreat: Moving from a local, rights-based approach toward a centralized, process-centric approach

- Ju-Ching Huang, Maryland Sea Grant Legal and Policy Fellow & SJD Candidate, Georgetown Law Center

The approach to managed retreat in the United States, particularly related to land use and planning, is shifting in two important ways. Local controls and individual rights protection are the two main features in the current land-use regulatory regimes. The opposites of these two concepts are centralization and a process-based approach. Local–federal describes the dynamics between the decision makers, and rights-based–process-centric describes the focus of the decision-making process. Through the case of Crisfield, Maryland, this research illustrates the shift and provides relevant insights about the issues involved.

In the United States, land use control powers are mostly delegated by state legislatures to local governments. Land use and development is regulated at the state and local level through regulatory ordinances such as zoning, building code, subdivision, critical area, floodplain, stormwater management, and sediment and erosion control. Land use control regulations such as creating setbacks, setting stricter building codes, and restricting development density have been among the most used and advocated managed retreat tools. However, given the temporal and spatial scale of climate change, many local governments lack capacity to address managed retreat—they are understaffed and lack expertise in how to protect their people, or perhaps even cities themselves. Some cities are hesitant to adopt stricter land use regulations as they might hurt local economic opportunities. This research examines the roles of local and federal governments in the context of managed retreat and argues that the federal government is playing an increased role and exerting a greater influence on local decisions.

In addition to the roles of local and federal control, another important consideration is the balance of rights-centric and process-based decision-making. As important as it is to protect individual rights (such as property and housing rights), a rights-based decision-making approach can often result in piecemeal decisions and failure to take a holistic view for long-term, sustainable land-use decision making. From restrictive development to buyout projects, in most cases the central issue comes down to whether the decisions will deprive people of their property rights. In many underserved or low-income communities, no property rights are involved; relocation can protect their safe and affordable housing rights – another important concern – but might result in the loss of intangible assets such as community ties. Therefore, rights-based decision making might not be helpful in terms of building equity. This research argues that a process-centric approach that focuses on building a dynamic decision-making process is crucial to ensure that decisions are being made in a holistic manner.

Armor or Withdraw? Likely Litigation and Potential Adjudication of Shoreland Conflicts Along Michigan's Shifting Great Lakes Coasts

- Richard Norton, Professor of Urban and Regional Planning, University of Michigan
- Guy A. Meadows, Professor, Marine Engineering, Michigan Technological University
- Oday Salim, Director, Environmental Law & Sustainability Clinic, University of Michigan School of Law
- Matthew Piggins, University of Michigan
- Philip Washburn, University of Michigan
- Lauren Ashley Week, J.D. and M.U.R.P. Candidate, University of Michigan

Michigan enjoys along its inland seas, the Laurentian Great Lakes, one of the longest coastlines in the U.S. Much of that shoreline is privately owned. Because of a confluence of development pressures and irrepressible physical dynamics, growing numbers of Great Lakes shoreland properties and structures, built on shifting sandy shores, are at heightened and accelerated risk of loss from coastal storm surge, inundation, erosion, and shoreline recession—a phenomenon akin to sea level rise on ocean coasts. In response, property owners are installing extensive hardened shoreline armoring structures like seawalls and revetments to arrest those erosional processes. Those structures, however, will substantially impair, if not ultimately destroy, the state's natural coastal beaches and other shoreland resources, as well as accelerate erosion of neighboring shoreland properties.

The clash of imperatives to protect shoreland properties versus conserving coastal resources signifies a wicked dilemma the State cannot avoid: armor or withdraw? More precisely, should the State allow the continued armoring of Michigan's Great Lakes shorelines in an attempt to fix in place shoreland properties, at great and ongoing private and public expense, and ultimately risk the loss of public trust resources? Or should it allow—and should it compel shoreland property owners to allow—natural processes to proceed, even though doing so will result in the natural conversion of privately owned shorelands into State-owned submerged bottomlands sooner than would otherwise occur? The State and its citizens cannot hope to simultaneously protect both the beach and the beach house along naturally receding Great Lakes shorelines; they must choose which interest to prioritize first, recognizing the cost of doing so by losing the other.

In addition to the complex physical dynamics at play along Michigan's Great Lakes coasts, the shoreline is subject to evolving legal complexities as well. The State, as sovereign, enjoys police power authorities that speak to coastal shoreland management. Because shoreline dynamics along the Great Lakes are more like those along oceans than inland lakes, the State has also long recognized the applicability of the public trust doctrine to its Great Lakes shores. In addition, the Michigan Constitution includes a mandate to protect the state's natural resources from pollution and impairment. Our assessment of Michigan law with respect to Great Lakes coastal shores is that Michigan's courts, state legislature, and people have consistently and clearly prioritized protecting and conserving the Great Lakes' natural coastal resources—the beaches—above developing or impairing them for private use, except when such development truly serves larger public trust interests. The administrative rules now used to execute those protections, however, prioritize protecting the private beach house first, even at the expense of destroying the natural beach and impairing other public trust interests. This administrative approach was not inevitable—indeed may be unlawful—and it has created strong (if unreasonable) expectations on the part of shoreland property owners, heightening the likelihood of litigation.

The Michigan courts have resolved a number of key questions regarding coastal shorelands, but there is no caselaw addressing directly the lawfulness of shoreline armoring. We conclude the courts are not likely to find that the State lacks authority to regulate, or prohibit altogether, shoreline armoring for the purpose of protecting coastal resources. There is caselaw, however, in support of Michigan courts finding either that the current regulatory regime provides adequate protection of coastal resources, or alternatively that it is deficient. Similarly, the courts are not likely to find that reinvigorated regulatory efforts to prevent the destruction and impairment of public trust coastal resources from armoring—even those resulting in the accelerated loss of private properties—violate constitutional protections, especially if State reforms are undertaken with deliberation and care.

If the courts conclude that current regulatory efforts are lawful and require no greater protection, then Michigan will likely see much of its Great Lakes shorelines armored and its natural coastal beaches destroyed. If they conclude that current regulatory efforts are deficient (or if they approve of reinvigorated protection efforts), however, then private shoreland properties may be lost to the lakes—losses that cannot be avoided forever but that might occur sooner than later absent attempts to arrest shoreline erosion. As with most wicked policy dilemmas, the best response may not be at either extreme—that is, always armor or always withdraw—but somewhere in between. Crafting that hybrid approach, and the appropriate rules for applying it, will be the most challenging course to navigate.

This paper, forthcoming in the Michigan Journal of Environmental & Administrative Law, provides a comprehensive review of

natural shoreline dynamics along Michigan's Great Lakes shores and a comprehensive review of existing doctrinal, constitutional, statutory, and administrative authorities under which the State and its local units of government regulate Great Lake shoreline armoring. It then identifies claims likely to be made given growing pressures to armor and—potentially—enhanced natural shoreline protection efforts the State might undertake in response, and it contemplates the potential adjudication of those claims. The presentation for this conference will focus on several key ambiguities in current Michigan law and novel analyses of those issues.

Take Out the Trash When You Leave: Cleaning Up Properties Abandoned to Rising Seas

- Thomas Ruppert, Legal Specialist & Coastal Planning Specialist, Florida Sea Grant

This presentation presents the problem of residential properties being abandoned to rising seas and how we can proactively approach this problem through planning for the costs of cleaning up properties before the properties are abandoned. The presentation draws from the book chapter "Take Out the Trash When You Leave: Cleaning Up Properties Abandoned to Rising Seas" by the presenter.

Rising seas exacerbate erosion cause more flooding in low-lying areas along our coasts. We already see increasing numbers of destroyed homes along our coasts, particularly in North Carolina and Florida, washing into the water and covering our beaches with their detritus. While these current losses are due to erosion, which is worsened by but not solely caused by sea-level rise (SLR), on-going SLR will flood more and more properties that neighborhoods. The environmental impacts of leaving abandoned homes to fall onto our beaches or leave them in newly developing wetlands is catastrophic, including the social ills and health hazards of numerous abandoned properties, as the experiences of Detroit and other "Rust Belt" cities can testify. Yet the cost to cleanup properties before this happens is immense. This presentation will discuss these issues and why current approaches remain insufficient. The presentation then discusses the crucial issues of who should pay for cleanups and why, including social equity concerns. From a common sense standpoint, those that cause the need for the cleanups should pay. The presentation examines the difficulties behind such an approach and its limitations. It then concludes that the need to avoid still further subsidies to properties in hazardous areas at risk of loss to rising seas should be addressed by internalizing the costs of cleanup to the properties themselves as this sends appropriate market signals and information about the hazards of rising seas to current and potential property owners.

The presentation will then examine why current mechanisms are insufficient to ensure that the costs of cleanups are internalized to abandoned properties rather than being paid by taxpayers. Next, the presentation evaluates various potential legal and financial mechanisms by which this could be accomplished. After a thorough evaluation, the presentation will focus on special assessments as the most apt tool in our toolbox for developing a comprehensive, community-based program for cleaning up abandoned properties. Even as the most appropriate potential tool, special assessments present weaknesses; these are addressed through recommendations for potential reform.

Finally, the presentation will conclude with an overview of key issues to address in developing a local-government-based cleanup financing program, along with a list of challenging issues that will need further work to address.

Speakers

Karen O'Neill
Associate Professor
Rutgers University

Ju-Ching Huang
Legal and Policy Fellow & SJD Candidate
Maryland Sea Grant & Georgetown Law Center

Richard Norton
Professor of Urban and Regional Planning
University of Michigan

Thomas Ruppert
Legal Specialist & Coastal Planning Specialist
Florida Sea Grant

5C) Resilient, Equitable, and Sustainable Infrastructure for Coastal Communities: Challenges and Opportunities

10:30 AM - 12:00 PM, Jun 21

Auditorium

This session welcomes/ encourages work that considers equity implications of climate impacts and adaptations on access to infrastructure and essential services. Both access to infrastructure and resilience of infrastructure to climate impacts are not evenly distributed. Any work to improve infrastructure resilience in coastal communities must consider social equity explicitly or risk exacerbating existing socioeconomic inequality or placing disproportionate burdens on marginalized groups. Equity and justice are critical aspects of this session.

Session chairs: Kelsea Best, Postdoctoral Researcher, University of Maryland; Qian He, Postdoctoral Researcher, University of Maryland Civil and Environmental Engineering; Deb Niemeier, Clark Distinguished Chair Professor, Director of Center for Disaster Resilience, University of Maryland; Allison Reilly, Assistant Professor, University of Maryland Civil and Environmental Engineering

Climate change and housing justice: implications for equitable adaptation

- Kelsea Best, Postdoctoral Researcher, University of Maryland

The negative effects of global climate change are already being felt by communities around the world, with the most serious burdens placed on vulnerable populations. One way that climate change is expected to continue to disrupt community well-being and potentially exacerbate inequality is through disruptions to housing availability and affordability. In this talk, we provide a review of the state of the research on the topic of “climate gentrification”, which posits that both climate change effects and adaptation measures may contribute to differences in property values. Importantly, these changes in property values may then reinforce pathways of economic, physical, and social displacement and marginalization of vulnerable residents. Especially in some coastal areas, evidence suggests that property values are already reflecting climate exposure, which has serious implications for housing justice, community demographics, and residential displacement. We also discuss other ways that climate change may interact with access to stable, affordable, and safe housing including post-disaster evictions and the unique vulnerability of renters. Through these examples, this talk broadly explores the question, “Who gets to live where in a climate-impacted world?” with a focus on the implications of this question for equitable adaptation planning. We provide several key areas for future research to continue to explore connections between climate change and housing justice including community-based and participatory methods, longitudinal studies, and research that operates across disciplines as well as temporal and spatial scales.

Using Travel-time to Essential Services to Identify Vulnerable and Fragile Communities

- Utkuhan Genc, Purdue University

Tropical cyclones (hurricanes) and associated coastal flooding are the costliest and deadliest natural hazards in the United States between 1980 and 2021. While the direct impacts are devastating to communities, the indirect impacts of these hurricanes on people’s lives can be just as harmful in the long term. The out-migration due to severe storm and flood events from rural communities can result in reduced mobility and accessibility to services which creates a fragile situation. For example, the geographically largest parish of Louisiana, Cameron Parish, has faced a steady population decline for decades, with additional challenges after hurricanes Laura and Delta in 2020 caused many businesses to shut down operations temporarily or, in some cases, permanently. Nonetheless, over 70% of the 2019 population is still residing in the parish and relies on these businesses or services to provide daily necessities such as food or gas. As the population declines over time, there will be fewer incentives for these businesses to stay in operation, which creates a fragile and uninhabitable situation for the remaining community members. In this study, we looked at travel-time changes under what-if scenarios representing closures of essential services such as grocery stores, gas stations, or medical emergency services. We measure the distribution of drive time differences in the parish population before and after the closest facility to each individual shuts down; this measure relates to resilience, as it indicates the degree to which residents would have access to alternative options for meeting essential needs. In addition to the distribution of marginal travel times, the number of alternatives in the present-day scenario within 30 minutes can also indicate resilience or fragility to closures. The multi-scale analysis ensures vulnerable communities within a region are identified and necessary policy actions can be taken regarding the vulnerability of the population. We used OpenStreetMap (OSM) and open-source python packages to build our algorithm and framework for analysis, with the purpose that similar studies can be carried out in different geographic regions.
The main empirical results of this study will be based on Cameron Parish, where first-hand observations and interviews with residents implied that the population decline-induced business closures are threatening the quality of life of community members. Additionally, a similar analysis will be done on Morgan City and Slidell, Louisiana, communities experiencing different migration trends. Quantifying a measure of vulnerability based on alternatives and marginal time will help us understand how “fragile” the community's long-term well-being is. Preliminary analysis has shown that Cameron Parish is quite fragile with respect to access to grocery stores, where even one store closure would substantially increase the percentage of the population that has to drive over 30 minutes to access groceries. The expected results from this study are an open-source method for analyzing drive time, a generalized approach to quantify fragility, and empirical results from Cameron Parish, Morgan City, and Slidell.

Robustness of Flood Protection Project Evaluation to Alternative Benefit Metrics

- David Johnson, Purdue University

A common criticism of traditional benefit-cost analysis (BCA) is that benefit-cost ratios (BCRs) are reductive in the sense that they aggregate all benefits and costs into a scalar value; decision rules that aim to maximize BCRs ignore distributional impacts in favor of pure economic efficiency. In the context of flood risk management, all else equal, benefit-cost analysis favors protection of affluent communities comprised of assets with higher replacement costs. Allocations of scarce resources for flood protection based on BCA could therefore lead to inequitable provisions of risk reduction; in particular, if buyouts/relocation programs target communities where they are more cost effective, this could leave behind households without the means to protect or insure themselves.

Using risk reduction and cost estimates of nonstructural flood protection projects under consideration by Louisiana’s Coastal Master Plan (e.g., elevation-in-place or voluntary acquisitions), we analyze ranked preferences for the projects using different measures of economic risk. In addition to BCRs, we also estimate cost effectiveness measures such as the reduction, per dollar of project cost, in the expected number of residential structures inundated over the planning horizon. Measures like this intentionally ignore the replacement costs or value of structural assets, implicitly valuing protection of each household equally regardless of wealth. In other words, this alternative metric is better aligned with measuring threats to the function of assets rather than to their monetary value. We will then overlay census data to estimate the risk reduction which would be afforded across different demographic categories by project portfolios of varying budgets.

We find that the choice of metric can have a major impact on the rank-ordered preferences for flood risk mitigation options. Once a realistic funding stream is applied to select a portfolio of projects to implement over time, it is less clear whether the choice of metric leads generally to substantially different distributions of risk reduction across racial and socioeconomic groups. However, analyzing the Pareto frontier of nondominated portfolios reveals that dramatic increases in equity can be obtained by placing only a small weight on metrics that are wealth-agnostic.

In our experience, decision makers often want to incorporate equity and social vulnerability considerations into their planning processes, but they either do not know how or worry about blowback if plans appear to explicitly favor one group over another. By incorporating alternative risk metrics into a cost effectiveness analysis of flood protection projects, our results indicate that more equitable outcomes can be achieved (i) without explicitly optimizing for it and (ii) with minimal loss in economic efficiency.

How do Presidential Declared Disasters and Federal Aid Programs affect Renter Eviction Risks? Longitudinal Evidence

from the United States

- Qian He, Postdoctoral Researcher, University of Maryland Civil and Environmental Engineering

Global climate change has intensified the frequency and severity of natural hazards in recent decades. Disasters can disrupt many aspects of life in affected communities, especially housing, with implications for recovery and residential displacement. People of renter status could experience social vulnerabilities that may be exacerbated by the occurrence of and reactions to disasters. Furthermore, renters have less access to government aid programs after a disaster or during the federal buy-out programs within high-exposure areas. Eviction orders and the threats of eviction can be devastating to renters in addition to other social-economic burdens. Studies have shown that evictions are closely connected to poverty, homelessness, joblessness, and mental health issues. At the same time, evidence is scarce on how renters' eviction risk could interact with natural hazards and the potential impact of federal aid programs in the United States. Through constructing a panel dataset (2009- 2018) that combines eviction (orders and threats), Presidential Disaster Declarations, FEMA assistance, and social-demographic data on the county level, this work explores the relationships between disasters, disaster aid, and eviction risks across the U.S. Using a spatial statistical methodology, we examine the following questions: How does the occurrence of a declared disaster influence eviction rates and threats in a county? How does the amount of disaster aid a county receives influence the rates for eviction orders and eviction threats? Findings from this study will help elucidate connections between disasters, housing, aid, and evictions and contribute to just and equitable disaster aid policies for renters in the U.S.

Infrastructure reliability and the burden of sea-level rise: Do current planning metrics capture the correct risk?

- Allison Reilly, Assistant Professor, University of Maryland Civil and Environmental Engineering

Many rural communities are on the front lines of climate change. The need to understand who may be affected and when is widely acknowledged in order to enable inclusive and cost-effective adaptation planning. Presently, planning resources generally focus on housing impacts; when will a house or neighborhood be inundated and which adaptation strategies are useful to improve the homeowner's fate? Housing, though, is but one of many types of reliable infrastructure needed to enable habitation of a parcel. Other required infrastructure includes reliable road access and ability to treat wastewater. In this work, we explore the potential threat of sea-level rise on non-housing infrastructure (e.g., roads, septic systems) in rural, coastal areas to help inform the impact of their loss on local communities. I will present work that evaluates local accessibility loss during high-tides for the entire US coastline (termed "risk of isolation") for various climate change scenarios, and also preliminary evidence from research that suggests that the risk of septic system failures are quite significant in many coastal communities. The onset of these risks is anticipated often decades prior to when household inundation is expected, suggesting that climate migration may begin much sooner in some areas that is currently expected.

This work has significant environmental justice implications. First, we find that communities of color are more likely to be at risk of isolation from sea-level rise than whiter communities. This higher risk is derived from a combination of higher exposure and fewer investments in roadway infrastructure. Without targeted transportation investments to maintain connectivity, these communities may be more vulnerable to job loss, chronic school absenteeism, and substandard access to emergency services. Second, communities of color are more likely to depend on septic systems than whiter communities due to racist infrastructure policies during periods of sewer expansion. The problems associated with this linger today in how we finance and repair infrastructure; sewer systems are often eligible for federal and state funds for maintenance and repair, while septic systems owner are typically responsible for their own repairs. Failure to make repairs can have public health consequences, and even provoke housing evictions. This myriad of factors combined suggest that communities of color will experience a greater burden from sea-level rise than whiter communities, that this burden may transpire in ways in which we are not planning, and much sooner than is currently expected.

Speakers

Kelsea Best
UMD/OSU

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Research Assistant
Purdue University

David Johnson
Associate Professor of Industrial Engineering and Political Science
Purdue University

Qian He
Postdoctoral Research Associate
University of Maryland, College Park

Allison Reilly
Assistant Professor
University of Maryland

5D) Equity and Environmental Justice in Urban Environments

10:30 AM - 12:00 PM, Jun 21

Cinema

Variations in equity prioritization when designing flood-resilient, urban housing policy for climate adaptation governance

- Melissa Tier, PhD candidate, Princeton University (presenting)

- Elke Weber, Professor of Psychology & Public Affairs, Princeton University

The need for ex-ante climate adaptation policy design is ever increasing in urgency as climate-related disasters continue to increase in frequency and severity, with diminishing hope of mitigating global emissions sufficiently to reduce catastrophic harm – especially for those most vulnerable. However, policy preferences for climate adaptation strategies remain woefully understudied. Furthermore, meeting robust environmental justice and equity standards will require innovative practices and foresight, but little is known regarding how such standards influence preferences for or against multifaceted climate policies. One climate adaptation strategy ripe for such consideration is urban housing resilience in preparation for and recovery from floods. These strategies are often complex and controversial (e.g., choices between protection, retreat, and relocation), and can also be structured in a variety of ways with regard to equity prioritization (e.g., degrees of distributive, procedural, and restorative justice). This study utilizes both quantitative and qualitative data from four urban locations (New York City, U.S.; Seoul, South Korea; Vienna, Austria; and Philadelphia, U.S.) in order to improve understanding of how equity and environmental justice in flood-resilient housing policies are conceptualized differently across distinct urban locations, as well as among residents versus policymakers.

First, we assess quantitatively, via a conjoint survey, how flood-resilient housing policy preferences differ by equity prioritization among residents from the four urban locations. Conjoint surveys are a type of stated preference method in which "respondent[s] evaluate each product or situation" and then "the utilities are estimated, decomposed, from the answers of the respondents" (Alriksson & Öberg, 2008: p. 245).* Originating as a product development tool, conjoint surveys have increasingly been used in policy design settings. Second, we assess qualitatively, via interviews, how flood-resilient housing policy preferences differ by equity prioritization among policymakers from the same locations. Finally, we compare the quantitative and qualitative results to assess whether there are any clear equity-related trends when comparing flood-resilient housing policy preferences among residents vs. policymakers in all of the studied locations.

Data will be analyzed during Spring 2023; we expect to find that flood-resilient housing policy preferences differ significantly by degree of equity prioritization among residents from cities in the U.S., Austria, and South Korea. We furthermore expect the average results of residents across countries to differ more than results within a country (e.g., NYC & Philadelphia). However, we also expect that the dominant conceptualizations of equity concerns within each country (e.g., class-based, race-based, etc.) will result in within-country variation along the lines of those key demographic categories. Finally, while flood policies have significant variation across the 3 studied countries, we nevertheless expect to find more similarity in results among policymakers across all locations than in results among residents. This is because of higher climate and flood policy literacy among policymakers, as well as elite policy learning that may occur between these cities (e.g., Philadelphia officials learning from NYC officials; U.S. & Korean officials learning from Vienna officials).

*Alriksson, S., & Öberg, T. (2008). Conjoint analysis for environmental evaluation. Environmental Science and Pollution Research, 15(3), 244-257.

Governing Transformation: Identifying and Combating Power in Managed Retreat

- Tyler Cooper-Kolb, Master's student, Oregon State University

Despite recent progress to curb global CO2 emissions and direct our global society towards less extreme emission scenario pathways, significant changes to coastal areas across the world have already occurred and are expected to persist due to thermal expansion of seawater and the persistent loss of land-ice, causing sea-levels to transgress landward. For coastal communities facing threats to habitability, the planned and coordinated movement away from risks associated with sea-level rise, or managed retreat, presents itself as a potentially advantageous and transformational adaptation strategy. Yet underlying elements of power condition adaption decision-making processes, and thus govern the transformative potential of managed retreat in any given system. In the following paper, following Brian Massumi's notion of Ontopower, I present a conceptual framework for understanding how operative logics –the underlying elements of power— are present within adaptation processes. I then elaborate on how these operative logics can position managed retreat to be antithetical to transformative adaptation, its supposed objective. Instead, operative logics merely reinforce the social and political structures that already exist, presenting a significant conundrum for social and environmental justice. To conclude this paper, I explore how incorporating insights from decentered deliberative democracy, which privileges the subjective experience of risk from members of the demos and allows for political emergence, can combat operative logics that limit the capacity for social transformation. The capacity for managed retreat to operate as a successful vehicle-of-change for coastal communities depends on its capacity to not only address the physical conditions that shape risk, but also the elements of power that operate within vulnerable communities.

Closing the Gap Between Adaptation Justice in Theory and Practice: Practical Dilemmas from Managed Retreat

- A.R. Siders, Assistant Professor, University of Delaware

Just managed retreat is a widely avowed goal of scholars, practitioners, and community members, yet achieving it in practice remains largely elusive. Managed retreat poses difficult challenges for justice, such as how to resolve trade-offs across values and stakeholders. Justice theories are intended to guide decision-makers in addressing these dilemmas, but most fall short of guiding practitioners or community leaders in their implementation choices. This paper uses a critical analysis of justice theory, in the specific context of property acquisition programs (buyouts) in the United States, to demonstrate the gaps between justice theory and its application to practice. The gaps identified are not unique to managed retreat, though, and nor are the recommended actions to close the gap.

Justice theories in the climate mitigation space are often "focused, in part, on the pragmatic question of their applicability to the current dilemmas of both climate change and the limitations of global governance" (Schlosberg and Collins, 2014, p. 365), but climate adaptation justice conversations have tended to focus on theoretical framings of justice rather than their practical implications. The objective of this paper is to advance a pragmatic consideration of adaptation justice.

The key decision points encountered by an administrator in a buyout program reveal several crucial weaknesses in justice theory. Specifically, justice theories struggle to prioritize distribution of adaptation resources, distribute adaptation efforts that cause both harms and benefits, weigh the trade-offs of uncertain harms and benefits, identify participants, resolve conflicts in participatory processes, or redress historic wrongs. Without guidance from justice theory or adaptation policy on how to resolve these dilemmas, implementation decisions are often shaped by administrators' personal value systems, such as their views on the purpose of adaptation, the role of government, and the importance of place attachment. Decisions are also constrained by limited authority, available resources, and institutional goals, which limits the option space for administrators to achieve just outcomes. Buyouts implementation, then is often uneven. Variation could potentially enable local tailoring, but without transparency into how decisions were made or comparisons across outcomes, it is uncertain whether variation improves tailoring to local contexts or perpetuates uneven and inequitable distribution of resources.

Both academics and practitioners can close the gap between theory and practice, and recommendations for both groups are presented. For academics, these include more nuanced evaluations of adaptation justice, more comparative analyses and consideration of counterfactuals and trade-offs, inclusion of a wider range of disciplinary perspectives, and more specific justice proposals. Proposals that do not address one or more of the practical dilemmas faced by administrators are likely to be too vague and high-level to advance the cause. For practitioners, recommendations to close the justice-theory gap include greater transparency in decision-making processes and criteria, to enable accountability, evaluation, and policy learning; and more holistic approaches to adaptation governance, to address the constraints on adaptation implementation. Achieving greater justice in managed retreat is not likely to be simple, straightforward, or without trade-offs. This does not make it any less critical to pursue.

References:
Schlosberg, D. and Collins, L. B. (2014) 'From environmental to climate justice: Climate change and the discourse of environmental justice', Wiley Interdisciplinary Reviews: Climate Change, 10.1002/wcc.275

Siders (2022) 'The administrator's dilemma: Closing the gap between climate adaptation justice in theory and practice, Environmental Science & Policy, 137: 280-89, 10/1016/j.envsci.2022.08.022

White Communities in Retreat: Climate Change, Privilege, and Adaptation in US Cities

- Kevin Loughran, Assistant Professor of Sociology, Temple University (presenting)
- James R. Elliott, Rice University
- Jay Wang, Rice University

With managed retreat in ascendance, what are its implications for racially segregated urban communities? This paper investigates the residential outcomes of FEMA's Hazard Mitigation Grant Program, a major federal program that provides funds for the buyout of flood-prone homes in the US. Drawing on an original dataset of address-to-address residential history data for approximately 9,500 buyout participants nationwide, we find that moves taken via managed retreat are driven not only by environmental risk, but just as powerfully by the racial composition of origin and destination communities. We find that on average, people who have made residential moves via FEMA's buyout program have reduced their flood risk by 63%. At the same time, these federally funded moves reveal a strong pattern of racial segmentation; nationally, 95.8% of such moves out of predominantly White communities end in predominantly White communities, which is reflective in part of the FEMA program's rural 1980s origins in the Upper Mississippi River watershed. However, when we focus our analysis on metro areas – where FEMA has shifted the program's geographic focus since 2000 – the same result holds. Despite broader, more racially diverse choice sets available in US cities, 94.9% of moves out of predominantly White urban communities also end in predominantly White communities. In contrast to studies that have presaged the emergence of climate gentrification in certain US cities, we argue that under the current mode of managed retreat, the far more common residential move is one that buttresses existing White social and spatial advantages; these are moves to neighborhoods of similar or greater – and not lesser¬ – racial privilege. We argue that new interdisciplinary scholarship focused on urban adaptation and managed retreat should attend more closely to this predominant pattern and the political and policy implications that follow from the federally-funded shoring up of White communities in the face of environmental threats. We discuss what this pattern of racialized environmental mobility implies for urban adaptation and managed retreat more generally.

Green infrastructure solutions to support flood mitigation and adaptation in coastal low-lying disadvantaged communities

- Narcisa Pricope, Professor, University of North Carolina Wilmington (presenting)
- Leah Mayo, Interim Assistant Dean for Community Engagement and Health Equity, University of North Carolina Wilmington
- Joanne Halls, Professor, University of North Carolina Wilmington
- Crystal Dixon, Assistant Professor of the Practice, Health and Exercise Science and Racial Equity Consultant, Wake Forest University

Coastal environments are essential ecosystems that play vital ecological roles and supply a wide array of ecosystem services, including flood control, especially in low-lying regions at the land-water interface. Coastal communities frequently impacted by natural hazards can face extensive and recurrent flood inundation and subsequent infrastructure damage with immediate and long-term detrimental effects on disadvantaged communities. Effective and adaptive coastal resiliency planning is becoming more necessary as the frequency and intensity of storms increase and coastal populations expand. Furthermore, climate change has disproportionate impacts on underserved and disadvantaged communities, with serious implications for equity and environmental justice. In this co-designed project, we will develop a green infrastructure suitability model in consultation with community groups to prioritize areas of implementation of nature-based solutions (NbSs) in a highly urbanized tidally influenced coastal county of the US Atlantic Coastal Plain region that is home to multiple disadvantaged communities at recurrent risk from flooding. With funding from a NASA EEJ award and building on results from a regional NOAA Sea Grant award, our project is developing a replicable methodology that establishes the evidence base for the effectiveness of NbSs in flood-vulnerable coastal watersheds and determines the feasibility of incorporating cutting-edge community engagement techniques into NbS implementation prioritization. We have three main objectives (third objective is work in progress during summer 2023): 1. Develop a cloud-computed, replicable remote sensing and GIS-based green infrastructure suitability index (GISI) methodology at the local scale in New Hanover County, North Carolina as a function of exposure to recurrent inundation and projected sea level rise and accounting for vegetation type and condition from time-series of remote sensing data. 2. Develop an environmental justice vulnerability index (at the block group level) using community-identified dimensions of environmental justice (EJ) with relevance to coastal planning for climate change (primarily flood mitigation) and adaptation measures, as well as an analysis of chronic Analyze the green infrastructure suitability index against it to identify areas of overlap between suitability for green infrastructure solutions and EJ communities that would most benefit from their implementation. 3. Use community engagement techniques (charrettes, surveys, focus groups, and/or community workshops) to elicit community input and feedback along four prioritization categories both during the development of the GISI and at the conclusion of the modeling efforts in order to prioritize solutions and produce implementation suggestions while engaging in community education on climate change impacts on EJ neighborhoods and green infrastructure as an adaptation strategy. The outcomes of this project include a community feasibility study proposing a reproducible and transferable methodology for identifying suitable NbS locations as a function of location, exposure to risk, socio-demographic makeup of the area and satellite remote sensing data on the one hand and, on the other, the perceptions, feedback and input of potentially targeted communities in terms of prioritization and education around possible implementation solutions. Green infrastructure/nature-based solutions enhance urban sustainability and address EJ issues through improving environmental conditions and human well-being, thus making urbanized areas more attractive and livable; restore degraded ecosystems and improve the resilience of ecosystems, especially wetlands and tidal marshes that deliver critical ecosystem services in low-lying areas; contribute to

improved risk management and resilience planning by synergistically reducing multiple risks than grey infrastructure alone; and contribute to developing climate change adaptation and mitigation strategies that can be implemented in at risk EJ communities in coastal regions.

Visualizing Relocation on a Spatial Spectrum: A Tool for Organizing Refuge alongside Community

- Laura Durgerian, Senior Associate Landscape Architect & Urban Designer, Mithun

As built environment practitioners, Mithun investigates how relocation processes can strengthen place attachments and build collective capacity to address ongoing climate shocks and stresses. Conceptual illustrations of the varied forms managed retreat could take across land ownership and spatial scales – within a single parcel, incrementally across a block, or at a community scale – allow community collectives to consider how climate adaptation and relocation intersects with their wider constellation of values and needs. Using these visualizations as prompts, coalitions of community-based organizations and designers can together define a contextually nuanced vision for sending and receiving sites that responds to local hazards, place-based identities, access to jobs and social capital, resilient shared infrastructure, and other community priorities. After presenting these spatial concepts, this session will discuss the Sea2City Design Challenge in Vancouver, B.C. as an example translation from concept to multi-phased site-specific vision that overlays multiple stakeholder prioritizes, including: commitment to decolonizing the design process, protection of sending site housing stock within its lifespan, restoration of pre-colonial shoreline habitat, co-stewardship of sending sites with First Nations, and alignment with city-wide planning efforts.

Speakers

Melissa Tier
PhD Student
Princeton University

Tyler Cooper-Kolb
Master's Student
Oregon State University

A.R. Siders
Director, Climate Change Science & Policy Hub
University of Delaware

Kevin Loughran
Assistant Professor of Sociology
Temple University

Narcisa Pricope
Professor
University of North Carolina Wilmington

Laura Durgerian
Senior Associate, Landscape Architect & Urban Designer
Mithun

12:15 PM

6) Climatopia: Envisioning Radical Designs for the Climate Crisis

12:15 PM - 1:15 PM, Jun 21
Auditorium

Sleek renderings of neighborhoods built on water, skyscrapers adorned with lush vegetation, car-free carbon-negative cities of the future—as the world grapples with the effects of climate change, architects, urban planners, engineers, real estate developers, and even high-net-worth individuals are radically re-imagining the future of our built environment. Even if never implemented, these climate utopias, or “climatopias”, represent a new form of aspirational city-making and future-building that seeks to integrate climate mitigation and adaptation goals. But for whom are these so-called utopian futures, and by whom are they created? How will they be designed, built, and monitored over time? What can be done to ensure they do not repeat the mistakes of past utopian design experiments that began with similar excitement and intrigue? In this session based on the research of PhD Candidate (University of Miami), filmmaker, and National Geographic Explorer Alizé Carrère, learn about the fraught legacy of utopian experimentation in the built environment, the power of narrative and aesthetics in visualizing new futures, and the promises and perils of climatopias in their diverse forms, including for managed retreat. For the second half of this session, Carrère will lead an interactive component with the group.

Please note that this session will be livestreamed but not recorded. Due to the interactive nature of the second half of the session, opprtunities for active virtual participation will be limited, but the full session will be available to watch live.

Speaker

Alizé Carrère
PhD Candidate
University of Miami

1:30 PM

7A) Buyouts and Property Acquisition

1:30 PM

7A) Buyouts and Property Acquisition

1:30 PM - 3:00 PM, Jun 21

Cinema

Means-Testing Buyouts in Climate Retreat

- Stephanie Stern, Professor, University of Arizona

As climate change causes unprecedented dislocation from flooding and sea-level rise, a new legal regime for climate retreat (i.e., shifting human settlement from severe climate risk zones) is developing. Buyout laws, such as FEMA's Hazard Mitigation Grant Program, fund government acquisitions of severely flood-impacted homes, enabling owners to relocate, and require localities to rezone acquired land as open space. Despite the growing interest in flood buyouts as a tool for climate change adaptation, there has been limited attention to the capacity of buyouts to incentivize "buy ins" to flood zones by subsidizing flood risk-taking—a problematic irony given buyouts' increasing role in climate retreat. In this presentation, I employ the law and economics theory of transition relief to reconceptualize buyouts from their current focus on dispossession to a form of climate transition relief that balances incentive effects against individual losses. Specifically, I advocate for a presumption against buyouts for flooded homeowners in order to curb incentives for high-risk housing choices. However, I carve out a significant exception for low-income residents of floodplains and proposes means-testing buyouts. In the face of severely constrained housing choice, unaffordable flood insurance, and high marginal costs from property loss, this group is less vulnerable to incentive distortion from compensation and more vulnerable to harm from dislocation.

Racial Dynamics of Federal Property Buyouts in Flood-Prone Areas

- Kay Jowers, Director, Duke University & Nicholas Institute for Energy, Environment & Sustainability (presenting)
- Lala Ma, Associate Professor, University of Kentucky Department of Economics
- Christopher D. Timmins, Professor, Duke University Department of Economics

Recent climate projections forecast significant increases in flood risks, and the greatest increases are anticipated to be in communities of color. The use of managed retreats, or "buyouts," of flood-prone properties as an adaptation response is also likely to grow. This paper investigates the equity implications of managed retreat by analyzing the role of race and ethnicity in buyout bargaining outcomes and how those outcomes affect longer-run neighborhood change. To do this, we combine nationwide administrative data on federal property acquisitions and housing sales transactions with a database tracking individual movement over time. We then estimate the discount in buyout payments relative to a property's fair market value, how the payment received affects where households relocate, and whether these impacts differ by race. We find that the buyout compensation received by families of color is around 8-10 percent lower than that received by white families. Moreover, these price discounts detract from individual wealth and the quality of the neighborhood to which families relocate. Our work highlights how government policy, aimed to address increasing climate impacts, may exacerbate the burden of climate change on vulnerable communities.

Resilience through property buyouts: Are buyouts effective in reducing a community's vulnerability to floods?

- Waqas Ahmed Raza, PhD Student, School of Urban Planning, McGill University (presenting)
- Lisa Bornstein, Associate Professor, McGill University

Governments worldwide are adopting property buyout programs to protect residents from flood risks. In response to the 2017 and 2019 floods, the Quebec government obliged certain households to demolish their homes, offering buyouts in compensation. In New Brunswick and Vermont, similar policies entailed voluntary household participation. However, preliminary research suggests that buyouts may not contribute to long-term resilience. They are highly disruptive to dislocated households; entail challenging implementation for municipal authorities, and prompt inequitable real estate dynamics that may undermine the municipal capacity to deliver services. Are buyouts an effective risk-reduction policy instrument? How could such programs be improved? In responding, this research investigates how mandatory (QC) and voluntary (NB and Vermont) buyout policies compare in their effects on the socio-economic vulnerabilities of households (a) participating in buyouts and (b) remaining in situ. Second, the research documents how property values, and associated tax revenues, have changed. Third, the research explores the challenges municipalities face in implementing buyouts and maintaining services. Study areas, with a number of dislocated households, are: Rigaud (QC), nearly 100 houses; the Lower Saint John River region (NB), 80 properties; and the TRORC region in Vermont, 154 properties. Data from policy reviews, property transfers, household surveys, and interviews with residents, local officials and retreat experts will be analyzed at the individual, household, and community levels. Results will provide insight into how different buyout approaches target specific vulnerabilities and with what effect. The research will contribute to evidence-based policies regarding buyouts for better flood risk management and resilience enhancement in Quebec and elsewhere.

Living with the Land Left Behind: Sending Communities and Acquired Coastal Properties

- Annika Tomson, NOAA Digital Coast Fellow, Coastal States Organization

Sea level rise, intensifying precipitation patterns, increasing Great Lakes lake level change variability, and higher erosion rates threaten coastal properties and infrastructure across the United States. In cases where climate impacts make certain shoreline structures and lots uninhabitable due to inundation or erosion, these properties may transition from private to public ownership via a number of legal or constructive methods, such as buyout programs, abandonment, or simply permanent conversion to public submerged land. Because many of the legal and practical responsibilities around land management fall to local governments, coastal communities are often responsible for dealing with the on-the-ground impacts of inundated and eroded property. With climate change placing an increasing number of homes and properties at risk each decade, more communities and local governments – particularly those that are rural, small, isolated, racially minoritized, or low-income – will be faced with managing a critical subset of vacated coastal properties.

The Coastal States Organization and Association of State Floodplain Management have undertaken a partnership project through the NOAA Digital Coast Fellowship to assess and improve the technical guidance resources available to local communities to understand, plan for, and manage this subset of acquired or vacated properties on the changing coast. This presentation will explore the experiences of sending communities' management of acquired previously private coastal property, and the role that the land left behind plays in their broader community. Initial findings will be presented from a series of local practitioner interviews and an assessment of existing resources available to support the management of acquired previously private coastal property. Trends and opportunities will be explored, toward the development of new guidance products in 2024.

Vacated coastal properties present a variety of challenges to the sending communities responsible for managing them. Local governments are constrained by limited technical, financial, and staff capacity, unclear authorities, and the controversial nature of managed retreat. Managing eroded or inundated land may necessitate the removal of structures, utilities, and roads as well as remediation of hazardous materials and debris. Acquired property also requires ongoing maintenance and may incur other project costs. At the same time, communities face lost property taxes when private coastal property transitions to publicly owned, resulting in decreased revenue. Neighborhoods face potential fragmentation from both physical checkerboarding of properties as well as social and economic isolation as community members move away. The transformation of the property to public land can alienate former residents if they feel their connection to the land has been terminated. Structural inequities in acquisition programs can favor wealthy individuals and whiter communities; in turn the benefits of the vacated land can be similarly concentrated.

Nevertheless, sending communities live with the land that is left behind as people relocate. If effectively managed, the land can support the habitability of the broader community, physically through flood protection and erosion control and socially through public access and use. Whether left alone or transformed, the land is a part of the community, and thus poses an opportunity for self-determination and agency in the kind of future sending communities want for themselves. This presentation dives into the experiences of sending communities as they steward acquired coastal properties and work towards building that future.

Louisiana Buyouts and Resettlement Programs

- Pat Forbes, Executive Director, Louisiana Office of Community Development (presenting)
- Sandra Gunner, Manager, Louisiana Office of Community Development

The State of Louisiana's Buyout and Resettlement Programs are voluntary programs that provides property buyouts in flood-prone areas, as part of the Louisiana's efforts to reduce flood risk throughout the state. The buyout program, which is designed to primarily benefit low- to moderate-income residents, offers an incentive—payment above fair market value—to eligible applicants who relocate to areas of lower flood risk. Our presentation will review the work that the program has accomplished to date along with highlighting the relationship established between the Louisiana Office of Community Development and Local Governments.

Speakers

Stephanie Stern
Professor
University of Arizona

Kay Jowers
Director
Duke University & Nicholas Institute for Energy, Environment & Sustainability

Waqas Raza
PhD Student
McGill University

Annika Tomson
NOAA Digital Coast Fellow
Coastal States Organization

Pat Forbes
Executive Director
Louisiana Office of Community Development

7B) Advancing Institutional Capacity to Reduce Social, Environmental, and Economic Vulnerability in Climate Migrant Receiving Communities (panel)

1:30 PM - 3:00 PM, Jun 21

Auditorium

Millions of people are expected to be displaced by climate change in the United States by the end of this century, yet little is known about community capacity to effectively receive and support them, or their ability to do so over time as the effects of climate change advance. Some people will adapt in place, but many will move. Where will they go and how can this movement of people result in positive outcomes for both those who move and the communities that receive them?

To support climate migration governance, policy, and planning, this panel session will present findings from research teams at Louisiana State University and the Urban Institute that have led studies examining community impacts, capacity, and responses to climate migration across the U.S. Gulf Coast region. Panelists will first introduce their studies and the community contexts in which they led their research, and a moderated discussion will follow to discuss opportunities to advance institutional and community capacity to reduce social, environmental and economic vulnerability in climate migrant receiving communities in the U.S. Gulf Coast region and across the country.

Topics to be discussed include: adaptive migration and equitable relocation; nonstructural opportunities for hazard mitigation and adaptation; planning for institutional resilience in receiving communities; trends in federal disaster and climate migration investments; strategies to reduce social, environmental, and economic risks in receiving communities; and recommendations for identifying potential future receiving communities and resilience planning.

Session Chairs: Haley Blakeman, FASLA, PLA, Associate Director and Assistant Professor of Landscape Architecture, LSU; Anne Junod, Senior Research Associate, The Urban Institute

Panelists:

- Traci Birch, LSU
- Haley Blakeman, LSU
- Anne Junod, Urban Institute
- Dan Teles, Urban Institute
- Breno Braga, Urban Institute

Speakers

Traci Birch
Assistant Professor and Managing Director of Coastal Sustainability Studio
LSU School of Architecture

Haley Blakeman
Associate Director, Assistant Professor
LSU Robert Reich School of Landscape Architecture

Anne Junod, PhD
Senior Research Associate; Metropolitan Housing and Communities Policy Center - Climate and Communities
Urban Institute

Daniel Teles
Senior Research Associate; Metropolitan Housing and Communities Policy Center - Community and Economic Development
Urban Institute

Breno Braga
Principal Research Associate; Center on Labor, Human Services, and Population
Urban Institute

7C) An Early Career Panel on the Limits and Reforms of Insurance under Shifting Climate Risk (panel)

1:30 PM - 3:00 PM, Jun 21

Broadway Room

Around the world, frequent extreme events like floods, storms, wildfires, and drought are placing strain on the types of risks that insurance schemes are able and willing to protect against. In the United States, public programs like the National Flood Insurance Program (NFIP) and private companies providing homeowner's insurance face bankruptcies and bailouts after major events whose frequency and severity have not been adequately baked into formal and informal expectations of risk by industry and the public at large. This has led to premiums that don't reflect the actuarial risk of living in specific locations and has enabled development into under-protected and under-insured areas. As a result, the absence of changing climate risk in insurance premiums has positioned public, and some private companies in precarious financial positions and may have long-term effects on the housing market. This is evident in the enormous debt burden of NFIP of 20.5 billion USD (de Ruig et al., 2022) and the exodus of private insurance companies across much of the West Coast and US Gulf Coast following major wildfires and coastal storms that racked up damage claims exceeding the amount in companies' reserves (Bittle, 2022). In the face of current and future climatic risks, the financial solvency of these schemes is difficult to reconcile under the status quo risk modeling, and pricing approaches.

Importantly, not only does this hit public and private (re)insurance companies but also policyholders who face disparities in who can access insurance, what levels of indemnity they receive with respect to actual damages, and to what degree they can afford financial protection in the first place. This burdens households to determine what risks they retain while also facing decisions about staying in place, retrofitting their home to mitigate potential risks, or choosing to relocate altogether.

The interaction of insurance access, actualized risk, affordability, and housing has garnered rising attention, particularly in the United States, following the aftermath of massive events like wildfires in Oregon in 2020 and Hurricane Ian in 2022. Innovative technological and policy responses are needed to ensure that insurance markets are open and effective for policyholders and can withstand large climate shocks. Given how related this issue is to the multi-thematic topic of managed retreat, this issue deserves more concerted attention and proactive ideation. The discussion will focus on insurance's role in housing and real estate and how insurance overlaps with individual-level mitigation or adaptation strategies like voluntary property acquisitions, home elevations or flood retrofits, and community buy-in and leadership on a local scale. We will discuss how technological advancements in risk observation and forecasting are changing how insurance is priced and packaged, including the role of technology in expanding forms of big data to critical public sector use cases around disaster management and insurance implementation. We will also consider how novel practices like parametric insurance can overcome challenges in penetration rates and how they intersect with housing, asking if there's room for the uptake of such programs in the United States. In sum, we aim to spotlight some critical technological and governance interventions that could usher in advanced forms of insurance.

In doing so, we will look at questions such as:

• What actions are insurers and governments taking to promote risk reduction or adaptation practices that reduce residual risk to be subsequently transferred or retained?

• How can this be reconciled with individual perspectives on risk, affordability, and community development and cohesion precisely in underserved frontlines of climate change?

• To what extent does the health of insurance markets reverberate through the broader property market?

• How can new technologies facilitate better and more equitable risk coverage while identifying and addressing critical protection gaps?

• How are AI-enabled methods of assessing risk expanding our understanding of the relationships between housing, risk, and insurance?

Through the panel discussion, we intend for the audience to walk away with greater familiarity with the status quo failings of insurance and the possible opportunities for insurance reforms. Hearing from a multi-disciplinary panel of early career researchers who work across housing-related issues, including relocation, buyouts, and real estate, the audience will deepen their understanding of how managed retreat research and activities interface with the insurance themes raised in the discussion. For such an interdisciplinary conference surrounding the topic of managed retreat, this session will appeal to participants from various disciplines.

Specifically, this panel discussion will feature the work and perspectives of early career researchers. As graduate students and early career scientists convening the panel, we are excited to showcase how our peers engage with this increasingly important topic, including perspectives on the direction of potential insurance reform and new methodologies in this field. References

Bittle, J. (2022, June 24). Louisiana's insurance market is collapsing, just in time for hurricane season. Grist. https://grist.org/housing/louisiana-homeowner-insurance-hurricane-season/

de Ruig, L. T., Haer, T., de Moel, H., Brody, S. D., Botzen, W. J., Czajkowski, J., & Aerts, J. C. (2022). How the USA can benefit from risk-based premiums combined with flood protection. Nature Climate Change, 12(11), 995-998.

Session Chairs: Hannah Friedrich, Ph.D. Student, School of Geography, Development, and Environment, University of Arizona; Alex Saunders, Ph.D. Student, School of Geography, Development, and Environment, University of Arizona; Emmalina Glinskis, Master's Student, University of California Berkeley, City and Regional Planning

Speakers

Jacob Bradt
Harvard Kennedy School

Ian Gray
Postdoctoral Fellow
School for Advanced Studies in the Social Sciences (EHESS)

Clay Kerchof
Senior Specialist
California Department of Housing & Community Development

Rachel Young
Princeton

7D) Managed Retreat in Coastal New England

1:30 PM - 3:00 PM, Jun 21

Room 555

Community Responses to Managed Retreat: Exploring Trade-offs through an Adaptation Alternatives Assessment in Hull, Massachusetts

- Chris Krahforst, Director, Climate Adaptation and Conservation, Town of Hull
- Bella Purdy, Climate Resilience Planner, Weston & Sampson
- Joanna Nadeau, Senior Resilience Planner, Weston & Sampson

The Town of Hull Massachusetts is in the process of exploring design alternatives for a climate vulnerable coastal neighborhood referred to as the Hampton Circle Area (HCA). The HCA is a low-lying area surrounded by Boston Harbor water on the eastern and western sides connecting two drumlins and is most vulnerable to sea level rise and storm surge impacts. Residents regularly witness nuisance flooding from high tides. The Town received a Municipal Vulnerability Preparedness grant from the Massachusetts Executive Office of Energy and Environmental Affairs to conduct a planning and design alternatives assessment to help design a roadmap for climate adaptation. One of the options explored in this assessment was planned retreat.

During the session, participants will learn about the town's successes and challenges in identifying planned retreat as a viable, cost-effective adaptation option for the HCA. The session will provide an overview of the multi-layered roadmap that includes near-term, mid-term, and long-term actions. The roadmap includes the following:
1. Redesign of a sea wall on the eastern side of the site that overtops and is eroded at its structural foundation (near-term)
2. Expansion of the Town's home elevation program in partnership with FEMA (near-term)
3. Community engagement and planning related to emergency response procedures (near-term)
4. Conducting a stormwater capacity assessment, updates to the system, and regrading of low-lying roadways (mid-term)
5. Integration of a vegetated, coastal buffer zone on the western side of the site (mid-term)
6. Planned retreat that results in just and equitable outcomes for long-term residents (long-term).

The presentation will conclude with an overview of how the town plans to implement a roadmap in which planned retreat is one of several adaptation strategies, as the next phase of the HCA project.

The HCA is unique because it has a community with many older adults with long-term tenure in the neighborhood whose properties have been passed down through generations. Hull is assessing planned retreat over a multi-decade time horizon, so that residents with deep ties to the neighborhood have adequate time to plan for transformative transitions.
The Town of Hull and Weston & Sampson utilized a variety of community engagement methods such as workshops, surveys, educational videos, focus groups, and an ArcGIS Storymap to support resident participation and acceptance in the emerging roadmap. The town gaged resident interest and willingness to relocate over a multi-decade time horizon, or sooner if desired. It was important that the engagement methods used helped residents understand future vulnerabilities and trade-offs, and that each resident felt heard and supported.

The HCA will act as a case study for participants who may be facing similar challenges in the coastal communities they live in, work in, study, or serve as practitioners. Presenters will facilitate question and answer about effective community outreach strategies when initiating discussions with residents about planned retreat. Adequate time will be given to discussion so that the presenters and participants can discuss these challenges and opportunities and brainstorm ideas for the future of this project.

Reimagining Water-Dependent Educational and Recreational Institutions in Coastal Areas

- Diane Mas, Chief Resilience & Sustainability Officer, Fuss & O'Neill, Inc. (presenting)
- Chris Gasiorek, Sr. Vice President of Operations and Watercraft, Mystic Seaport Museum
- Katherine Kahl, Extension Assistant Professor, Sustainable Fisheries & Coastal Resilience, Gloucester Marine Station, University of Massachusetts Amherst (presenting)
- Sara Morrison, Business Line Manager – Climate Resilience, Fuss & O'Neill, Inc.

For organizations whose mission, purpose, and daily function is inextricably linked to the waterfront, retreat is not only relocation of facilities or activities. Managed retreat may necessitate a reconsideration of fundamental functions, which can impact the facilities and programs needed, the resources required, and perceptions by the public and even financial support and sources. For educational institutions, parks and recreational facilities, and other water-dependent, non-residential entities, planning for the future may include hardening measures to keep the water out, reimagining and reinventing spaces and programs to let water in, or reconsidering the size and scale of facilities and programs under future conditions. This presentation

explores the unique challenges, as well as potential opportunities, that coastal, water-dependent institutions face. While being located in a coastal area has necessarily meant dealing with coastal hazards from storm surge to algal blooms, projected climate change will bring a combination of shocks and stressors including gradual sea level rise and associated sunny day flooding to increased flooding from coastal storms and increases in the intensity and frequency of storm events. Understanding the potential cascading impacts to a site and its mission and operations will also be critical in planning for a viable future. Preparing for future conditions will require: (a) a clear understanding of future climate projections and subsequent understanding of institution exposure and vulnerability on a relevant planning horizon, (b) consideration of the organization mission, purpose and goals, (c) involvement of key stakeholders including institutional operations and governance, as well as the population(s) served by the institution, and (d) thoughtful alternatives analysis, which includes considering a range of solutions, institutional mission and goals, and balancing costs and benefits, including some which may be difficult to monetize. Using case studies from Mystic Seaport Museum (Mystic, CT) and the University of Massachusetts (UMass) Gloucester Marine Station (Gloucester, MA), and Goddard Memorial State Park (Warwick, RI), this presentation/panel will focus on the experiences of parks/recreational facilities, marine-focused educational institutions, and other non-residential, non-commercial institutions in order to share challenges and also share common best practices, approaches, and opportunities for retreat while maintaining a critical water-dependent focus and function.

Mystic Seaport Museum (MSM), a historic, cultural, and uniquely Connecticut institution, is, unfortunately, vulnerable due to its mission and collection, which demand that it be located in a coastal marine environment. Nestled on the waterfront of the Mystic River, MSM is highly vulnerable to the effects of sea level rise and increased storm events. Flooding, which is occurring at the site with increased frequency, jeopardizes MSM's ability to welcome and educate the more than 250,000 annual visitors on its 49-acre campus that is home to 180+ structures, a coastal seafaring village, historic watercraft, and a catalog of more than two million artifacts. One of only a few remaining Connecticut and New England maritime museums, MSM also serves the academic community as the campus for the Williams-Mystic program and the Munson Institute. According to the Connecticut Institute for Resilience and Climate Adaptation (CIRCA), the Towns of Stonington and Groton should plan for 20" of sea level rise along the banks of the Mystic River Estuary by 2050. As the water level in the Mystic River increases due to sea level rise, even smaller storm surges, with high rates of occurrence, will greatly impact MSM's grounds, its facilities, and its ability to serve the community. In response, the MSM created the MSM Sea Level Rise Strategic Facility Plan, a vision for the future of the Museum. The additional benefit of this project is that these adaptations will be visible to the hundreds of thousands of visitors who will experience them through exhibits and programming.

The UMass Amherst Gloucester Marine Station (GMS) is embarking on an exciting planning process that both addresses immediate infrastructure needs and shapes longer-term research and experiential learning opportunities for students. Located in Hodgkins Cove (Gloucester, MA), the GMS has a long history as a granite quarry (mid-1800s -1927) and a lobster pound (1930s -1963). In 1964, the property was conveyed to the University of Massachusetts Foundation. Since 1970, UMass has conducted a variety of research on seafood nutrition and microbiology, bluefin tuna and sea turtles, sustainable fisheries and other seasonal marine research. The station has reached a turning point with UMass Amherst's decision to make strategic investments in new faculty hires, planning, and infrastructure improvements aimed at bolstering capacity and ensuring the long-term resilience of the station as a hub for hands-on, immersive marine and coastal research, learning, and engagement. Now the University is focusing on addressing issues related to deferred maintenance and more immediate research and teaching needs, while also laying a foundation for longer-term planning at the site that will address the impending challenges presented by rising sea levels and changing climatic conditions through the application of natural and nature-based solutions. Adapting the GMS to future climate impacts will necessitate a reconsideration of fundamental functions. This allows for a reimagining of the facility and programs possible on the site over time, which will impact public perceptions and the financial support and other resources required to maintain the mission of the Station, which will focus on becoming a testbed for innovative coastal climate adaptations through building resiliency approaches that work with natural systems. The case study will showcase how the GMS will be working to create a true living lab with an aim of becoming a hub for catalytic coastal resilience research while incorporating elements of phased retreat.

Goddard Memorial State Park owned and operated by the Rhode Island Department of Environmental Management is located on the coast of Rhode Island. Goddard Park attracts thousands of visitors each year as Rhode Island's most popular Metropolitan Park. It includes numerous recreation facilities including trails, fields, and forested areas, as well as a performing arts center. Recent Master Plan development for the project acknowledged the need to consider climate change impacts on this coastal recreational site. Designing with a 50 to 70 year timeline required consideration of key amenities and features of the Park, ways in which sea level rise, more intense rainfall and higher temperatures would impact both facilities and user experience, and how master planning should response to those changes.

Understanding and Addressing Barriers to Managed Retreat along the Coast of Massachusetts

- Kristin Uiterwyk, Director, Urban Harbors Institute, University of Massachusetts Boston

The concept of managed retreat seems to be gaining interest in Massachusetts, but very few communities are actively implementing managed retreat projects. To better understand the barriers to managed retreat, the Urban Harbors Institute at the University of Massachusetts Boston conducted a survey of municipal staff and managers in November of 2022. More than half of the state's 73 coastal municipalities responded to the survey, providing useful insights into why their communities have or have not considered managed retreat. Among the barriers most commonly identified were a lack of sites for relocation, cost of purchasing land, and concern about public response. Equity concerns were among the least commonly sited barriers to managed retreat. In this presentation, we will dig into the data to identify tools and resources that can help communities advance the concept of managed retreat and discuss areas in need of additional research.

Weighing risk to coastal living: Climate change threats, COVID-19 outbreak, and the housing crisis in Northeastern US

- Kanako Iuchi, Associate Professor, Tohoku University (presenting)
- Donovan Finn, Assistant Professor, Stonybrook University
- John Mutter, Professor, Columbia University

The Boston Metropolitan region has always been susceptible to coastal flooding (Kirshen, Knee, & Ruth, 2008). However, the wakeup call provided by the devastation of New York City from 2012's Hurricane Sandy, actual threats from the sea level rise (up to 20 cm rise with the sea level since the 1950s) (Kaufman, 2021), and sequential 2018 nor'easters have pushed the Boston region to move forward by addressing the climate change issues. The State of Massachusetts, since 2016, mandates that municipalities to develop "vulnerability plan" (Shi & Varuzzo, 2020), and FEMA's 2015 upgraded flood risk maps along the US east coast made coastal communities more aware of risks to coastal living with the possible rise of insurance premiums.

This research targets the small coastal town of Hull (2020 population: 10,475) on the isthmus south of Boston Bay. Hull faces

climate threats, hastened sea level rise, and recurrent nor'easters. In 2020, the area had relatively low COVID-19 incidents, with a high vaccination rate. Still, the town was much quieter throughout summer when their population of seasonal residents is usually high. Pre-COVID, the Town had successfully attracted residents from neighboring towns and central Boston to move in, with many describing Hull as the last unspoiled “gem” in the Boston metro area. Two public transit options – commuter boats and trains – in addition to private automobiles make commuting from Hull to downtown Boston relatively smooth. In addition, housing prices, on average, were much more affordable in the region as its somewhat isolated location discouraged people from moving in. Prior to the COVID19 outbreak Hull's population and housing prices were relatively stable with modest increases; however, the area's housing prices increased sharply after.

This exploratory research investigates how coastal residents determine and navigated intertwined risks of climate change, the pandemic, and rising housing costs (including insurance) when choosing a place to live. The research takes a qualitative approach to understand: i) the socio-cultural and housing settings of the town and the region, ii) government policies and programs on different risks, and iii) resident attitudes and actions related to risk and risk mitigation. This paper particularly focuses on the residents’ interview results that ask about their residence, lifestyles in the pandemic, and concerns on climate change issues, including flood insurance. Respondents included full- and part-time residents, natives and newcomers, and owners and renters of the properties. Twelve responses were collected thus far through semi-structured, open-ended interviews conducted via phone, Zoom, and in person in the summer and fall of 2021. Interviewees were snowball sampled.

Preliminary results suggests that while residents are increasingly aware of both climate risk and COVID-19 threats, decisions about coastal living are mainly based on livelihood and lifestyle preferences. While many respondents were aware of, or have even experienced, winter storms and floods that have devastated their neighborhoods, they continue to be content with their current residential choices. Residents have even increased their satisfaction with their residence and lifestyle (e.g., access to nature) during the COVID-19 pandemic, as they worked from home without commuting. This response was common across the respondents with different backgrounds. Meanwhile, this pilot study has also identified that Hull is increasingly favored by retirees, due to factors like housing affordability and access to nature. Further research is needed to explore the impact of the retiree influx on the area’s social resilience, as the phenomenon could contribute to an increase in housing prices and social vulnerability for the seasonal residence pattern. Overall, this exploratory research suggests that the hazards are not the most important considerations for coastal residents, a finding consistent with prior research (e.g., Amundsen 2015) but worthy of additional investigation.

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Retreat in Real Time – Nantucket’s Balancing Act Along a Changing Coast

- Devon McKaye, Resilience Planner, Arcadis (presenting)
- Vince Murphy, Town of Nantucket, Sustainability Programs Manager

Nantucket, an island about 30 miles off the coast of Massachusetts, is no stranger to the concept of retreat. Along Nantucket’s Baxter Road, high up on the Siasconset (Sconset) bluffs, retreat is unfolding in real time. Historically, the Sconset bluffs have been vulnerable to periodic erosion but, with climate change, sea level rise and increased storm intensity are expected to exacerbate the rate of erosion. Over time, the area behind the bluffs has been developed and now faces an uncertain future. While the debate over the best long-term solution for erosion in this area continues, the Town is balancing many competing interests including near- and long-term objectives, public and private priorities, and other considerations.

This presentation will explore the complexities of managing retreat and detail how the Town of Nantucket has leveraged their Coastal Resilience Plan and related planning and analysis efforts to better understand the nature of the risks along Baxter Road, explore potential alternatives, and work towards the development of a community-supported and actionable roadmap for Baxter Road.

Speakers

Christian Krahforst
Research Associate
University of Massachusetts/Boston

Bella Purdy
Climate Resilience Planner
Weston & Sampson

Diane Mas
Chief Resilience & Sustainability Officer
Fuss & O'Neill, Inc.

Katie Kahl
Director, Strategic Initiatives
UMass Amherst Gloucester Marine Station

Kristin Uiterwyk
Director
Urban Harbors Institute, University of Massachusetts Boston

Kanako Iuchi
Associate Professor
Tohoku University

D

Devon McKaye
Resilience Planner
Arcadis

3:30 PM

8A) What Happens With the Land After a Buyout?

3:30 PM - 5:00 PM, Jun 21

Cinema

Growing numbers of property buyouts are raising a perplexing question for governments and communities: What happens with the land after a buyout? Who should decide, when, and how? This panel highlights cutting edge research from around the country, with an emphasis on the Northeast. It examines the need for and challenges of managing buyout lands for social and ecological healing, as well as strategies for implementing thoughtful approaches. Jamie Vanucchi (Cornell University) will share research on the actual state of buyout properties from three U.S. states (WA, TX, and NC), how different programs' land management plans affect the ecological conditions of these sites, and the challenges of measuring what counts as ecological restoration. Emma Zehner (Yale) complicates this picture by sharing research about the barriers that brownfields and other contaminated sites face in the buyout or property acquisition process and in post-buyout land management processes. Elyse Zavar (University of North Texas) will share research on the benefits of commemorating relocated communities to better support community healing, memory, and retaining social ties to place. Brooke Maslo (Rutgers) will share ongoing work around restoring Blue Acres-funded buyout parcels in New Jersey following Hurricane Sandy. Finally, Shanasia Slyman (Cornell University) will argue that buyout programs can be more effective if they better integrate land stewardship aspects into the buyout process and incorporate communities in managing and caring for the land after demolition. Mike McCann (The Nature Conservancy), who has been facilitating a series of "What Happens with the Land" conversations in New York City, will moderate the panel.

Session Chair: Linda Shi, Assistant Professor, Department of City and Regional Planning, Cornell University

Remembering after Relocation: The role of commemoration in buyouts

- Elyse Zavar, Associate Professor, Department of Emergency Management and Disaster Science, University of North Texas

Relocation programs, such as buyouts, seek to provide residents opportunities to reduce their risk exposure to a range of hazards. However, relocating from a home deemed too hazardous for occupation frequently disrupts social ties and place attachment, especially for long-term residents and/or residents of close-knit communities. These broken emotional and social connections to people and place can add stress to those already experience trauma from a disaster and/or relocation. Commemoration provides an avenue to help residents maintain their connections to their former homesites as well as communicate to the public-at-large the hazards associated with that area. Despite these benefits, commemoration remains rare on post-buyout landscapes in the U.S. and abroad. This presentation examines successful post-buyout commemoration sites and offers best practices for remembering after relocation.

Reconciliation or Restoration? The Ecological Futures of Floodplain Buyout Sites

- Jamie Vanucchi, Associate Professor and Director of Undergraduate Studies, Cornell University

As climate change increases the frequency, severity, and reach of floods, governments and communities are increasingly relocating residents and retreating from low-lying areas. Buyouts of repeat-flood homes break the unsustainable and costly cycle of rebuilding damaged structures after disasters, but the process often ends with demolition of the building. While policymakers and many departing residents hope that this sacrifice will leave behind restored landscapes (Koslov, 2016), little

is known about what actually happens to these sites (c.f. Zavar and Hagelman III, 2016). Do they become restored? To what? By what criteria should we assess what is on the site? Under what conditions do programs restore more sites to an ecologically dynamic condition? We explore these questions in the context of four programs in the United States that implement floodplain relocation or buyouts: Austin, Texas; Houston, Texas; Charlotte-Mecklenburg, North Carolina; and Washington State. We argue that there is no singular restoration goal or strategy, but a spectrum of options that run between ecological "restoration" to "reconciliation". We develop a framework that encompasses a set of land management activities along this spectrum. Drawing on satellite imagery and field verification, we assess the extent to which the 3,416 buyout parcels spanning 2,811 acres in these four regions implement these land management strategies. We also interview buyout program and land managers and staff. We find that each program adopts a very different management strategy, which results in distinct social and ecological outcomes. In our efforts to measure and assess the state of ecological restoration on buyout sites, we surfaced numerous questions about what restoration goals should be, how to measure them at state, national, or international levels, and how to assess change over time. Here we present our framework and typologies of program approaches, share findings and then consider programs' challenges and support needs. Responding to the gaps and needs we identify can help contribute to much needed floodplain restoration, reconciliation, and support the potential of floodplains to shift from risk zones to community assets and landscapes of value.

Survey of Federal, State, Local, and Community-Led Approaches to Flooding at Brownfields, Superfund Sites, and Other Contaminated Sites Left Behind

- Kelly Leilani Main, Executive Director, Buy-In Community Planning (presenting)
- Emma Zehner, Master of Environmental Management Candidate, Yale School of the Environment

There is growing focus on the risks that sea level rise and inland flooding pose to contaminated sites, such as brownfields, Superfund sites, and other industrial land. Sites once thought of as secure could spread contaminants, posing significant public health threats. As a result of discriminatory land use and housing policies, formerly redlined neighborhoods have disproportionately high concentrations of hazardous waste sites and higher flood risk. Studies have recently quantified the magnitude of the problem, but this issue is not new: at a 2000 public meeting related to the Environmental Protection Agency (EPA)'s Superfund program, a community advocate asked: why doesn't a site's location in a floodplain impact how likely a community is to qualify for relocation assistance if interested? Other communities have fought flooded sewage, mold, and other health threats associated with flooding for decades.

Buy-In Community Planning, a national nonprofit that engages communities in proactive planning to solve the challenge of chronic flooding, sought to find examples of effective approaches and identify potential funding sources to address this challenge. This research started with several questions: What federal and state funding exists to address contaminated sites left behind? What are communities already doing to address flooding at brownfield sites and Superfund sites? Do contaminated sites or other potential sources of contamination—such as underground storage tanks—pose barriers for communities interested in accessing buyout dollars through the Federal Emergency Management Agency (FEMA) and the Office of Housing and Urban Development (HUD)? This research found that federal remediation programs offer guidance but don't require grant applicants to implement remedial actions that account for climate impacts. It found that federal buyout programs, which often require a property to be remediated prior to acquisition, may pose some hurdles to commercial and, in some cases, residential properties near or on contaminated sites. Overall, this research finds that federal funding for flood mitigation, environmental remediation, and land restoration projects don't often overlap, which may prevent a streamlined, urgent approach to this problem.

This research also found examples of innovation. Community-research partnerships, such as Toxic Tides in California and LEAD Agency's mapping of abandoned coal mines and flooding in Oklahoma, are using data to propose policy changes. Communities are using innovative land banks, land trust, and land swap tools to fund acquisition and remediation. The Conservation Law Foundation is pursuing legal action against ExxonMobil for failing to prepare coastal facilities for climate impacts, resulting in spills that violate the Clean Water Act and Resource Conservation Recovery Act. Local governments are piloting solutions: New York City combined its environmental justice, climate change, and remediation offices and offers bonus funding within its brownfields program for flood-prone properties that take climate resilience measures. Two Oklahoma towns have used a combination of federal and local funding to proactively relocate facilities with hazardous materials. States have intervened: North Carolina has historically acquired hog farms in flood-prone areas through the Swine Floodplain Buyout Program and Vermont's Flood Resilient Communities Fund may offer opportunities for both acquisition and remediation from a single funding source. Researchers have highlighted the important role that state legislation could play in forcing brownfields grant recipients to prepare for climate impacts. A California state regulator recently required a developer to repeat an environmental assessment with more accurate sea level rise predictions. Internationally, Australia's Environmental Protection Authority is funding testing and remediation for residents impacted by contamination spread by flooding. This paper highlights potential limitations of existing federal funding, identifies case studies of creative approaches, and based on these findings, offers several policy and programmatic recommendations.

Creating Flood-Resilient Landscapes in New Jersey Communities

- Brooke Maslo, Associate Professor, Rutgers University

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.

Tapping into Virtuous Social-Ecological Relationships in the Floodplain

- Shanasia Sylman, Ph.D. Student, City and Regional Planning, Cornell University

Generally, the buyout process focuses on the social dimensions of identifying qualifying households, negotiating with eligible households, and supporting households through the emotional and bureaucratic process. By contrast, post-buyout land management often has very limited social engagement, especially where management plans prioritize biodiversity or hydrological function. We will review research in other fields that show how community and ecological health sustain each other to demonstrate the benefits of attending to socio-ecological systems. We then show how buyout programs in the United States segment the property purchasing process from floodplain management, housing relocation, community health, and ecological restoration. Many practical and systemic barriers inhibit better marrying social and ecological health in floodplain buyout processes and outcomes, but we argue that concern for the long-term state of the land after a buyout can improve the way buyout programs are perceived and, therefore, supported. Our hope is that these suggestions are met with creativity and openness and spark ideas for innovation.

Speakers

Elyse Zavar
Associate Professor
University of North Texas

Jamie Vanucchi
Associate Professor
Cornell University

Kelly Leilani Main
Executive Director
Buy-In Community Planning

Brooke Maslo
Associate Professor
Rutgers University

Shanasia Sylman
Ph.D. Student, City and Regional Planning
Cornell University

8B) The Missing Link? Multilateral Institutional Arrangements for Planned Relocation (panel)

3:30 PM - 5:00 PM, Jun 21

Auditorium

Decision-making and planning for climate-related relocation among national governments very often involves significant technical support from external stakeholders. Requests for support vary widely – how to create human rights-based policy guidelines, how to conduct technical assessments of what is a habitable risk or a suitable destination site, how to fund relocation with limited resources – and reflect the diversity of national contexts, approaches, and cultures that influence decision-making around relocation. Yet current responses from international organizations to government requests are ad hoc, unsystematic, and inconsistent. Unlike climate related displacement and migration of individuals and households, there is no obvious institutional home for the issue of community-wide planned relocation among multilateral organizations. As a result, while international guidance and insights about ‘effective practice’ exist within academia and some IOs, it can be difficult to operationalise at national and sub-national levels, and capacity-building support has been limited.

This raises the questions: 'how can the existing ad hoc network of multilateral institutions better support governments and affected communities from decision-making to implementation? Is a new institutional home the missing link?

This panel discussion aims to articulate the gap in institutional leadership on planned relocation at the international level and explore these implications this can have for decision-making in practice. After characterizing the gap, the session will then examine why this gap matters. What would frontline countries and communities gain from filling this institutional gap? Would a potential solution involve improving technical support and capacity building for governments? This support could include: normative developments tailored to national context, technical assessments, meaningful community participation, and access to funding. Finally, the panel will conclude with a discussion of potential new institutional arrangements that could represent ways forward to address this gap, assessing their pros and cons.

The overall purpose of this session is to bring together academics and practitioners concerned with governance and support for planned relocation at the international scale. Through a panel discussion, the session will catalyze dialogue on why the gap in institutional leadership on planned relocation exists (e.g., why it has “fallen through the cracks”), what filling this gap may achieve, and the advantages and disadvantages of potential new institutional arrangements to fill the gap.

Speakers

Rachel Harrington-Abrams
PhD Candidate
King's College London

Erica Bower
Stanford University

Susan Ekoh
Researcher
German Institute of Development & Sustainability

Gabriela Nagle Alverio
J.D.-Ph.D. Candidate
Duke University

Sarah Koeltzow
Policy Officer
Platform on Disaster Displacement (PDD)

8C) Incorporating Scientific Data and Modeling into a Zoning Regulatory Framework: The County of Kaua'I, Hawaii

3:30 PM - 5:00 PM, Jun 21
Room 555

The County of Kaua'i has initiated and adopted a number of climate hazard zoning ordinances that utilize the data from scientific studies to determine where or how construction can occur.

The purpose of this session is to go over how scientific modeling for climate change can be utilized in the drafting and implementing of built environment regulations. Regulatory standards for design and siting of structures around hazards is traditionally based on historic events, such as those regulations adopted under the national floodplain management program. However, climate change induced sea level rise in conjunction with increased intensity and frequency of storms and flooding events, will expand the extent of hazardous zones to previously unaffected areas. So how can zoning and building policies continue to allow development and construction in areas that will be impacted by climate change induced hazards without incorporating mitigating standards?

Climate scientists are generating a wealth of studies and projections on climate change's array of impacts. Can planners and policymakers use this information beyond just broad policy positions and visions and instead use these studies to physically regulate an area's built environment? Are there legal issues utilizing scientific projections to determine property rights?

Ka'aina Hull, the County of Kaua'i Planning Director, and Dr. Charles "Chip" Fletcher, the Interim Dean of the School of Ocean and Earth Science and Technology, University of Hawai'i will present on the Kauai Coastal Erosion Study and how a scientific study of Kauai's coastal erosion rates dictate building setbacks in one of the country's most progressive shoreline setback ordinances. They will also present on the State of Hawai'i's Sea Level Rise (SLR) Viewer that models coastal erosion, passive flooding, and annual high wave flooding impacts, and how Kaua'i has recently adopted a Sea Level Rise Zoning District Overlay with SLR design elevations required for all construction and development within this projected area of impact.

This discussion will also include the participation of a land use attorney, to give the legal landscape for land use regulations and scientific modeling. There are considerable legal obstacles to hazard mitigation regulations, but there are also strategies and methods to navigating and overcoming these challenges.

Speakers

K

Kaaina Hull
Planning Director
County of Kaua'i

C

Charles "Chip" Fletcher
Interim Dean
School of Ocean and Earth Science and Technology, University of Hawai'i

I

Ian Jung, Esq.
attorney and land use entitlement practitioner

5:30 PM

Managed Retreat Interactive Session

5:30 PM - 7:00 PM, Jun 21
Auditorium

The goal of this special "town hall" style session is to hear stories, see pictures or paintings, listen to songs and poems, and marvel at the creative spirit that arises out of difficult human experiences, out of places of transition, out of homes left behind and homes-yet-to-be newly discovered or inhabited. We want to hear the voices of those living on the frontlines of the climate crisis, of relocation and migration. We want to lift up the lived experience of those having gone or in the process of going through "managed retreat".

Goals:
- Form deeper social connection among participants
- Give migration/retreat a “human face”
- Foster an emotional understanding of migration/relocation/losing and remaking home

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Speaker

Susanne Moser
Director, Climate Change Science & Policy Hub
Susanne Moser Research & Consulting

Thu, Jun 22, 2023

8:30 AM

9) Plenary: Reimagining roles in managed retreat

8:30 AM - 10:00 AM, Jun 22
Auditorium

We invite representatives from federal, state, local, and Tribal government and non-government organizations to discuss how the roles of their organizations have evolved within the managed retreat policy ecosystem and how those roles might continue to shift. Through a moderated discussion, we will explore how different institutions view their role within managed retreat and how they could better collaborate in the future.

Moderator

A.R. Siders
Director, Climate Change Science & Policy Hub
University of Delaware

Speakers

Kelly Leilani Main
Executive Director
Buy-In Community Planning

Shavonne Smith
Director
Shinnecock Environmental Department

Pat Forbes
Executive Director
Louisiana Office of Community Development

Eric Letvin
Deputy Assistant Administrator for Mitigation
DHS/FEMA/Mitigation

10:00 AM

Poster Session

10:00 AM - 10:30 AM, Jun 22
Auditorium

Today’s actions for future solutions: Undergraduate students’ perspectives on climate change communication

- Taylor Vahey, Bryant University
- Cathy Qi, University of Washington

Climate change is arguably the most dire and urgent issue facing our world today. The impacts of increased carbon dioxide emissions are far reaching and will require the collaboration of many players in society to mitigate the effects and adapt. Businesses need to transition their strategies to operate sustainably, education systems need to prioritize teaching climate change, and scientists need to better communicate their research with the general public so there is broad support for climate action. We present an undergraduate student perspective on learning, communicating, and leading campus actions in the era of climate change.

Climate change education is vital in communicating scientific facts to college students. To create the cultural shift and behavior

changes necessary to protect the environment and to adapt to the new climate, students need to learn accurate and updated factual information about climate change. The United Nations is also advocating for schools to provide climate education to their students to prepare them for lives and careers in the midst of a warming environment. Information needs to be relevant and actionable within the daily lives of students for them to retain information and change behaviors. Research also shows that teachers want to inform their students about climate change, but may hesitate if they do not feel qualified. As students, we will discuss the current challenges in learning about climate change in college. For example, graphical representations of the human caused increases of CO2 can be best understood by comparing CO2 changes in the past and projected future. Students need to realize that since climate change is unprecedented through human history, examining the geological record and temperature fluctuations of the Earth will help students to comprehend both the rate and magnitudes of the change and its impact. Experiential learning is an effective tool to engage students in a solution based way. As undergraduate students who have learned about climate change through an experiential learning program, we advocate for all higher education institutions to incorporate opportunities for students to get hands-on encounters with sustainability and climate change. By collaborating with school alumni and like-minded corporations, educators have the opportunity to engage and communicate with diverse groups including women, minority, and international students. As the effects of climate change have been felt disproportionately on a multitude of locations, having students from geographically diverse areas of the world involved in thinking about the potential solutions to this global issue is necessary and urgently needed today. Having a diverse group of minds involved in the learning process of climate change is one way to mitigate climate injustices. Vulnerable groups most affected by climate change should have the knowledge and understanding from scientists to know where to relocate in the future as certain locations become increasingly dangerous, exposed to extreme weather and destruction. There is a strong demand from young students to be exposed to more climate education and to be involved directly in seeking solutions, in order to prepare them for their future careers in the 21st century. In the near future, we believe that all job opportunities will have climate related components. We will discuss results from interviews conducted through our current research through Bryant University and the Harvard Radcliffe Institute involving over 50 Bryant alumni with careers involving sustainability. We will outline data on what concepts and skills are most important to learn at the undergraduate level to prepare for work in these fields. We argue, through our own experience, survey data, and interviewing with alumni, that college education is critical in planting the seed for the preparation of the lives of the next generation to enhance their climate change resilience.

High tides mean high time: using landscape architecture to facilitate successful climate migration through managed retreat

- Emma Cervinka, Bachelor of Landscape Architecture Candidate, 2023, University of Guelph

Climate change has been identified as a major issue to be addressed by landscape architects in the 21st century. The UN's Sustainable Development Goals aim to protect the environment and human livelihood, prompting landscape architectural bodies to commit to sustainable design practices. A growing solution is 'managed retreat' – "the coordinated movement of people and assets out of harm's way." (Siders, 2019) This research aims to identify how landscape architects can synthesize design interventions that address sociocultural and environmental issues of managed retreat. A review of academic journals and grey literature, seven key informant interviews, and two North American case studies, will be conducted to investigate the role of landscape architects in climate migration. The review will conclude that managed retreat requires place-based design and identify key practices for landscape architects to employ, using Hurricane Fiona as an example. The principles will contribute to the growing knowledge on sustainable climate migration. The final project will employ the guidelines established throughout the thesis project to suggest the implementation of managed retreat in an at-risk community along the waterfront in Boston, MA.

Rethinking Relocation and Resilience: Understanding How the Pushes and Pulls of Place Shape Relocation Decisions in the Greater Houston and New Orleans Regions

- Abbey Hotard, Texas A&M University at Galveston

Resilience to disasters is determined by the web of resources and abilities that build resistance and adaptive capacity. Adapting to future hazards involves making tradeoffs across a range of personal and community capital assets for resilience. Household relocation decisions, in particular, depend on the interplay of "push" (e.g., crime, hazards) and "pull" (e.g., employment, social ties, natural amenities) factors that affect quality of life within a community. These push and pull factors are manifestations of the interactions between community and personal capital assets for resilience. Past research has demonstrated that hazard-driven relocation decisions are influenced by perceptions of existing community conditions. This research expands upon that understanding by highlighting the interaction between personal assets and perceptions of community assets during relocation considerations to provide an assessment of resilience particularly among residents preferring to remain in coastal communities.

Planetary Neighborscape: A Reparations Framework for Climate Migration

- Ari Vamos, Graduate Student, Landscape Architecture, University of Pennsylvania Weitzman School of Design
- Aaron O'Neill, Graduate Student, Landscape Architecture, University of Pennsylvania Weitzman School of Design
- Jun Lee, Graduate Student, Architecture, University of Pennsylvania Weitzman School of Design

Planetary Neighborscape was developed for Matthijs Bouw's fall 2022 University of Pennsylvania design studio on climate migration in the Netherlands. While the original studio prompt focused on movement from the country's urban west to its rural east in the face of sea level rise, we expanded our scope to engage climate migration at a global scale. Drawing on both scholarly and activist calls for climate reparations, our design proposal explores a scenario in which former colonial powers such as the Netherlands and Germany facilitate climate migration from former colonies such as Indonesia and Namibia. This scenario reimagines the rural Dutch tradition of naoberschap, or neighborly responsibility and mutual aid, as an expanded transnational solidarity in the face of the climate crisis. By landing this scenario in Dinxperlo, a small farming community on the eastern Dutch-German border, we explore what physical and social infrastructures might be necessary to both successfully resettle climate refugees and address challenges faced by the receiving community, including drought and a shrinking agricultural economy. The design proposal is based around three key elements: modular climate refugee housing, bio-based material production to support this new construction, and sustainable land management to increase groundwater storage and prevent drought. Alongside the physical design, we worked through a phased social process that would build relationships and consensus between sending and receiving communities before migration begins. The physical infrastructure takes the form of a distributed vocational school campus that trains both existing residents and new arrivals in bio-based material production, modular construction, and sustainable forestry and agriculture. We designed 3 campus sites: a refugee welcome center and language hub in the center of Dinxperlo, a construction training and refugee housing site, and a sustainable land use education park. Each site layers a range of uses across interior and exterior space, blending productive, educational, cultural, and social functions to imagine how people from disparate communities might live and work together. Our proposal pays particular attention to how climate refugees could build lives in a new place and make the built environment their own. A modular

housing system allows a range of configurations based on different family sizes and kinship networks, as well as supporting self-built expansion and customization over time. Climate refugee-led productive and didactic landscapes decenter conventional Dutch water engineering and make space for the Dutch to learn from other ways of living with water. Finally, flexible public spaces create room for both collective celebration and collective grief. Through this interdisciplinary collaboration between architecture and landscape architecture, we hope to give built form to what are often abstract calls for climate reparations. By envisioning a possible future of mutual solidarity and abundance, we argue that climate reparations are both an ethical obligation and a necessity for survival–for former colonies and former colonizers alike.

Weighing the Costs and Benefits of Climate Adaptation

- Melissa May, Senior Planner, Resilience Practice Leader, SSFM International

In the face of rising sea levels and increasingly extreme, unpredictable weather patterns, government agencies are confronted with daunting challenges in planning for future investments in infrastructure and development. Climate adaptation involves difficult choices with vast social, economic, and environmental repercussions. The vulnerabilities and the urgency to adapt are well documented in many areas. What is needed next are solutions and action. Climate adaptation requires a rigorous, replicable, and defensible decision-making framework for identifying and vetting different solutions for vulnerable areas. The adaptation pathways approach is being utilized worldwide to enable agencies to evaluate climate adaptation options based on feasibility, costs and benefits, and community acceptance. These solutions may range from a “do nothing” approach, to engineered solutions that protect or harden existing infrastructure, to managed retreat that relocates vulnerable infrastructure and development out of harm’s way. The adaptation pathways approach evaluates these options over different timescales and levels of climate impact, ultimately identifying “pathways” of short, mid, and long-term solutions and trigger points at which increasing impacts and/or costs make it necessary to move to the next phase. These adaptation pathways provide a sound basis to guide investment and secure funding for implementation. Cost-benefit analysis and other types of economic analysis are critical inputs into the development of climate adaptation pathways. This involves analyzing the hard costs associated with design and construction of different solutions, as well as the societal and environmental costs, including the ecological, economic, and societal benefits provided by intact beaches and coastal ecosystems, and the costs associated with their potential loss.

Timber Urbanism: Assessing the carbon footprint of mass-timber, steel, and concrete structural prototypes for peri-urban densification in the Hudson Valley's urban fringe

- Eleni Stefania Kalapoda, Architect & Urban Designer, Columbia GSAPP

The current fossil-fuel based urbanization pattern and the estimated human population growth are increasing the environmental footprint on our planet’s precious resources. To mitigate the estimated skyrocketing in greenhouse gas emissions associated with the construction of new cities and infrastructure over the next 50 years, we need a radical rethink in our approach to construction to deliver a net zero built environment. This paper assesses the carbon footprint of a mass-timber, a steel, and a concrete structural alternative for peri-urban densification in the Hudson Valley's urban fringe along with examining the updated policy and the building code adjustments that support synergies between timber construction in city making and sustainable management of timber forests. By quantifying the carbon footprint of a structural prototype for four different material assemblies—a concrete (post-tensioned), a mass timber , a steel (composite) and a hybrid (timber/steel/concrete) assembly applicable to the three new building typologies of the IBC 2021 (Type IV-A, Type IV-B, Type IV-C) that range between a nine to eighteen-story structure alternative—and scaling-up that structural prototype to the size of a neighborhood district, the paper presents a quantitative and a qualitative approach for a forest-based construction economy as well as a resilient and a more just supply chain framework that ensures the wellbeing of both the forest and its inhabitants.

Labor Mobility as Climate Adaptation Strategy in the Pacific

- Limon B. Rodriguez, Johns Hopkins University School of Advanced International Studies (SAIS)

Vulnerable to climate change, the Pacific Island countries (PICs) face an existential threat. In fact, in response to rising sea levels, a set number of citizens from Fiji, Kiribati, Tonga, Tuvalu, and Samoa are provided access to permanent migration to New Zealand annually. Projected to be submerged in the future, citizens from PICs are being prepared for labor markets in Australia and New Zealand through labor mobility. Labor mobility, particularly, circular migration, serves as a rampway through which workers are equipped with technical and vocational skills to access labor markets in host countries and with soft skills to enable their integration, especially when their home countries may no longer be habitable. To manage the risk of decreasing domestic employment opportunities as a direct impact of climate change, labor mobility as an adaptation strategy is recognized in policies of PICs (e.g., Tuvalu’s National Labour Migration Policy Report, Kiribati’s Joint Implementation Plan on Climate Change, Vanuatu’s National Policy on Climate Change and Displacement).

My paper focuses on two labor mobility schemes between Australia and PICs: the Seasonal Worker Programme (SWP) and the Pacific Labour Scheme (PLS). Kiribati is an example of why these schemes are linked to climate adaptation. The SWP, for instance, did not originally include Kiribati because travel costs are high, but since it is one of the first projected countries that will be submerged, it was included in the program to enable its people to move to Australia voluntarily. More broadly, these schemes are a climate adaptation strategy in the Pacific because they: a) generate financial and social remittances to cope with impacts of climate change; b) lower population pressure on climate-stressed environments and natural resources; and c) reduce the number of people supported in home countries thereby exerting less pressure on household food stocks. For example, financial remittances are used for building climate-resilient houses, installing water pumps and water tanks given droughts and intrusion of saltwater, improving seawalls, and purchasing solar panels. And social remittances enable transfer of agricultural skills, such as pruning which was applied to breadfruit trees which were previously not producing fruits because of drought and salty water. These benefits present opportunities to: a) train migrant workers in and connect them with agricultural extension services in home and host countries; b) offer agricultural certifications because some migrant workers are interested in training on salt-tolerant crops which can be applied in home and host countries; and c) partner with agricultural training centers in PICs (e.g., Rural Training Centers in Solomon Islands).

However, these schemes can be maladaptive if they shift the costs of adaptation to migrant workers and their home countries, including through: a) transfer of unsustainable agricultural practices (e.g., use of synthetics chemicals in fertilizers and pesticides); b) abuse (e.g., underpayment and non-payment of wages); and c) high social and emotional costs (e.g., poor mental health due in part to homesickness, marital dissolution). While measures are being carried out to resolve these issues, such as payment of minimum hourly rates, improved employer portability, and bringing families of longer-term workers, my paper recommends the following: a) delivery of agriculture training on safe and effective use, and benefits and risks of transfer of synthetic chemicals to farms; b) latching agricultural labor mobility onto work placements or farm tours on organic and protected cropping farms and farmer exchanges; c) improved regulation of recruitment practices; d) involvement of diaspora in governance and support structures; e) creation of opportunities for permanent residency; and f) climate financing mechanisms,

notably, the Readiness Resources from the Green Climate Fund, and funding from multilateral development banks and international organizations for financial sustainability.

Modeling climate change impacts on habitability and mobility dynamics in Kiribati

- Emily C. Nabong, PhD Candidate, The University of Sydney

In 2020, the United Nations Humans Rights Committee shared a landmark decision stating that a person cannot be returned to a country where climate change impacts create exposure to life-threating risks. In this legal case, however, the I-Kiribati applicant was denied refuge as the committee argued that there is not yet an imminent risk to life by living in Kiribati. In this study, we explore the topic of imminent risk to life by evaluating changes in habitability and its effect on future migration patterns in Kiribati. We build from a Sustainable Livelihoods Framework to assess how climate change affects existing interactions between factors (i.e. human, natural, physical, social, and financial) and leads to loss in habitability. Using a system dynamics approach, we aim to find tipping points in habitability and key drivers of migration in Kiribati as well as evaluate how the time scale and magnitude of migration changes under different representative concentration pathways. With these results, we contribute to conversations of habitability and imminent risk for future climate displaced people.

Speakers

Taylor Vahey
Bryant University

Emma Cervinka
MUD Candidate 2024
University of British Columbia

Abbey Hotard
Texas A&M University

Ari Vamos
Graduate student in the Department of Landscape Architecture
University of Pennsylvania Weitzman School of Design

Melissa May
Senior Planner, Resilience Practice Leader
SSFM International

Eleni Stefania Kalapoda

Limon Rodriguez
Doctoral candidate
Johns Hopkins University School of Advanced International Studies (SAIS)

Emily Nabong
PhD Candidate
The University of Sydney

10:30 AM

10A) Ensuring Flood Buyout Participants relocate to Safe, Affordable Local Housing (panel)

10:30 AM - 12:00 PM, Jun 22

Auditorium

Government representatives and program practitioners from NJDEP Blue Acres and NJDCA Smart Move will introduce the Smart Move program, sharing and discussing the impetus, purpose, goals, and current progress to date. Panelists will focus on the crosswalk between the Blue Acres buyout program and the Smart Move new housing development program, calling out policy challenges, solutions, and opportunities that highlight the intersection between buyouts and housing and specifically how Smart Move can and will promote housing for vulnerable populations displaced by post-disaster flood buyouts.

Background on Blue Acres:

Blue Acres is a voluntary buyout and incentive program administered by DEP. Buyouts are acquisitions of properties located in a floodway, floodplain, or other Disaster Risk Reduction Area that reduce the risk from future flooding. Under Blue Acres, buyout properties will be voluntarily sold to DEP or their designee for current fair market value (post-storm value) and must be converted to and maintained per open space, recreational or wetlands management, or other disaster risk reduction practices. The program also may provide incentives to eligible homeowners to help them afford the costs related to relocating to a lower risk area.

Background on Smart Move:

The State of New Jersey is piloting a program that subsidizes the new development of quality, energy-efficient, resilient, and affordable housing in lower risk areas within or near disaster-impacted communities that are participating in NJDEP Blue Acres or other buyout programs that are supported by different funding sources. The program aims to provide safe housing for relocating residents so they may stay in or near their communities after selling their high-risk properties.

NJDCA will competitively select two communities to participate in the pilot. Once the eligible communities have been selected, DCA will procure private for-profit or nonprofit developers to build new housing that will be sold to qualified homebuyers or Blue Acres participants. In the initial pilot, DCA will prioritize qualified primary residential occupants who sold their high-risk owner-occupied homes through the Blue Acres Buyout Program.

The new developments will be built outside the 500-year floodplain and the inland or coastal climate adjusted floodplain, as defined by DEP. The site and housing designs will include additional resilience and energy efficiency construction standards, which will be defined in the program guidelines.

This project will be developed and implemented in close coordination with DEP to facilitate the relocation of Blue Acres Buyout Program participants into the new development, where feasible. If approved Blue Acres participants will be expected to utilize the net amounts of their buyout and incentive funds toward their new housing development purchase. At least 70% of the homes will be sold to LMI homeowners or homebuyers.

Speakers

Courtney Wald-Wittkop
Manager, Blue Acres Program
NJDEP

James Mooney
SmartMove Program Manager
NJDCA Disaster Recovery & Mitigation

Pat Forbes
Executive Director
Louisiana Office of Community Development

10B) European Approaches to Managed Retreat

10:30 AM - 12:00 PM, Jun 22

Room 555

Climate mobility in Europe? Reviewing the evidence

- Michele Dalla Fontana, Postdoctoral Marie Curie Fellow at the Environmental Policy Group, Wageningen University, the Netherlands (presenting)
- Ingrid Boas, Environmental Policy Group, Wageningen University

The frequency of extreme weather events has increased over the last decades in different regions across Europe. According to the Internal Displacement Monitoring Centre (IDMC), just in recent years, extreme weather events have displaced hundreds of thousands of people. For example, heavy rainfall across western Europe in mid-July 2021 led to at least 84,000 displacements. In the same year, wildfires triggered around 155,000 displacements in Southern Europe. On top of that, the number of reported cases of relocation or planned retreat of settlements due to exposure to risks such as floods and Sea Level Rise is increasing (e.g. East Anglia and Norfolk counties on the eastern coast of England or the municipality of Almada in Portugal). Despite this, news media and politicians seem more interested in discussing climate change-induced mass migrations towards Europe rather than recognising people's internal mobility responses to environmental change. Furthermore, there is a geographical bias in the scientific literature as well, as research on climate change, environment and human mobility is underrepresented in European cases and mainly focuses on the Global South. This paper reviews where the discussion on the effects of environmental change on human mobility in the European context stands. To do so, we review the relevant scientific literature and a selection of European and National strategies on climate change adaptation and Disaster Risk Reduction to understand whether and how human mobility is contemplated in these frameworks. The present study is an initial attempt to fill the geographical gaps in the literature on environmental change and human mobility. At the same time, it questions the assumption that European countries can consider themselves immune to environmental change-related human mobility.

The efficiency of setback zones and retreat in reducing future urban exposure in Europe's coastal lowlands

- Claudia Wolff, Postdoctoral Researcher, Coastal Risks and Sea-Level Rise Research Group, Geography Department of

Kiel University (presenting)
- Athanasios T. Vafeidis, Kiel University
- Hedda Bonatz, Kiel University

Future coastal risks will be significantly influenced, not only by sea-level rise and the intensification of extreme events, but also by where people decide to build and settle. Even though multiple studies have demonstrated that one of the most effective adaptation measures is to limit urban expansion inside the coastal floodplain, little research has been done to analyze the potential of land use-planning interventions in minimizing future coastal exposure in Europe. This study is a first-order EU-wide evaluation of the effectiveness of different coastal setback zones and retreat as an adaptation strategy for limiting upcoming urban exposure. We have developed country-specific urban change models using machine learning techniques for all coastal EU Member states (plus BIH, GBR, and NOR,) for which data and Shared Socioeconomic Pathways projections were available and have assessed the amount of urban land in the coastal lowlands. Results show that the optimal designation of setback zones is country- or location-specific and mostly dependent on the type of shoreline and the morphology of the coastal profile/floodplain. Planning setback zones appears especially beneficial for nations with a long coastline such as Italy, Norway, France, Sweden, or Great Britain, as it is inherently more expensive and challenging to adapt to and protect long coastal stripes. Overall, coastal future urban exposure in the EU can be reduced by 47% if the most effective setback zone for each country is implemented (considering a high urban growth scenario). Additionally, our findings demonstrate that one of the most efficient approaches for the majority of EU countries to decrease urban exposure in the coastal lowlands is to establish a coastal setback zone by a specific elevation, i.e., construction is prohibited above a certain height above sea level. The results highlight the fact that how we design, construct, and develop urban space in the EU coastal lowlands will determine how exposed future urban areas are to sea-level rise.

Practitioner perspectives on accommodation and retreat in response to climate change in the Netherlands

- Carolien Kraan, PhD candidate, University of Miami (presenting)
- Marjolijn Haasnoot, Senior Researcher and Associate Professor, Deltares & Utrecht University
- Katharine J. Mach, Professor, University of Miami

The Netherlands considers itself the safest delta in the world due to its excellent flood risk management system. However, unless extremely ambitious reductions in global greenhouse gas emissions are implemented, the country will face significant climate change impacts over the coming centuries that will impact its water management system. Multiple scenarios have been presented for future adaptation options for the country as a whole. This study explores perspectives on accommodation and retreat as climate change adaptation options under increasing climate change in the Netherlands. We use an expert elicitation process, in which closed-form quantitative judgments are enriched through open-ended follow-up questions. In-depth, semi-structured interviews with >30 experts explore how accommodation and retreat can play a societally beneficial role in climate change adaptation. Experts have a variety of backgrounds, including academia, government, NGOs, and the private sector. This presentation will give an overview of the experts' range of perspectives on accommodation and managed retreat, including how likely they consider accommodation and retreat measures to be implemented, what forms they may take, barriers and opportunities to such adaptation measures, and how these could be overcome or harnessed to ease implementation.

Procedural justice in climate adaptation: assessing state-led (in)voluntary land use change and relocations in The Dutch Delta

- Lieke Brackel, PhD candidate, Delft University of Technology

If we do not stop the current trend of global warming, more land use change and relocations will have to take place in coastal areas all over the world. Also in the densely populated Dutch Delta, space is needed for adaptation measures such as water retention basins and dyke reinforcements (Alphen et al., 2022). The Dutch hydro-social system is highly engineered and requires continuous pumping and heightening of seawalls to allow for millions of people to live below sea level.In the name of future generations or other species, it can be argued that the Dutch need to loosen current coastal armouring strategies and give more space to exposure reducing measures such as managed retreat. However, historic myths about 'fighting the water wolf' represent deep cultural beliefs that favour keeping the water out. Moreover, rebuilding flexibility and delta dynamics would deeply affect the lives of farmers and house-owners currently living in the flood plains and polders to be transformed. Hence, even when managed retreat and land use change can be justified in certain places, the challenge is to address the conflicts and questions of justice that arise with buy-out programs and (in)voluntary relocations in the name of climate adaptation.

In this empirical ethical study, we assessed land use change conflicts and state-led relocations that have already occurred in Dutch water management to learn for the future. We use the Capability Approach as a framework for procedural justice and to conceptualise what is at stake for the citizens involved, focusing specifically on the political capability 'control over one's environment' (Holland, 2017; Nussbaum, 2011; Robeyns, 2017; Sen, 2009; Schlosberg, 2012). The Capability Approach to justice helps to point out what kind of public support different people need and how inequalities may be reinforced in adaptation transitions in different contexts.

In the Dutch case, salient options for differentiated public support were identified from in-depth conversations with 22 interviewees were: room for choice, stable and clear policies, rules and support for fair lobbying, and attention to peoples' divergent emotions and attachments. One important limitation of our findings is that differentiated public support requires more time and funding compared to one size fit all approaches. However, the conversations with citizens showed that small differences in the way people are treated or engaged with can already make a difference for their experience of the (in)voluntary relocation process. When citizens have to deal with pending relocation plans and even expropriation, the uncertainty and long negotiating process resembles a true crisis in ones' life. Integrating ethical theory with the perspectives of citizens, legal experts and policy officers involved in state-led relocations provides a deeper understanding of what it means to have sufficient political control over one's environment in land use transitions. Water management is traditionally more technocratic and pays less attention to human emotions, so small ways to differentiate can already help to improve the process and give a place to the inherent loss associated with managed retreat.

Even though managed retreat is justifiable for all kinds of reasons, we still need to find better ways to address the loss and uncertainty citizens experience during (in)voluntary relocation processes to achieve just climate adaptation.

Speakers

Michele Dalla Fontana
Environmental Policy Group, Wageningen University, Wageningen, Netherlands

Claudia Wolff
Kiel University (CAU)

Carolien Kraan
PhD Candidate
University of Miami

Lieke Brackel
Delft University of Technology

10C) Managed Retreat in NY and NJ I

10:30 AM - 12:00 PM, Jun 22

Cinema

Barriers to housing mobility: A critical look at Uniform Relocation Act in NYC

- Hugo Sarmiento, Assistant Professor, Columbia GSAPP (presenting)
- Deborah Helaine Morris, Adjunct Professor, Columbia University

The Uniform Relocation Act ("URA") is a federal statute that establishes minimum standards for federally-funded projects that require the acquisition of real property or displacement of people from their homes or places of business. Passed in 1970, the URA mandates consistent assistance, from notification, services, and compensation methodology for federally funded projects across agencies. Across federal programs and agencies, the reach and influence of the URA appears to be vast but both under-discussed and not well understood. In the context of federal disaster recovery programs, the URA is the backbone of property acquisition "buyout" programs, which are an increasingly significant component of climate adaptation programs in the United States today. There is evidence that buyout programs prioritize delivering resources to single-family homeowners and that the levers of assistance do not adequately support rental tenants, nor recognize or address long-term structural issues like the affordable housing crisis and the racial wealth gap, which disproportionately impact low income, BIPOC communities. This is not always well documented or meaningfully researched in a way that informs improvements in governance. This research will use the New York relocation experience as a case study to better understand how policy frameworks, such as the URA, have shaped housing mobility in the context of disaster recovery. The research seeks to answer: What are the policy barriers, in the URA, to housing mobility for impacted communities? How effective is the URA in supporting residents, namely low-income and communities of color, who historically, have been discriminated against in the housing market? It analyzes a new dataset constructed with support from the New York Governor's Office of Storm Recovery ("GOSR") [soon to be renamed "New York State Office of Resilient Homes and Communities"] the population of rental tenants that were permanently displaced by its post-Sandy buyout programs, to explore the program's relationship to underlying issue social difference and spatial inequality, including wealth inequality and patterns of racial segregation. Analysis of this dataset is complemented by interviews of government agencies and local experts.

Co-producing adaptation to flooding in urban communities: A case study of Rockaway peninsula in New York City

- Malgosia Madajewicz (presenting)
- Philip Orton, Research Associate Professor, Stevens Institute of Technology
- Ana Fisyak, Community Engagement Manager, Equinor
- Michaela Labriole, Director of Strategic Education Initiatives, New York Hall of Science
- Judith Hutton, Coordinator of Strategic Education Initiatives, New York Hall of Science
- Judah Asimov, NYC Economic Development Corporation
- Jeanne Dupont, Executive Director, Rockaway Initiative for Sustainability and Equity

Many urban areas are experiencing rapidly growing flood risk as sea levels rise. Managing the risk requires complex decisions that assess pros and cons of reducing risk in flood prone locations and relocating large populations. Despite public investments in risk reduction, communities who remain will continue to face residual flood risk. For example, flood barriers generally are designed to be closed only for flood events that exceed a certain threshold because closures have impacts on economic interests and ecosystems. Coastal residents can invest in reducing the risk of damage from flooding that will continue to reach their homes, but few residents have been making such investments even in places that are seeing rapidly intensifying flooding, and buy-out programs are still in their infancy. Much remains to be understood about motivating coastal residents to take action to adapt to flooding.

This study examines how co-producing an understanding of the benefits and costs of flooding with coastal communities influences attitudes about adaptation and adaptation behavior relative to simpler approaches that municipalities have been pursuing more commonly in their efforts to motivate residents to adapt through online communication and neighborhood outreach. The case study co-produced knowledge about current and future flood risk and benefits and costs of adaptation options in order to improve the capacity of coastal homeowners to make informed decisions about adaptation actions that they may be able to take with their own resources, such as elevating mechanicals in a home, floodproofing basements, installing alternative sources of energy, elevating homes, and relocating. An interdisciplinary team of scientists, educators, and staff from a non-profit coalition of community groups, with input from the City of New York, co-produced the knowledge with leaders of community groups of homeowners in the highly flood-prone Rockaway region of New York City (NYC).

The study uses a rigorous mixed method program evaluation methodology to assess if and how co-production of knowledge

about flood adaptation options influences residents' attitudes and behavior relative to neighborhood outreach programs and online information provided by the City of NY. The qualitative component is based on transcripts from workshops in which community group members discussed the co-produced information and interviews with community members. The quantitative component is a difference-in-difference regression analysis that compares the change in attitudes and behavior over time among members of community groups which participated in co-producing the materials and members of community groups which did not participate. Both sets of groups had access to neighborhood outreach implemented by the City of NY and online resources. The researchers selected participating and non-participating groups. The difference-in-difference approach estimates the causal effect of the intervention under certain conditions.

The study makes two main sets of points. The first concerns understanding benefits of adaptation. Residents and decision makers continue to focus their concern on large flood events, whereas over the next thirty years the distribution of damages will change, with the preponderance of damages being caused by more frequent and less intense events, against which the currently planned flood barriers will provide little protection unless closures occur more often than planned. Focusing on events that will cause less of the total damages and are likely to be mitigated with infrastructure affects the effectiveness of adaptation choices. Furthermore, the commonly used assessments of the size of these damages are most likely underestimates, with implications for adaptation planning.

Second, co-production resulted in the investigation of different types of information than are communicated in neighborhood outreach and online. The information was much more specific to decisions that residents can make. The discussion of the decision-specific information changed attitudes toward adaptation action, with residents expressing more urgency and with a statistically significant increase in the percentage of residents who consider the residents themselves to be responsible for taking adaptation action. The study examines the change in attitudes and behavior over one year, which is insufficient to observe large changes in behavior. However, members of participating community groups began to take actions of which they were not aware before participating in the co-produced workshops. Inability to afford even the less expensive retrofits and lack of funding available to community groups pose a major obstacle as does the complexity of adaptation decisions, which depend on investments planned by the City of NY and likely actions by other residents. The results have implications for designing approaches to adaptation in coastal communities in the study area and in other urban settings.

A Senses of Justice and Contextual Equity Approach to Inform Land Restoration following Buyouts in Edgemere's Floodplain

- Veronica Olivotto, PhD Candidate of Public and Urban Policy, The New School

Scholarly work on managed retreat in the U.S.A has largely focused on understanding what are the acceptance factors for and against voluntarily relocating, as well as understanding the legal and policy implications based on occurred buyouts and acquisitions. Increasing attention is also placed on understanding the social justice implications of managed retreat. Research has focused on whether the opportunity to access buyouts is equitably spread, how the compensation schemes are designed and who they favor, and whether managed retreat processes are effectively reducing the vulnerability of households who embark on it. Less research has focused on those who stay and their lived experiences. Because the buyout processes take a long time, or because no more appealing option is available, or due to a sense of dependence on one's neighborhood, communities where MR happens are often broken apart, leaving behind a patchwork of vacant land and loss of sense of place. This study explores recognitional justice codified as 'senses of justice' collected through oral histories with 20 residents living in Edgemere (Rockaway, Queens, NYC), a low-lying majority-minority neighborhood where post hurricane Sandy buyouts, a long history of failed urban renewal has led to large amounts of vacant land. The interviews findings were complemented by observations at three community visioning events for land restoration and contrasted with quantitative analysis of neighborhood vulnerability change.

Towards A More Community-Driven Conversation About Risk and Relocation

- Paul Gallay, Director, the Columbia Center for Sustainable Urban Development's Resilient Coastal Communities Program

The proposed paper will analyze the conditions under which communities
are brought into discussions around managed relocation and recommend a more community-driven approach to such discussions, based on findings from participatory research conducted with ten New York Metropolitan Area community organizations in the Spring of 2022. This research shows that gaining community support for managed relocation will require the abandonment of current "top-down" planning processes in favor of an approach that maximizes community empowerment, equity, accountability
and trust, as well as a close examination of potential alternatives to relocation.

Rehousing the Displaced: A Framework for New York City to Accommodate Renters Leaving the Floodplain

- Alex Miller, MS in Sustainable Environmental Systems, Pratt Institute School of Architecture

Without significant intervention, New York City's housing crisis will likely worsen by 2050 as the floodplain expands further into coastal neighborhoods, displacing residents and removing buildings from the city's housing stock. Housing is currently too scarce and expensive in the city to fully accommodate that displaced population. Additionally, most New Yorkers are renters, a group that is uniquely vulnerable to climate-borne inequities. This project was initiated to identify relevant components of New York's housing and climate crises vis-à-vis renters; assess how those components interact with each other and are governed; and locate solutions via City and State legislation, policies, and administrative practices. The presentation includes detailed recommendations to generate social housing in receiving communities, create equitable processes for managed retreat, and establish sustainable and just funding sources.

Speakers

Hugo Sarmiento
Columbia University

Malgosia Madajewicz
Associate Research Scientist
Columbia University

Veronica Olivotto
PhD Candidate
The New School

Paul Gallay
Director, Resilient Coastal Communities Project
Columbia Climate School

Alex Miller
Research Fellow
Urban Ocean Lab

10D) Habitability: Empirical insights from the Field, and in Policy

10:30 AM - 12:00 PM, Jun 22
Satow Room

Social Structures Connected to Multiple Social Categories Can Cause a Differentiated Impact of Environmental Change on Perceived Habitability

- Simon Merschroth, University of Vienna (presenting)
- Jan-Niklas Janoth, University of Vienna
- Harald Sterly, University of Vienna
- Patrick Sakdapolrak, University of Vienna
- Mumuni Abu, Senior Researcher at the Regional Institute of Population Studies, University of Ghana

The loss of habitable land is increasingly recognised in environmental risk assessments. Changes in the habitability of a place hereby occur socially differentiated because the mechanisms behind these changes function socially differentiated. In detail, these inequalities are shaped by social structures connected to culturally constructed social categories. However, most works either stick to describing these differentiated outcomes or tend to analyse the underlying social structures connected to only one specific social category – rather than looking at their intersection. Thus, only a small number of studies has explored how various social structures connected to multiple social categories intersect to contribute to socially differentiated impact of environmental change on perceived habitability. Accordingly, researchers have been calling for intersectional approaches in the analysis of environmental change within social sciences, including aspects of subjectivity, space, and time.

Building on empirical insights from qualitative field work in Northern Ghana and analysed through theoretical standpoints of Habitability and Feminist Political Ecology, we show that the interplay of different social structures resulting from norms and rules connected to multiple intersecting social categories can contribute to a socially differentiated impact of environmental change on perceived habitability. Hereby, social structures connected to gender interact with those connected to household characteristics, age, and socio-economic status to mitigate or exacerbate the influence of environmental change on perceived habitability. These perceptions are further influenced by an individual's position in space and over time. Moreover, subjective individual notions of well-being and their interplay with one's livelihood further navigates a person's perceived habitability across these intersections. Analysing this finding through the lens of Habitability and Feminist Political allows us to show how the impacts of environmental change are dynamically embedded within a socio-ecological system and shaped through subjective perspectives on it. Moreover, our findings problematise how adaptation to environmental change can contribute to the reinforcement of existing social categories. We thereby aim to add to informing socially nuanced policies in the field of environmental change and development that initiate socio-ecological transitions instead of reproducing social inequalities. Understanding that social structures are culturally constructed as opposed to existing naturally can thus contribute to transforming them.

Habitability to climate change beyond the point of no-return: co-designing adaptation plans and preparing for loss and damage

- Ariadna Anisimov, Postdoctoral researcher, University of Antwerp (presenting)
- Alexandre K. Magnan, Senior Research Fellow on vulnerability and adaptation to climate change, Institute for Sustainable Development and International Relations

The climate emergency is a reality. Climate change impacts are expected to intensify over the 21st century no matter what emissions reduction scenario. Communities in low-lying coastal areas, particularly in small island developing states (SIDS) are facing an existential risk to livelihoods from compounded climate challenges: extreme weather events and slow on-set (sea level rise). The most urgent question for policy and decision-makers is on the future and long-term (un)habitability of these coastal areas and the possibility of retreat and relocation.

Life beyond the point of 'no-return' under climate change requires more ground-rooted research on challenges linked to the historical ties to land, culture and risk perception, social acceptability of adaptation, land tenure and compensation. Specifically, empirical studies are needed to bring the voices of the communities at the forefront of climate change and habitability issues, in order to inform local-to-national and international adaptation policy and the design of compensation tools for non-economic losses associated with relocation. Adaptatin limits and Loss and Damage in this regard is a growing area at the science-policy

interface, with major developments since COP26 in Glasgow and COP27 in Sharm el Sheikh. The key question emerges on how to design relevant funding arrangements and operationalize such a mechanisms that truly responds to local voices and views.

This presentation takes a critical look at opportunities for bridging ground rooted studies on adaptation limits, questions of habitability (and its definition, to whom) and what this means for the Loss and Damage debate at higher policy circles (UNFCCC). It calls for multi-disciplinary methods and case studies to support radical shifts in framing adaptation research and implementation that is based on bottom up approaches for codesigning adaptation pathways where coastal retreat and relocation go hand-in-hand with community empowerment, ownership and the fulfillment of fundamental rights.

Shifting the boundaries of habitable spaces? The interplay of migration and socio-cultural dimensions for constituting locally perceived habitability in a context of environmental change in Northern Ghana

- Jan Niklas Janoth, University of Vienna (presenting)
- Patrick Sakdapolrak, University of Vienna
- Harald Sterly, University of Vienna
- Simon Merschroth, University of Vienna
- Mumuni Abu, University of Ghana

The fairly differentiated range of environmental changes that are currently transpiring on global to local scale levels imply both sudden and long-term shifts in the respective habitability of places for its constituent populations, and will continue to pose challenges, especially to resource-dependent societies in rural areas. Places as local manifestations of environmental change will be particularly affected with regard to potential impacts, rendering a more thorough analysis of interconnected human-nature systems in particular places – and in their connection with other locales – an urgent necessity. Studies circling around notions of habitability are emerging as a promising field of research in that regard, especially when based on a foundation of socio-ecological systems theories. The renewed tailwind for human-centered approaches to socio-ecological systems research also brings the role of socio-cultural dimensions as fundamental determinants of well-being in socio-ecological systems to the fore with increasing vigor and emphasizes the need to incorporate the role of human migration as a dynamic social mechanism as well. This study provides an empirical starting point for extending existing theoretical foundations by providing much needed empirical evidence. The research is based on six weeks of fieldwork in a rural community in Northern Ghana and attempts to uncover the reciprocal interrelation of socio-cultural dimensions and human migration in an area where the perceived habitability is increasingly affected by negative environmental changes. We utilize a process-based and human-centered theoretical framework of habitability, which is informed by a socio-ecological systems perspective, and thereby especially intend to foreground the culturally-informed well-being component of the concept. Results show that socio-cultural dimensions are highly relevant for the perceived configuration of local habitability and interact with migration in intricate ways. On the one hand, this research underlines the seminal role of socio-cultural dimensions for diversely shaping migratory trajectories, whilst also emphasizing that migration conversely impacts locally perceived habitability and underlying socio-cultural configurations on the other hand. Such locally-informed results are crucial for the implementation of well-tailored approaches aimed at increasing resilience and undergird the respective level of acceptance and support for measures that will likely fail without an appropriate cultural background check.

Migration and the Paris Agreement on Climate Change: A Right to Livability Going Beyond Loss and Damage

- Helene Benveniste, Postdoctoral Environmental Fellow, Harvard University (presenting)
- Simona Capisani, Durham University

Climate-related mobilities, that is the range of consequences that climate change has and will have on human mobility, is a complex and heterogeneous phenomenon. Depending on the context, climate change can either induce more movement – more likely within than across borders – or more immobility, with varying degrees of agency in the mobility outcome. Yet, despite this heterogeneity, in the current international policy landscape relevant for climate mobilities, key institutions predominantly focus on cross-border movement. The global climate change regime under the 2015 Paris Agreement is somewhat more expansive in its consideration of the challenges climate-related mobilities pose. Yet its focus remains narrow: first, it regards displacement as the central problem requiring address; second, it consigns climate mobilities to the Warsaw international mechanism for Loss & Damage. Consequently, the current institutional setup is both normatively and practically limited in its capacity to address the whole range of mobility outcomes resulting from climate change.

In this paper, we propose a novel normative framework for addressing climate mobilities, grounded in a right to a livable space. We argue that this framework addresses the heterogeneity of mobility outcomes and provides justificatory grounds for utilizing the Paris Agreement on climate change as a key governance framework. We show that it is advantageous in its capacity to allow for broader protection claims than competing normative paradigms, and that it circumnavigates issues of causality and responsibility introduced by these paradigms.

Crucially, we then discuss ways to implement a livability right in the Paris Agreement. In doing so, we critically examine the normative scope of Loss & Damage (L&D) and its newly prominent place in the climate regime. We highlight how the practical considerations posed by climate-related mobilities can clarify distinct normative interpretations of L&D. Given the recent momentum harbored by L&D at last year's Conference of Parties, our framework provides a timely foundation on which to base institutional set up of climate mobilities in the Paris Agreement that goes beyond where it currently stands.

Representing Retreat: How maps shape expert conceptions of habitability in regional climate change adaptation planning in Vietnam's Mekong Delta

- Lizzie Yarina, PhD Candidate, Massachusetts Institute of Technology

Vietnam's Mekong delta, as one of the world's flattest and lowest-lying geographies, is increasingly framed as a region facing imminent inundation by way of sea level rise. At the same time, converging local factors including sand mining, groundwater extraction, and infrastructure failures are leading to waterlogging and subsidence. Current efforts to adapt to environmental crisis in the region, domestic and international planners leverage maps to both visualize these problems and converge around possible solutions. Focusing on the Mekong Delta Integrated Regional Plan (MDIRP) approved in 2022 and authored by a Dutch consulting team, I consider how different representations conceptualize tradeoffs across space in time. In particular, how do maps shape expert conceptions of which zones are fit for habitation, and which should be relinquished to rising seas? And how do these diverge from the experiences of delta residents, the majority of whom make their livelihoods from less than one hectare of agricultural land?

Based on ongoing dissertation research, this paper presentation draws on one year of spatial-ethnographic research in Vietnam including expert interviews, resident interviews, document analysis, and field visits.

Speakers

Simon Merschroth
simon.merschroth@univie.ac.at

Ariadna Anisimov
Research Fellow - postdoctoral
University of Antwerp, Institute of Development Policy

Jan Niklas Janoth
Student
University of Vienna

Helene Benveniste
Environmental Fellow
Harvard University

Elizabeth Yarina
PhD Candidate
MIT

12:15 PM

11) Book Reading: Charleston: Race, Water, and the Coming Storm

12:15 PM - 1:15 PM, Jun 22

Auditorium

Speaker

Susan Crawford
Professor
Harvard Law School

1:30 PM

12A) Governance, Policy and Planning

1:30 PM - 3:00 PM, Jun 22

Broadway Room

Consideration of Managed Retreat in Queensland Coastal Hazard Adaptation Strategies

- Aysin Dedekorkut-Howes, Senior Lecturer of Urban and Environmental Planning at the Griffith School of Engineering and Built Environment (presenting)
- Caitlyn Christie, Griffith University
- Kate McGuire, Griffith University

One of the most effective ways of addressing coastal hazards is avoiding development in high-risk areas. As challenging as this is to implement, moving settlements in already developed vulnerable areas presents an even bigger problem. Globally, managed retreat initiatives have so far been limited to very small-scale settlements or infrastructure due to the political, legal, financial, social, technical, and regulatory complexities.

In Australia Queensland is one of the most vulnerable states to the coastal climate change impacts and has the highest number of residential and light industrial buildings and the greatest value of existing road infrastructure at risk from a sea level rise. More than 80 percent of Queenslanders live on the coast. In 2016 Queensland state government launched the QCoast2100 program which funds Queensland coastal local governments to prepare Coastal Hazard Adaptation Strategies (CHAS). Of the 31 coastal local governments participating in the first phase of the program 21 of them released a draft or final strategy to date and the remainder are in the final stages of the process. This presentation examines the consideration of managed retreat in the CHAS documents through a qualitative case study of the QCoast2100 program. The project involves a content analysis of the draft or final CHAS documents as well as in-depth semi-structured interviews with those who were involved in the preparation and implementation of CHAS documents. Interviewees include local government officers, consultants, program managers, and expert panel members who reviewed the completed strategies. The semi-structured interviews aim to understand the process through which these plans were produced, areas that can be improved as well as what is needed for their implementation. Interview questions focus on how sufficient these strategies are for adapting to coastal hazards, barriers to preparing and implementing adaptation plans, and what can be done to overcome them. Interviews specifically sought to understand public engagement processes and management of controversial topics such as retreat within local governments as well as with the public.

Preliminary findings indicate that the term retreat is treated as controversial and in general avoided where possible. Transitioning and repurposing are popular substitutes. This change in some cases originates from elected local government officials, in others from local government staff or consultants who managed the public engagement process. In general, the strategies do not view retreat as an urgent issue, but as something that needs to be considered in a couple of decades time. Local governments are unwilling to commit to options they cannot fund and that may prove to be unpopular with their electorates. In

this regard, adaptation pathways approach provides local governments a way to broadly consider retreat without making any firm commitments. The couple of decades in between is expected to be useful for the local area residents to get used to the idea of transitioning. However, current plans and discussions do not provide a roadmap of how retreat can happen and be financed. The lack of even small scale pilot studies will make it difficult to implement when those decisions can finally be made.

Adaptation Capacity Reflects and Reinforces Intermunicipal Inequality

• Jon Nelson, Assistant Professor in Residence, Rhode Island School of Design

One of the hallmarks of increasing inequality in recent decades is the concentration of wealth and opportunity in smaller geographic regions. Sometimes referred to as “super-ZIPs”, these enclaves of the affluent and educated boast sizable municipal budgets buoyed by their residents’ property values. While much has been written about the concentration of opportunity, less work has considered how this trend has also created inequality in local government capacity. All municipalities have day-to-day responsibilities that they must meet but preparing for sea-level rise is not among them. In “super-ZIPs”, municipalities can invest in planning staff and well-educated residents serve on volunteer climate adaptation committees. But in most ordinary ZIPs, this investment is a luxury that they can’t afford and might even be met with hostility by more conservative members of the community. In this study, I examine how wealthy communities leverage their town budgets to outcompete poorer communities for a range of federal grants that are then often used to preserve property values rather than invest in managed retreat. This uneven playing field means that even the most qualified planners and managers in less-advantaged communities can only accomplish a fraction of what their wealthier peers attain with relative ease. The result is a growing divide in vulnerability to sea-level rise, and as a result those who are most vulnerable will have the least means to recover, or retreat, when, not if, higher sea levels destroy, devalue, or render uninhabitable their property. This growing gap can only be filled with an unprecedented burst of spending, regulation, and public works projects while such investments are declining in political palatability. The result is that wealthier communities develop a false sense of security while poorer communities suffer attrition as those who can afford to retreat do so, and those who cannot await the inevitable.

44 Feet: Vulnerabilities, opportunities, and strategies for managing risk from sea-level rise to Humboldt Bay’s spent nuclear fuel site

• Alexander Brown, Graduate Research Assistant and Master’s Candidate, Cal Poly Humboldt

• Jennifer Marlow, Assistant Professor of Environmental Law, Cal Poly Humboldt; founder of the 44 Feet Project

Climate change is forcing residents of Humboldt Bay, California, to question the current assumption that spent nuclear fuel will be stored in perpetuity on a bluff above the Bay, in a seismically prone region where sea levels are rising relatively faster than anywhere else on the West Coast. This paper reviews the recommendations from a series of Focus Group workshops convened with Tribes, elected officials, scientists, agency representatives, and residents from the general public to evaluate future pathways for responsibly managing the spent nuclear fuel site on Humboldt Bay—one of the most at-risk coastal nuclear storage sites in the United States in light of climate change.

The Focus Group issued six action-oriented recommendations that would make planning and policy decisions more resilient to the changing states of Humboldt’s coastline, and avoid the “policy shock” of inertia and regret.

The workshops were unique, in that they provided space for recognition and inclusion of both expert-driven and non-scientific knowledge, while integrating transdisciplinary collaborative learning around the complex biogeophysical, regulatory, political, economic, and social contexts that shape decision making around risk in the climate era.
Although spent nuclear fuel (“SNF”) has been safely stored onsite at operational or decommissioned nuclear reactors for decades, design changes for storage facilities such as Humboldt’s may be needed to safely store the SNF in light of changing climatic conditions. Updated modeling of natural hazard risks must also be accounted for in future decision-making.

Nestled on the eastern shoreline of California’s second largest estuary, the Humboldt Bay Independent Spent Fuel Storage Installation (“ISFSI”) shields 37 tons of SNF from the biosphere in a below grade concrete vault. The structure sits 115 feet away from the shore atop Buhne Point, a bluff 44 feet above mean sea level. Pacific Gas and Electric (“PG&E”), the ISFSI licensee, will continue to store the SNF on site until the U.S. Department of Energy retrieves and stores the waste in an interim or permanent repository. The Nuclear Regulatory Commission regulates all legal and technical aspects of the ISFSI, with limited regulatory authority afforded to local and state bodies. In addition to coastal hazards, including shoreline retreat, bluff erosion, and sea level rise, the ISFSI site is built on top of several active earthquake faults.

Major challenges abound for managing SNF in the long-term, including technical complexity that makes risk communication difficult, engineering lifetimes that must keep pace with multi-centurial radioactive timescales, divergent goals and values, social and political uncertainty, and uncertainty in management timelines. The concept of ‘long-term’ is fitting in this context, but just how to define it is challenging. For instance, PG&E’s ISFSI license expires in 2065 yet their provisional management role is assumed to cease in 2032 upon federal waste retrieval. Additionally, regional transportation planning for Highway 101 and King Salmon Avenue will eventually have to address 2 meters of sea level rise expected by 2076. Lastly, based on the absence of a federally licensed consolidated SNF storage site, the California Coastal Commission has permitted the ISFSI at the Buhne Point location under the assumption that it will remain on-site in “perpetuity.” Climate change adds an additional element of vulnerability and is a threat multiplier to contemporary management standards. These combined factors suggest a new framework is needed to accommodate long-term future change expected at the Humboldt Bay site.

To develop this framework, we interviewed 24 individuals with experience on the issues of Humboldt Bay ecological and community resilience, sea level rise, and spent nuclear fuel, in order to curate a thoughtful, forward-thinking conversation about community attitudes and perceptions regarding risk, efficacy, and responsibility for the site’s future on Humboldt Bay. We employed scenario planning methods to structure a series of Focus Group Workshops in which participants explored multiple plausible futures, envisioned desirable futures, and identified futures to avoid. Scenario planning allowed participants to embrace rather than forego the deep uncertainties characterizing the issue of long-term SNF management while deliberating about a manifold of possible outcomes (including worst-case scenarios), advancing current and future knowledge, and recommending ways to strategically direct public resources to prepare for the unknown.

During the Focus Group sessions, participants (1) shared background and perceptions of present and future risks of a radiation release to the local atmosphere, land, and seawater from the ISFSI; (2) discussed potential climatic impacts on the long-term safety and integrity of the site, including assessing the impacts of sea level rise on the bluff where the ISFSI is located; (3) examined how the need for responsible spent nuclear fuel management factors into the larger sociocultural, political, economic,

and environmental contexts of Humboldt Bay, including the relationships between participants and the decision-making structures within which future decisions will need to be made; (4) confronted barriers to meaningful participation, particularly from groups excluded or overlooked in the current community engagement efforts led by PG&E; and (5) pioneered innovative, adaptive, forward-thinking, and community-centered proposals of short-term options that could support responsible long-term management of spent nuclear fuel on Humboldt Bay, prioritizing those aligned with stakeholder values and interests.

Scenario frameworks enabled participants to apprehend uncertainty, situate the problem within scientific and nonscientific perspectives, and advance values-informed decision-making. It proved a relevant tool for reimagining the coastal resilience of the Humboldt Bay ISFSI and other critical coastal infrastructure. Outcomes informed community-engaged recommendations for the responsible long-term storage of Humboldt Bay's SNF that "hope for the best but prepare for the worst."

Additionally, adaptation pathways planning influenced our approach to scenario planning. Three variations of pathways maps emerged from the Focus Group sessions. These pathways identified measures that can be exploited today, and measures that could be implemented in the future if specific scenario conditions were to manifest. This approach allowed us to sequence future actions alongside their corresponding threshold conditions, triggers and signposts, lead and lag times, interventions and contingencies, and path dependencies (lock-ins). The three emergent pathways separated inadequate actions from adequate ones, while highlighting those that appear most effective or feasible under certain scenarios. These pathways create an initial guide that decision makers and the public can reference to enhance future engagement and decision-making proceedings. Our outputs also identified data gaps; we need to know what we do not yet know, and claim what we do know. Second, workshop outputs identified areas where collaborative information or resource sharing is needed to assist in making critical threshold decisions, including whether the spent nuclear fuel should be protected in place or relocated away from sea level rise and coastal hazards, and further highlighted achievable milestones and desired criteria to aid in decision-making.

Finally, this paper identified challenges inherent to community participation in a decision-making climate characterized by long time horizons, federal preemption, scientific uncertainty, and protracted political nihilism. Recommendations not only identified future research gaps, but identified opportunities for collaboration, knowledge and resource sharing, and regulatory and policy developments aligned with broader regional goals to equitably and justly build climate and policy resilience in the Humboldt Bay region. Recommendations fell into six main areas: 1) Collaborative Partnerships; 2) Joint Fact Finding; 3) Management, Mitigation, and Monitoring; 4) PG&E and Industry-specific recommendations; 5) Consideration of Beyond-Design-Basis (or "Nightmare") accident scenarios; and 6) Public Engagement.

Practitioner Perspectives on Climate Mobility in South Florida

• Katharine Mach, Professor, University of Miami (presenting)

• Jennifer Niemann, Research Analyst at the University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science

• Rosalind Donald, Assistant Professor, American University

• Nadia Seeteram, Postdoctoral Research Scientist, Lamont-Doherty Earth Observatory, Columbia Climate School

• A.R. Siders, Director, Climate Change Science & Policy Hub, University of Delaware

• Xavier I. Cortada, Artist and Professor of Practice, University of Miami

• Alex Nyburg, Department of Biology, University of Miami

• Jessica Owley, Professor of Law, University of Miami

• Adam Roberti, Executive Director, Xavier Cortada Foundation

• Ian A. Wright, Department of Economics, University of Miami

In coastal urban areas with immense exposure to sea level rise and other climate-related stressors, moving away from hazardous areas may be an important adaptive response in the near or long term under intensifying climate change. Such movements pose equity concerns, however, and retreat especially has been considered a last resort by both residents and practitioners, potentially limiting the overall effectiveness of adaptation. Here, we assess perceptions, barriers, and opportunities associated with climate mobility in South Florida, a region actively preparing for severe and increasing climate-related risks. Based on 77 hour-long interviews with adaptation practitioners central to climate responses in the region, we evaluate perceptions of (1) adaptation goals in South Florida, (2) the potential role of climate mobility, including retreat, in adaptation pathways supporting those goals, and (3) constraints and enablers for both near-term and long-term resilience. Interviewees, hailing from local to federal government, the private sector, nonprofit organizations, and academia, define climate mobility as migration, gentrification, or permanent retreat where climate-related extremes or changes play some role. In the future, interviewees anticipate increasing scales of climate mobility in South Florida but say long-term transition plans are inadequate. Although interviewees perceive climate mobility as often effective in climate-related risk reduction with other potential socioeconomic and environmental benefits, they are concerned that such movements will create distributional inequities and financial and sociocultural disruptions. They view lived experiences, technical evidence, professional networks, and implementation support as key enablers for long-term, proactive, pre-disaster planning for climate mobility, even though the inherent controversy and political, financial, and social justice implications of such responses substantially limit discussions at present. As revealed across the interviews, discussing the difficult topic of climate mobility encourages mindful choices about the losses inherent in climate-driven transformations and the options for reducing damages through evolving pathways of adaptive climate responses.

Addressing climate-related human mobility through NDCs and NAPs: State of play, best practices, and the way forward

• Ann-Christine Link, PhD student and instructor, UNU-EHS

Climate change is altering human mobility patterns across the globe, particularly in climate-vulnerable developing countries. With increasing recognition of the complex interlinkages between climate change and human mobility, governments and subnational authorities have begun to address this nexus in planning and policy processes, including Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs). To better understand how human mobility is integrated into NDCs and NAPs, this paper analyzes the 171 NDCs submitted by Parties in the second round from 2019-2022, the 40 NAPs submitted to the UNFCCC so far, 20 semi-structured interviews with 33 stakeholders, and 16 workshops and webinars. In

particular, the paper identifies categories and examples of interventions that connect human mobility, adaptation, and loss and damage within and across these sectors. The analysis reveals that while human mobility is increasingly featured in NDCs and NAPs, it is mostly seen as a risk or a problem, and only a few NDCs and NAPs promote a balanced view of human mobility by acknowledging potential positive (e.g., migration as adaptation) and negative outcomes (e.g., failure to adapt). The majority of NDCs and NAPs does not commit to concrete actions, and those that do focus on avoiding or reducing adverse impacts and maladaptive aspects of climate-related mobility (e.g., preventing movement through resilience-building, promoting migration as adaptation, and providing protection and support for those affected). Through case studies, the paper highlights best practices from specific country NDCs and NAPs as well as interconnections between human mobility and a range of priority sectors for adaptation and loss and damage, showcasing clear opportunities for enhanced policy integration. However, as identified by stakeholders, enhanced finance, institutional capacities, and data are required to strengthen the integration of human mobility into NDCs and NAPs. There is a need to identify and better understand policy actions that can be implemented at the local, national, sectoral, and global level, as well as to assess their impact and map potential synergies.

Speakers

Aysin Dedekorkut-Howes
Senior Lecturer
Griffith University

Jon Nelson
Assistant Professor in Residence
Rhode Island School of Design

Alexander Brown
Cal Poly Humboldt

Katharine Mach
Professor
University of Miami

Ann-Christine Link
Research Assistant
UNU-EHS

Jennifer Marlow
Assistant Professor of Environmental Law; Founder of the 44 Feet Project
Cal Poly Humboldt

12B) Climate-Related Migration and the Private Sector I: How Did We Get Here?

1:30 PM - 3:00 PM, Jun 22
Room 555

Speakers

Haley Gentry
Senior Research Fellow
Tulane Institute on Water Resources Law & Policy

Patrick Marchman
Principal / Associate Director, Climate and Sustainability
KM Sustainability/InnSure

Liz Russell
Louisiana State Director
Environmental Defense Fund

Calandra Cruickshank
Founder and CEO
StateBook International

Greg Lindsay
Author and Journalist

12C) Managed Retreat in NY and NJ II

1:30 PM - 3:00 PM, Jun 22
Cinema

Developing a Buyout Program in New York City

- Tyler Taba, Senior Manager for Climate Policy, Waterfront Alliance

Council Member Tiffany Caban (District 22) is introducing a bill in the New York City Council to study the feasibility of developing a voluntary flood-zone home buyout program and fund.

The increasing threat of flooding requires a citywide voluntary buyout program. These programs have historically not prioritized individuals with higher need and lower adaptive capacity. Because buyout programs were not designed to manage relocation services, they've created perverse outcomes such as those found in the voluntary post-disaster buyouts in Staten Island, where 99% of the 323 households studied relocated to areas of higher social vulnerability, and 20% remained exposed to coastal flood hazards.

Buyout programs must transform into holistic relocation programs that help community members find safer areas to live, work, and operate, and that restore ecosystems. This includes redefining success to focus on relocation and restoration outcomes (affordable relocation in nearby safe and upland transit-connected areas, collective versus individual action, site restoration success, net increases in floodplain basin).

Waterfront Alliance supported Council Member Caban's office in the initial phase of drafting language for this bill. This panel/workshop would aim to foster a deeper dialogue about what a buyout program for New York City should look like. Waterfront Alliance would open the conversation up by outlining the existing considerations in the feasibility study, which would be followed by a collaborative conversation with members of the workshop/audience about what components might be missing and should be included in the study.

Ideally, members of the community would be in attendance and would help shape the bill and study's trajectory. Managed retreat and buyouts are highly controversial in communities that Waterfront Alliance works closely with through the Rise to Resilience coalition. The need for a buyout program is clear and bringing the community together to better understand this process is a critical component of ensuring the success of any such program.

Managed Retreat and Relocation: Evaluating the Relocation of Homeowners in the New York Rising Buyout and Acquisition Programs

- Peter Mattingly, Research Program Manager, NYS Office of Resilient Homes and Communities (ORHC) (Presenting)
- Alex Pennington, Director of Research and Strategic Analysis, NYS Office of Resilient Homes and Communities

While a growing body of research and practice has demonstrated the usefulness and importance of buyouts and acquisitions programs as part of resiliency and climate adaptation strategies, one underexamined aspect of these programs is the resulting patterns of relocation experienced by applicants. As buyout and acquisition programs are increasingly incorporated into disaster recovery and broader climate adaptation toolkits, it is also important to understand the relocation outcomes of the people selling their homes and moving. The New York State Office of Resilient Homes and Communities (ORHC) facilitated the New York Rising Buyout and Acquisition Programs were allocated $656 million from the State's CDBG-DR funding following Superstorm Sandy. From a rigorous matching process through Lexis Nexis, we identified the relocation address of applicants in these programs to evaluate whether applicants increased or decreased their flood risk and what factors influenced an applicant's change in their flood risk status, as well as how their relocation address compares with their original address before Sandy. Overall, the results of this research demonstrate that the vast majority of matched applicants relocated within New York State and decreased their flood risk, with only 8% relocating to an area with the same flood risk, and just 0.3% matched applicants moving to an area with a worse flood risk profile. From this research, we evaluate the issues that many agencies and applicants alike face in the relocation process and what issues can be addressed or resolved to promote and equitable response.

Shaping the landscape of risk: federal transfers for floodplain interventions

- Laura Geronimo, PhD Candidate, Rutgers University Bloustein School of Planning and Public Policy

How flood risk is conceived in the United States is embedded in political and moral economies that prioritize property rights (R. Elliott, 2021). The way we have negotiated the terms of flood risk and risk mitigation enable building and rebuilding in the floodplain, despite repetitive loss and damages (Kousky, 2018). If we understand flood risk, broadly, as the interaction between humans and the natural environment, then the land use and development choices people make are critical to determining flood risk (Burby & French, 1980). Land use decisions are primarily made at the local level but are impacted by intergovernmental transfers. In the context of climate change and disaster management, funds from federal agencies like FEMA and the USACE impact land use decisions through various programs like flood insurance and mitigation projects. However, the goals of federal mitigation projects sometimes come into conflict with homeowners' desires to be near water, and local officials' incentives to preserve their tax base. New Jersey is an interesting case study to observe these dynamics, given the high amenity value of the coast, strong municipal home rule, and programs at the state level to plan for climate impacts. We use a mixed methods approach to understand how federal transfers impact land use decisions in New Jersey's floodplain communities. Leveraging government databases, we map intergovernmental transfers for property interventions like buyouts and elevations. Through interviews with property owners, local, state, and federal officials, we explore diverse perspectives on how federal flows are impacting local land use, flood risk, social equity outcomes, and municipal finances. Preliminary findings identify negative externalities of programs that prop up risky property markets, conflicts and barriers to equitable buyout implementation, and leverage points to improve the social outcomes of intergovernmental transfers.

Climate Adaptation Strategies for Cooperative Housing

- Josh Rotbert, Research Assistant, Cornell University (presenting)
- Deborah Carlin, Assistant Researcher, Cornell University
- Julia Spande, Research Assistant, Cornell University
- Linda Shi, Assistant Professor, Cornell University
- Kate Boicourt, Director of NY-NJ Coasts and Watersheds, Environmental Defense Fund

Cooperative housing is one of the most common forms of housing in the New York City area and can be instrumental in preserving affordable housing. Almost a thousand low-income co-ops are located in New York City's floodplain, yet coops are excluded from many forms of flood risk mitigation funding and disaster aid, such as those provided by FEMA. These buildings are disproportionately vulnerable to flooding impacts because many are older, ineligible for flood insurance, have residents over 65 on fixed income, lack the reserves to make investments, and cannot afford to lose basement or first floor units.

Research, policies, and funding have focused on public and single family housing, neglecting this prevalent form of multi-family housing. We respond to this gap through a research project that draws on spatial GIS mapping of flood risk exposure, a survey of cooperatives in the floodplain, interviews with building managers, and policy analysis. This presentation will share emerging findings on the impact of previous major flood events on the finances, the physical impacts of floods to buildings and their operations, and the ability of cooperative housing boards to navigate their responses. We conclude with a review of gaps in cooperative housing's access to resources and what lessons can be learned to inform changes to flood relief, flood risk mitigation policies, and broader adaptation programs. We propose a suite of policy and funding changes as well as green and gray infrastructure strategies to better help cooperative housing adapt to climate change.

A multi-hazard climate displacement compounding index for NYC

- Marco Tedesco, Lamont Research Professor, Columbia University

Displacement is one of the most urgent issues of cities nowadays, historically driven by aspects related to, for example, socio-economic, racial, social and infrastructure. In this regard, New York City is facing similar issues to large, expanding metropolises, specifically tensions arising from financial and economic pressure, on the one hand, and the increasing number of people that are moving within, to and from the five boroughs, on the other hand. We specifically refer to displacement in this work following the definition of the New York City Mayor's Office as the "the involuntary movement of an individual or family from their home or neighborhood, whether as the result of eviction, unaffordable housing costs, or poor-quality housing." To start addressing this issue, the NYC Mayor's office has recently released a Displacement Mapping tool, which allows to quantify and map displacement risk over the city, leveraging on the large datasets available throughout the city and from the most recent census.

However, one aspect that is currently missing from the tool is an understanding of the ways in which displacement and climate-related hazards intersect. The combined, compounding effects of displacement and climate hazards have the potential to further increase the exposure of socially vulnerable populations, amplifying and catalyzing the effects of the two aspects (displacement and climate change) when considered separately.
Here, we report the results of the development of a multi-hazard climate and displacement compounding index for New York City developed within the framework of the New York City Panel on Climate Change's Equity Working Group. The index combines the risks associated with either climate change or displacement into an integrated index, and associated variables used to generate it, that allow the identification of those areas at high risk from both displacement and climate change. The index thus offers a tool to identify those areas where prompt interventions should occur in terms of mitigation and adaptation. The current version of the index includes five hazards (coastal flooding, riverine flooding, heatwaves, winter weather and hurricanes). Climate data and relative risks for the ranking of the index is obtained from the recently released FEMA National Risk Index. In the presentation, we report the procedures and tools used to obtain the index, its mapping and an analysis of how population and other socio-economic, racial and ethnic data have changed over areas identified at high risk.

Speakers

Tyler Taba
Senior Manager for Climate Policy
Waterfront Alliance

Peter Mattingly
Research Program Manager
NYS Office of Resilient Homes and Communities (ORHC)

Laura Geronimo
Rutgers University - Bloustein School of Planning and Public Policy

Josh Rotbert
Researcher
Cornell University

Marco Tedesco
Lamont Research Professor
Columbia University

12D) What does the habitability concept contribute to thinking on managed retreat?

1:30 PM - 3:00 PM, Jun 22

Satow Room

The United Nations Conference on the Human Environment held in Stockholm in 1972 marked a turning point in global concern about the environment. In the same year, Limits to Growth was released by the Club of Rome, projecting overshoot of global carrying capacity by the end of the 21st century in two of its three scenarios. Fifty years later, the climate crisis, rapid species loss and land cover change, and renewed anxieties about disease and nuclear warfare have revived concerns about global environmental insecurity and given them a renewed urgency. Recent scientific literature suggests that we have entered a period in history characterized by systemic, global and existential risks that threaten the future of the planet. Even if concerns over global existential risks are considered by some to be exaggerated, there remains concern over the sustainability of production systems, climate impacts, and other pressures on the environment in given localities, raising concerns over local habitability. Given past critiques of concepts like carrying capacity and concerns over environmental determinism, are there new approaches that acknowledge human agency and the potential for locally and globally creative solutions while recognizing that we live in a world of finite resources with limited ability to absorb the vast amounts of pollutants generated by modern consumer society. This panel, building on a Population-Environment Research Network (PERN) cyberseminar organized with the HABITABLE project, will engage in a discussion on the relevance of the concept of habitability, its use in the context managed retreat/realignment, and its theoretical and practical implications.

Session Chair: Alex de Sherbinin, Senior Research Scientist and Deputy Director, CIESIN, Columbia Climate School

Conceptualising habitability in a connected, unequal and changing world

- Harald Sterly, Senior Scientist University of Vienna

The contribution identifies three themes that need to be considered in order to make habitability a fruitful and operationalizable concept, from the perspetive of climate resilient development in an equitable and just way: A) the habitability of a place habitability must be seen as socially differentiated; members of a community conceive the habitability of a given place as different, depending on their positioning along intersecting axes of privilege and marginalization, unequal access to resources, and vulnerability. Thus, habitability is conditioned by structural factors from micro to meso level, but plays out very differently on the micro level. B) the habitability of a place cannot be seen in isolation from other, proximate and distal places and processes; it is constituted also through their connectivities to other places across space and scales. C) a focus on the (geophysical) hazard side is not sufficient to fully understand habitability; it is important to look also at the (often social) processes, drivers and root causes that result in changes. Integrating these three aspects with Horton et al.'s (2021) conceptualization, habitability needs to be seen as intersectionally differentiated, and as a product of the wider political ecology and political economy that binds place and people in larger scale economic, political and ecological structures, processes and flows of resources, finances, knowledge and people.

Habitability

- David Wrathall, Associate Professor, University of Oregon

I will present a formal model for assessing habitability that squarely deals with justice in two ways: 1) it assumes differential vulnerability as a starting point, and 2) requires an understanding of the constraints on governance, including power relations and historical political economies.

How to combine top-down habitability modeling with bottom-up social science research

• Alex de Sherbinin, Senior Research Scientist and Deputy Director, CIESIN, Columbia Climate School

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Speakers

Harald Sterly
Senior Scientist
University of Vienna

David Wrathall
Associate Professor
Oregon State University

Alex de Sherbinin
Deputy Director
CIESIN, Columbia Climate School

3:30 PM

13A) Managed Retreat in Hawaii

3:30 PM - 5:00 PM, Jun 22
Broadway Room

Managed Retreat in Hawaii's Statewide Sea Level Rise Exposure Area: Planning and Policy Progress and Challenges

- Bradley Romine, Coastal Management and Resilience Specialist, University of Hawaii Sea Grant College Program, Pacific Islands Climate Adaptation Science Center (presenting)
- Charles (Chip) Fletcher, Interim Dean, Director of the Climate Resilience Collaborative, School of Ocean and Earth Science and Technology, University of Hawai'i at Mānoa
- Colin Lee, Esq., Climate Change and Resiliency Policy Analyst, University of Hawai'i Climate Resilience Collaborative
- Juliette Budge, Operations Project Manager, Climate Resilience Collaborative, School of Ocean and Earth Science and Technology University of Hawai'i at Mānoa
- Amy Wirts, Coastal Lands Program Coordinator, University of Hawaii Sea Grant College Program
- Leah Laramee, Hawai'i Climate Change Mitigation & Adaptation Coordinator, State of Hawaii Department of Land and Natural Resources

Chronic and event-based coastal flooding and erosion are already widespread problems across the Hawaiian islands, including highly-publicized damage to coastal homes, hotels, coastal highways, and beach environments. Over the past few decades in Hawai'i, coastal property owners have erected seawalls and other hardening structures that exacerbate erosion, houses have fallen onto beaches or have been destroyed by large waves, and property owners have exploited local government's limited capacity for law enforcement by openly violating conservation laws. These instances have endangered beach users and marine animals, polluted nearshore waters, diminished public access and availability for enjoyment, and contributed to miles of lost beach across the state.

A unique collaboration between the State of Hawai'i and the University of Hawai'i through the Hawai'i Sea Grant Program and the Climate Resilience Collaborative (CRC) (formerly the Coastal Geology Group) produced a statewide Sea Level Rise Vulnerability and Adaptation Report and Sea Level Rise Viewer online mapping tool (hawaiisealevelriseviewer.com) that contains precisely mapped projections of passive (high tide) flooding, annual high wave flooding, and coastal erosion statewide at various intervals of sea level rise. Using this data and methodology from CRC, a combined Sea Level Rise Exposure Area (SLR-XA) was mapped statewide and made available in the online mapping tool. The SLR-XA map data provides a scientific basis for governmental and community actions to prepare Hawai'i for sea level rise.The SLR-XA map data provides a scientific basis for governmental and community actions to prepare Hawai'i for sea level rise. The methodologies for this research were subsequently peer-reviewed and published in Nature journal Scientific Reports (Anderson, et al. 2018).

Options for adapting to sea level rise impacts, including managed retreat of public infrastructure and private development from hazard areas, are being widely discussed with particular consideration of Hawai'i's island setting. This research has given state and local governments in Hawai'i an opportunity to utilize cutting-edge, peer-reviewed science in planning and policy approaches to facilitate managed retreat. Recent policy and planning successes at the state and county levels related to managed retreat in Hawai'i include increasing shorefront building setbacks, expanding authorities to transfer development rights outside of the SLR-XA, sea level rise hazards considerations in building permits and environmental assessments, requiring disclosure of sea level rise risk in private real estate transactions, considering sea level rise in long range and community development plans, executive directives requiring agencies to consider sea level rise in the decision making process, and establishing managed retreat funds.

This presentation will discuss notable incorporations of sea level rise science into state and local policy and planning, legislative challenges of approving these measures, and the projected impacts that these laws will have to facilitate managed retreat in Hawai'i. These and other policy and planning efforts are described in detail in a 2022 update to the Hawai'i Sea Level Rise Vulnerability and Adaptation Report available at: https://climate.hawaii.gov/hi-adaptation/state-sea-level-rise-resources/

Costs and Tradeoffs of Coastal Retreat in Response to Sea Level Rise: A Case Study of the North Shore of O'ahu, Hawai'i

- Kammie Tavares, Research Assistant, University of Hawai'i at Mānoa Institute for Sustainability and Resilience (presenting)
- Makena Coffman, Professor of Urban and Regional Planning, Director for the University of Hawai'i at Mānoa Institute for Sustainability and Resilience
- Rachael Han, Climate Impacts Research Specialist. University of Hawai'i at Mānoa Institute for Sustainability and Resilience
- Conrad Newfield, Research Assistant, University of Hawai'i at Mānoa Institute for Sustainability and Resilience
- Alice Terry, Research Assistant, University of Hawai'i at Mānoa Institute for Sustainability and Resilience
- Renee Setter, Research Assistant, University of Hawai'i at Mānoa Institute for Sustainability and Resilience
- Nori Tarui, Professor, Economics, Research Fellow, University of Hawai'i Economic Research

The consequences of human-induced climate change will force coastal communities to adapt at an unprecedented rate (Bindoff et al., 2007). Approximately one billion people residing near the coast globally are projected to be impacted by sea level rise (SLR) by 2100, with assets valued at US$8-14 trillion ($2011) (Pörtner et al., 2022). Unless the adaptive capacity of vulnerable and affected populations is addressed, coastal communities and environments will be severely and negatively impacted. The viability, longevity, and socio-ecological impacts of SLR response measures vary widely. Despite the urgent need for action, careful SLR response is necessary to avoid maladaptive outcomes, which tend to support actions that prioritize short-term benefits over long-term gains (California Coastal Commission, 2015; Pörtner et al., 2022). For example, the hardening of coastal areas with eroding sandy beach fronts can exacerbate coastal erosion, resulting in loss of the sandy beach, and perpetuate increasing risk to the public (California Coastal Commission, 2015; Hawai'i Climate Change Mitigation and Adaptation Commission, 2021; Pörtner et al., 2022).

Many coastal managers have stated the importance of maintaining the wide array of uses and values of Hawai'i's beaches in the face of SLR, though there is little consensus on how this can be achieved (Bremer et al., 2022). To contribute to an understanding of SLR response for Hawai'i and other beach communities with retreat-oriented policies, this study identifies the costs of coastal retreat using a case study of Sunset Beach on the North Shore of O'ahu. We select this area because it is a world-famous beach that is experiencing chronic erosion exacerbated by SLR and seasonal wave events are threatening homes (Cocke, 2022). We identify the types of costs related to three approaches to retreat, i.e. retreat of existing infrastructure and dwellings that are implemented proactively, just-in-time, or reactively (Griggs & Reguero, 2021). The quantitative costs we assess are property acquisition (through voluntary buyouts or eminent domain); structure removal and remediation (both private structures and public infrastructure); loss of property tax revenues; and private property loss. Because we only consider retreat strategies, differences in environmental costs between retreat scenarios are relatively small (in comparison to in situ adaptation). We assess how costs accrue through the year 2100, including how costs are borne to either private or public actors. We categorize dwellings and infrastructure into the three types of retreat over the 80 year time horizon using Hawai'i-specific SLR maps that unpack passive flooding, coastal erosion, and high wave run-up. There are additional social costs related to relocation (Mach & Siders, 2021), public safety and environmental pollutant costs related to falling structures, as well as litigation and enforcement costs that are considered qualitatively, but are outside the scope of our quantitative analysis.

Proactive Community Collaboration to Address Coastal Erosion Hazards and Increase Resiliency on the North Shore of O'ahu

- Lauren Blickley, Hawaii Regional Manager, Surfrider Foundation (presenting)
- Dolan Eversole, Coastal Management Specialist, University of Hawai'i Sea Grant College Program
- Bradley Romine, Coastal Resilience Extension Specialist, University of Hawai'i Sea Grant
- Stefanie Sekich, Sr. Manager Coasts and Climate Initiative, Surfrider Foundation

The North Shore coastline of O'ahu faces imminent threat from ongoing chronic coastal erosion, wave inundation and flooding that are worsening with climate change and sea level rise. These coastal hazards threaten public trust legacy beach areas and

billions of dollars of public infrastructure and private property. The proliferation of shoreline hardening structures in the last 30 years, and the resultant widespread beach loss, illustrate the immediate need to develop holistic, long-term solutions for the area that include community-oriented values and place-based options.

In an effort to proactively address accelerated beach loss and improve community resilience on the North Shore, and thus ensure the long term protection of the public trust beaches and dunes, the Surfrider Foundation, The University of Hawai‘i Sea Grant College Program, and SSFM International convened the North Shore Coastal Resilience Working Group (NSCRWG) for a series of discussions and assessment of response options in 2021 and 2022.

The NSCRWG is a community-driven, collaborative effort amongst diverse stakeholders to discuss and identify possible solutions for addressing increased impacts from coastal hazards within the North Shore planning district. The Working Group, selected by the conveners to represent a cross-section of community stakeholders, includes North Shore residents and landowners, state and local government staff, elected officials, coastal scientists, engineers, planners and nonprofits.

Over a series of six meetings, Working Group members identified three coastal erosion ‘hot spots’ on the North Shore, including Sunset/Kammies, Chun’s/Laniākea and Mokulē‘ia. The group also discussed coastal adaptation challenges and explored the relative merits, costs, benefits and feasibility of various solutions. NSCRWG members voiced strong interest in further exploring coastal adaptation options for the North Shore, including advancing discussions of managed retreat strategies toward actionable solutions and implementation.

With the urgency of beachfront homes presently on the brink of collapse on North Shore beaches, the most critically vulnerable ‘hot spots‘ identified by the Working Group were identified as potential demonstration sites for adaptation, including managed retreat. The priority hotspot at Sunset/Kammies, for example, represents a late-phase geographic category of adaptation options due to the advanced nature of severe and ongoing coastal erosion fronting an extremely high-value public beach. This area is a high priority for consideration of more advanced adaptation options that may include limitations on new development (avoidance), relocation and removal of willing sellers of coastal lands.

Working Group members also overwhelmingly agreed on the importance of identifying phased adaptation options, including exploring short-term solutions like sand management and dune restoration. As such, two meetings were dedicated to exploring and applying the approach of adaptation pathways to North Shore erosion hot spots at Sunset/Kammies, Chun’s/Laniākea, and Mokulē‘ia.

Building on the need for a phased adaptation approach, the Working Group applied adaptation pathways for four separate planning horizons (current, nearterm, mid-term, and long-term) for each identified hot spot. Sample strategies were discussed and evaluated, and are envisioned to be part of future coastal land use and for management planning purposes. These strategies reflect a phased approach based on the planning horizons identified. The adaptation pathways provided are a starting point. The goal is that they will be more fully developed by city agencies in coordination with the North Shore community.

As part of these discussions, the group further identified seven critical concerns and six recommendations for immediate action by relevant organizations, agencies and policy-makers. The critical concerns and recommendations were released in the working group’s 2022 final report entitled “Adaptive Coastal Management Recommendations, Actions and Strategies.”

In addition to the issues and recommendations identified, one of the NSCRWG’s key outcomes was building a group of informed and engaged citizens who were connected with technical expertise and government agencies. This project thus expanded the community’s capacity to educate others within the community and advocate for action.

The NSCRWG effort represents one of the first community-based coastal adaptation working groups in Hawai‘i. While the issues and recommendations identified are specific to the North Shore, they are relevant and timely to coastal communities statewide, serving as a starting point for similar discussions in other communities. The model of convening various community, technical, government and other perspectives to discuss and build a shared understanding and consensus about these complex issues, as well as how to address them, is one that can be replicated and built upon on the North Shore and elsewhere. The Working Group outcomes furthermore represent a starting point for more detailed evaluation and climate change adaptation planning for the North Shore that includes the evaluation of adaptation pathways, triggers for action and phasing of options at a variety of timescales.

The Public Trust Doctrine and Managed Retreat in Hawai‘i

• Colin A. Lee, Esq., Climate Change and Resiliency Policy Analyst, University of Hawai‘i Climate Resilience Collaborative

This abstract’s argument is adapted from a law review article written by this author and published by the University of Hawai‘i Law Review. Colin A. Lee, Eliminating the Hardship Variance in Honolulu's Shoreline Setback Ordinance: The City and County of Honolulu's Public Trust Duties as an Exception to Regulatory Takings Challenges, 43 U. Haw. L. Rev. 464 (2021).

Facilitating managed retreat in response to sea level rise in Hawai'i presents many challenges for the government, specifically in light of its constitutional duties under the public trust doctrine (the “PTD”) to conserve and protect natural resources. For state and local governments, one prominent challenge of managing retreat is navigating complicated real property use issues with private coastal property owners as the ocean encroaches on their land. As this paper will discuss, a longstanding and dynamic legal mechanism, the PTD, dictates the final outcome with regard to balancing governmental duties with private property rights in Hawai‘i.

Hawaii Land Acquisition Funds to Facilitate Managed Retreat

- Dolan Eversole, Coastal Management Specialist, University of Hawaii Sea Grant College Program

Climate change induced sea-level rise is having profound and wide-ranging global impacts on the environment, infrastructure, public health, and economy. Climate change projections and impacts are driving interest in regionally-tuned, sea-level rise adaptation strategies for potential application to coastal land use in Hawai‘i. It has been well-established that chronic and event-based coastal hazards including flooding and erosion are widespread and increasingly frequent problems across the Hawaiian islands, including highly publicized damage to coastal homes, hotels, coastal highways and associated infrastructure, and beach environments. As a result of widespread chronic and episodic coastal erosion in Hawai‘i, coastal property owners have erected seawalls and other hardening structures that can often exacerbate coastal erosion and beach loss. While the importance of sandy beaches in Hawaii is widely accepted by government and community groups, the specific socio-economic value of beaches and

the related natural resources is largely unknown and therefore missing in the factors considered for coastal land use decision-making. A common alternative to mitigation and hardening is to protect coastal resources through preservation and conservation efforts. One tool for conservation is to acquire properties that are in the public interest to preserve such as beaches and dunes. There is growing interest in coastal land acquisition in order to protect beach resources in Hawaii but the idea is untested, expensive and not universally accepted by all stakeholders.

Adaptation policy application and implementation concentrates on adaptation pathways and triggers for action that contribute to resilience. Coastal land use adaptation for resilience can be categorized by function and outcome. General land use adaptation categories include; mitigation, accommodation, avoidance and preservation, each of these fields with distinct sub-categories and planning strategies. Academic review and critique of institutional and governance innovations and frameworks related to resilience-building adaptation initiatives provide a rich opportunity for assessment and comparison of various adaptation strategies and community-oriented collaborative planning. Assessing the impact and influence of natural hazard and disaster considerations at multiple geographic scales, including pre and post-disaster recovery policies provides context on how to effectively integrate climate adaptation with disaster planning. Application of local and regional climate adaptation plans and pathways can be significantly improved through established and emerging community civic engagement methods and collaborative planning frameworks.

Speakers

Brad Romine
Coastal Management and Resilience Specialist
University of Hawaii Sea Grant

Kammie Tavares
Graduate researcher
University of Hawai'i

Makena Coffman
Professor/Director
University of Hawai‘i at Mānoa Institute for Sustainability and Resilience

Lauren Blickley
Hawaii Regional Manager
Surfrider Foundation

Colin Lee
Climate Change and Resiliency Policy Analyst
University of Hawai‘i Climate Resilience Collaborative

Dolan Eversole
Coastal Management Specialist
University of Hawaii Sea Grant College Program

13B) Climate-Related Migration and the Private Sector II: How Insurance, the Real Estate Industry, and Litigation Are Shaping Relocation Options (panel)

3:30 PM - 5:00 PM, Jun 22

Room 555

Speakers

Hannah Teicher
Harvard GSD

Jessica Mederson
Partner
Stafford Rosenbaum LLP

Carolyn Kousky
Associate Vice President for Economics and Policy
Environmental Defense Fund

Monika Serrano
Resilience Program Manager
Turner Construction Company

Calandra Cruickshank
Founder and CEO
StateBook International

Greg Lindsay
Author and Journalist

13C) Modeling and Visualizing Climate Mobility and Managed Retreat

3:30 PM - 5:00 PM, Jun 22

Cinema

Modeling migration out of Central America and West Africa

- Fabien Cottier, Columbia University (presenting)
- Brian Katz, Oregon State University
- Ángel Muñoz, Barcelona Supercomputing Center
- Carmen Gonzalez Romero, Barcelona Supercomputing Center
- Michael Puma, Columbia University
- Jennifer A. Nakamura, Columbia University
- Richard Seager, Columbia University
- Alex de Sherbinin, Columbia University
- David Wrathall, Oregon State University

The 2015-2019 migration crisis between West Africa and Europe and the ongoing crisis of unauthorized Central American migrants at the US southern border have been cited as emerging challenges and fundamental threats to national sovereignty and security that may intensify as climate change impacts worsen. Understanding the drivers of the flows in respective sending areas, in particular with respect to habitability, is seen as critical to policy responses. In this aim, we develop a quantitative model to reproduce observed international migration flows. Observed flows are captured through border apprehensions in monthly time steps available from the US Department of Homeland security and Europe's Frontex. These, in turn, are used to develop sensitivity analyses and counterfactuals that yield insight into migration dynamics.

The model, which projects migration for multiple timescales into the future, is built upon and verified against the history of migration over the past few decades using observed histories of potential drivers, both social and environmental. Successful models are applied to the future adopting a storyline approach. In the storyline approach, equally plausible but distinctly different futures are examined in detail.

A collection of storylines will be developed for future migration that span the space a range of factors, associated with habitability in migrant sending areas, e.g. more or less severe climate change, histories of extreme weather events, and differing social, economic and political trajectories. By using storylines, we demonstrate how future challenges to habitability and livelihoods may alter migration flows to Europe and the United States. Storylines are compelling, relative to probabilistic forecasts, in representing plausible realities in a level of detail that can enable users and planners to conceptualize social impacts, in particular with respect to habitability in migrant sending areas, and policy responses.

Livelihoods on the Move: Towards fine-scale climate mobility modelling in India

- RJ van Duijne, Postdoc, CIESIN, Columbia Climate School

This article reports on a large research project on climate-related male labour migration in India. Growing evidence shows that the agrarian existence of tens of millions of households has come under mounting pressure as more frequent drought and groundwater depletion lead to poor harvests or complete crop failure. Alternative local livelihoods outside farming are scarce, causing widespread distress among agrarian populations. Yet, despite these dire circumstances in the countryside, we do not expect large-scale permanent rural-to-urban migration of entire households. Strong social ties with the community/caste in the home village often preclude a permanent change of residency, and households remain deeply rooted in their village through family-owned lands or a shared family home. Under these circumstances, temporary and individual male labour migration serves the needs of the household best. The analysis is based on a custom-made geospatial database that includes the population sizes and agrarian workforce profiles of all 640,844 rural villages of India. This database spans 30 years of workforce data. We merged this geodatabase with an advanced hydrological model containing the exact climatic conditions in each individual

village for that same timeframe. This unique database allows for systematic spatial investigations of correlations between anomalous hydrological patterns and shifting workforces out of agriculture across India, and it does so at very fine spatial scales. We present preliminary findings on the exact hydro-meteorological conditions that can best predict movement out of farm work at the individual village-level. Our analysis controls for India's five major climatic zones, major crops, growing seasons, and the influence of irrigation.

Leveraging CHC-CMIP6 High-Resolution Climate Projections for Anticipating Future Human Mobility and Habitability Worldwide

- Cascade Tuholske, Assistant Professor, Montana State University (presenting)
- Emily Williams, UCSB
- Chris Funk, UCSB
- Pete Peterson

In the coming decades climate change portends to increase human mobility and decrease human habitability in many of the most populated places on the planet. Climate hazards such as elevated hot-dry and hot-wet extremes will impact both rural and urban health and livelihoods in regions with the least adaptive capacity. Yet current outputs from Coupled Model Intercomparison Project Phase 6 (CMIP6) are coarse-grained (~250 km) and do not map future climate conditions to heterogenous, fine-grained human settlement patterns to sufficiently anticipate climate hazards that may increase mobility and decrease habitability. For example, while there are more than 13,000 cities and towns scattered across the planet that house 4 billion people today, they only comprise 3% of the land surface area. Similarly, nearly a third of global food production comes from farms that are 2 hectares or smaller. Accordingly, the lack of precision of CMIP6 projections may inadequately anticipate climate hazards for those most vulnerable across the urban-rural continuum. This creates serious questions regarding climate justice and equity in terms of planning for future human mobility and habitability.

To overcome the spatial limitations of CMIP6 models, here we present the Climate Hazards Center Coupled Model Intercomparison Project Phase 6 climate projection dataset (CHC-CMIP6). This dataset includes global high resolution (~ 5km) grids of precipitation, temperature, and relative humidity, as well as vapor pressure deficits (VPD) and wet bulb glob temperatures (WBGT), following CHIP6 SSP245 and SSP5-85 scenarios for 2030 and 2050. CHC-CMIP6 outputs harness high-resolution and accurate temperature and precipitation observational record to down-scale CMIP6 outputs to 0.05° resolution. As such, the high-spatial-resolution of CHC-CMIP6 allows for more precise understanding of future climate conditions in both rural and urban locations worldwide that may spur human mobility and reduce habitability in the most populated places on the planet. Such information is key for anticipatory and equitable planning of human movement and adaptations in regions at most risk to future hazards under climate change.

Immersive Virtual Reality as a Communication Tool towards the Development of Floating Cities for Climate Adaptation

- Shengzhe Wang, Assistant Professor, University of Colorado Denver (presenting)
- Bing Han, Assistant Professor, University of Colorado Denver

Our warming climate poses a significant risk to coastal settlements across the globe as sea levels are expected to rise up to 2 m by the 22nd century. Given the high concentration of population centers along the world's coastlines, this would constitute a land loss of 1.79 million km2 with up to 187 million people displaced. In adaptation to this uncertain future, architects, engineers, and policy makers have proposed innovative strategies for population retreat and relocation such as the construction of very large floating structures (VLFS) capable of supporting entire urban communities. Despite exhibiting numerous environmental and economic advantages over traditional methods of land reclamation, floating cities have no historical precedent and how they would be perceived by the public remains a contentious topic. To facilitate their implementation at the community scale, it is imperative that innovative tools of communication are developed for the general public to evaluate VLFS from the perspective of comfort and habitability. For this purpose, we leverage head-mounted display (HMD)-based virtual reality (VR) to provide users with a visually immersive experience depicting life on a floating city. Beyond the recreation of realistic interior spaces within a floating building, the virtual environment will oscillate in accordance with simulated building motions excited by different sea states. The immersive VR experience will help designers and prospective occupants decide whether such vibrations will be acceptable for general habitation per their individual requirements. Ultimately, we present a widely accessible communication and education tool for the replication of complex environmental conditions to support stakeholder decision making concerning unprecedented infrastructure solutions for climate adaptation.

Speakers

Fabien Cottier
Postdoctoral Research Scientist
Columbia University

Robbin Jan van Duijne
postdoc
CIESIN, Columbia University

Cascade Tuholske
Asst. Professor
Montana State University

Shengzhe Wang
Assistant Professor
University of Colorado Denver

13D) Community Engagement in Managed Retreat

3:30 PM - 5:00 PM, Jun 22

Satow Room

The role of social capital in Natural disasters and hazards a management in the Sultanate of Oman

- Elnazir Ramadan, Associate Professor, Sultan Qaboos University (presenting)
- Suliman Zakaria, Sultan Qaboos University

Natural hazards and disasters pose a serious threat to society. Efficient hazard management plans serve as primary tools to reduce community vulnerability and enhance resilience. Tropical Cyclone Shaheen slammed into Oman on the autumn of 2021 with ferocious winds and heavy rain, flooding streets, which led to evacuations of coastal areas. While there is a growing collection of literature on the role of social capital during disasters. community solidarity and mobilization represent a corner stone in disaster mitigation and recovery, yet the role played by community organizations and structures is still not fully understood and community coping strategies are not adequately explored. The prime objective of this paper is to investigate the role of social capital in the implementation of recovery policies for areas affected by disasters. Social capital, which is typically defined as a function of trust, norms, and networks relationship plays a significant role in managing risk and crisis situation saving human lives from an adverse effect and impact of disasters. Community members and structures is thought to be a key factor in community participation actions. The study methodology primarily involved quantitative method of data collection The data collected using questionnaire survey. As natural disasters recovery processes often have limited incorporation of communal mitigation measures such as social capital into their overall planning. This study evaluates the inclusion of social capital in hazards planning efforts and to better understand stakeholders' engagement in disaster management and planning.

(Non-)Managed retreat in Fairbourne, North Wales: Naming, Blaming and Claiming

- Alex Arnall, Associate Professor, University of Reading (presenting)
- Chris Hilson, Professor, School of Law, University of Reading

Managed retreat or managed realignment is a key policy option for dealing with increasing climate risks associated with a range of physical processes including inland and coastal flooding, coastal erosion and sea level rise. This policy choice may be actively sought out by communities or it may be resisted by them. In either situation, the policy is often the source of conflict between local communities and public authorities. Law and society literature on naming, blaming and claiming provides important insights into the way in which conflicts emerge and end up in formal institutional claims being made in courts via litigation. In the current paper we apply this literature to examine claims-making in a broader sense beyond just the courts. Drawing on empirical work carried out in Fairbourne, a village in North Wales, we look at how the managed retreat decision there has been received and challenged. The idea of managed retreat has a neat apparent simplicity to it. It names or diagnostically frames the problem in Fairbourne as one of climate-induced sea-level rise and then proceeds to put forward managed retreat of the village as the obvious sole prognostic solution in place of 'holding the line' where sea defences would be maintained and strengthened into the future. The Community response has challenged the apparent inevitability of this logic. While accepting climate change as a phenomenon, villagers are not prepared to name sea level rise as an inevitable problem that will put the village at physical risk. While they thus challenge the 'retreat' aspect of managed retreat, the claims-making process also sheds light on the often under-researched 'managed' element of the term. Much of their blaming relates to the way in which they have been left without any clear managed solutions. Into this vacuum they have therefore put forward a variety of their own desired solutions or claims, some of which are clearly unrealistic. We argue that public authorities not only have a duty to involve communities in decision-making on managed retreat, but they must also provide a clear idea of precisely how that retreat will be managed. If, as seems to be the case with Fairbourne, laissez-fair is the unwritten de facto solution, what the community is left with is, in effect, a form of non-managed retreat.

Questioning "community" engagement in planned relocation

- Betsy Priem, PhD Student in Sociology, University of Chicago (presenting)
- Erica Bower, PhD candidate, Stanford University
- Rachel Harrington-Abrams, PhD Student in Geography, Kings College London

As planned relocation is increasingly considered a viable adaptation strategy for entire "communities" on the climate frontlines, principle-based guidance and guidelines for effective practice is emerging from academics and practitioners alike - especially in the context of discussions about environmental justice, climate justice, and equity. A consistent recommendation across relevant guidance is the need for "community" engagement throughout relocation decision-making, planning, and implementation. Indeed, "community" engagement is nearly universally assumed to be important.

Yet "community" is not a monolith. Who precisely is meant by "community" often remains ambiguous, as is the answer to the question of what constitutes meaningful engagement through the facilitation of an equally ambiguous external stakeholder. In this oral presentation of our forthcoming paper we will unpack how community is framed and its implications for 1) who participates, 2) who facilitates and 3) the nature of meaningful engagement.

We first explore the utility of the term "community" in planned relocation, challenges that emerge from boundaries imposed by varying spatial- network- interest- and identity-based definitions, and the problematic insinuation of consensus. Next, to delve deeper into how 'community' is utilized, we consider the role of the stakeholder facilitating engagement and their motivations, the type of support offered, and power dynamics at multiple scales. Finally, we identify obstacles to meaningful engagement, including around trust in local representatives and elite capture, sustaining engagement over time, and quality of engagement along a spectrum ranging from tokenistic information sharing to self-determination.

Throughout the presentation, we pose questions for consideration by stakeholders who are operationalizing "community engagement" strategies in policy and practice, and identify ways to cross gaps between academic theoretical discussions and frontline realities.

Adaptation by Relocation: Evaluating Public Responses to Government Buyout Programs

- Sara Constantino, Assistant Professor, Psychology, Northeastern University

As sea levels rise and extreme weather events become more frequent and severe, millions of U.S. properties are now at risk of repeat or chronic flooding. One policy response has been expansion of government programs to purchase private properties and subsidize the relocation of American families and businesses (i.e. property buyouts). These measures aim to protect communities and minimize public costs but can also be coercive. They can encroach on personal liberties, exacerbate inequities,

and fracture communities, depending on how they are designed. For example, buyouts that are offered to individuals rather than communities might leave those remaining in at-risk places even more vulnerable due to disinvestment and decreased tax revenues.

Property buyouts have been a part of federal disaster relief programs for decades but recently have attracted more attention as states and localities have initiated their own self-funded buyout programs. We have little knowledge of how the American public would respond to such programs, which give the government a direct role in private decisions about where households can and should be located. In a large-scale, nationally representative survey of Americans, we use a conjoint experiment to assess public preferences towards different features of buyout programs, including whether they are mandatory or voluntary, whether they prioritize equity or efficiency, whether they include relocation provisions, and whether they are implemented by local, state or national governments. Additionally, we assess whether prior extreme weather experience and ideological preferences, among other sources of heterogeneity, shape the conditions under which respondents accept coercive measures.

Impediments to Managed Retreat and Success of Community-based Relocation in the US

- David Casagrande, Professor, Lehigh University

The FEMA buyout program remains the primary policy tool for "managed retreat" from flood-prone areas in the US. I will present results of survey, interview, and ethnographic research conducted between 2008 and the present on impediments to relocation and the benefits of community-based relocation. Flood risk determined by hydrological models, lived experience, individual perception of risk, and socio-economic factors strongly influence attitudes about flood insurance and government buyouts of homes in the Midwest US where entire communities have relocated in response to flooding. On the Chesapeake's Eastern Shore, risk perceptions are constructed as a social process in which political ideology, religious solidarity, and water-based livelihoods interact to promote social norms and discourse that discourage relocation in response to rising sea level. Both cases highlight disconnections between public beliefs, local emergency planning, and federal policy.

Sea2City Design Challenge: Transformation, resilience, and decolonization in Vancouver's False Creek

- Angela Danyluk, Senior Environmental Specialist, City of Vancouver

The purpose of the talk is to provide an overview of the process and outcomes of a first-in-Canada coastal adaptation design challenge, the Sea2City Design Challenge (Sea2City). This collaborative and decolonized approach to coastal adaptation can serve as model for other coastal communities. Sea2City was a collaborative design challenge hosted by the City of Vancouver. The project brought together two multi-disciplinary design teams, City staff, local coastal adaptation experts, Host Nation representatives, knowledge keepers and designers from Musqueam, Squamish, and Tsleil-Waututh, and wider community members over a 12-month period to reimagine key sites along Vancouver's False Creek shoreline. The challenge produced a range of coastal adaptation concepts that could be implemented over the next 100 years and demonstrated how Vancouver could become more resilient to rising sea levels while accommodating urban development, fostering ecological revitalization, and contributing to
decolonization of the shoreline. Coastal adaptation concepts strongly favour managed retreat over a time period of 80-100 years based on building life cycle, flood risk and public values.

Speakers

Elnazir Ramadan
Associate Professor
Sultan Qaboos University

Alex Arnall
Associate Professor in Environment and Development
University of Reading

Betsy Priem
PhD Student
University of Chicago

Sara Constantino
Northeastern University

David Casagrande
Professor
Lehigh University Full-time

Angela Danyluk
Senior Environmental Specialist
City of Vancouver

Fri, Jun 23, 2023

8:30 AM

14A) Flood Displacement, Vulnerability and Adaptation

8:30 AM - 10:00 AM, Jun 23

Satow Room

Modelling human displacement in Pakistan flood 2022: An assessment of opportunities and limitations

- Pui Man Kam, PhD candidate, Weather and Climate Risks, ETH Zurich (presenting)
- Steffen Lohrey, TU Berlin
- Tabea Cache, University of Lausanne
- Bianca Biess, ETH Zurich
- Sabrina Di Vincenzo, Politecnico di Milano
- Radley M. Horton, Columbia University
- Lisa Thalheimer, United Nations University

In summer 2022, a large part of Pakistan was flooded by a record-breaking flood. This disaster is accountable for killing thousands of people and livestock, destroying houses and crop lands, and leading to the displacement of millions.

In this study, we investigate to what degree impact modelling can reflect the number of displaced persons by this flood event. We use the CLIMADA (CLIMate ADAptation), an open-source probabilistic natural catastrophe risk assessment platform to estimate the number of people being displaced or affected directly by the floods. We further investigate what could be the optimal displacement vulnerability curves that link the intensity of flood to the extent of people at risk of being displaced. Our initial analysis comprises recorded displacement data from 23 districts in the Sindh province, and 5 districts in Balochistan.

This study provides insights to the extent that current modelling approaches could estimate displacement risk, and discuss limitations to capturing the complexity of the relationship between multiple hazards, vulnerability and displacement.

Demographic exposure to extreme heat and flooding

- Andrew Zimmer, Postdoctoral Researchers, Montana State University (presenting)
- Cascade Tuholske, Assistant Professor, Department of Earth Sciences, Montana State University
- Nina Brooks, Assistant Professor, School of Public Policy, University of Connecticut
- Carolynne Hultquist, Lecturer, School of Earth and Environment, University of Canterbury, Christchurch, New Zealand

Rapid urbanization in the developing world often leads to large numbers of urban residents living in low-income urban settlements. Many of these urban residents are trapped in place due to poverty and face the highest risk from climate change and socially-induced vulnerabilities. The intersection of rapid urbanization and climate change threatens to expose millions of urban residents to extreme heat and flooding events. Both hazards can be harmful for human health and limit urban economic development, but impacts associated with extreme heat and flooding are heterogeneous across different urban demographic groups, with some age/sex groups groups being more vulnerable to these hazards than others. For example, the elderly may face increased health risks, while working-age populations may be more vulnerable to economic impacts. Despite our coupled knowledge of urban population growth, extreme heat and urban flooding, we lack an understanding of which urban populations worldwide face the greatest burden to the combined impacts of extreme heat in flooding. This analysis uses new, high-resolution data to disaggregate exposure to extreme heat and flood by age-sex group for 13,000 urban places between 2000 and 2020. We explore and highlight key regions, cities and demographic groups that are unequally exposed to climate hazards. By identifying how urban demographic patterns converge with extreme heat and flooding exposure, this research can inform policy decisions for climate adaptation, and where managed retreat is needed from these twin hazards.

Missed opportunities: Barriers to managed retreat in Sumas Prairie, BC, following the 2021 floods

- Felicia Watterodt, Master of Environmental Studies candidate, University of Waterloo (presenting)
- Brent Doberstein, Associate Professor, University of Waterloo

In 2021, British Columbia (BC), Canada experienced three major climate disasters within the span of six months, culminating in a series of atmospheric river (AR) events that affected two-thirds of the province and resulted in significant flooding and debris flows. The disaster caused a range of impacts for local residents and the provincial economy, including widespread displacement, significant financial losses and property damages, sector-wide disruptions, and isolation when BC's most economically significant and densely populated region, Vancouver/the Lower Mainland, was cut off by road and rail from the rest of the country. This province-wide state of emergency highlighted the vulnerability of BC's current flood management system to extreme weather events. Among the most costly and devastating disasters in Canadian history, the flood risks exposed by the AR event have been closely linked to built environment challenges, such as poor land-use decisions and the failure of engineered hard-infrastructure solutions (e.g., dikes).

This research study examines the extent to which a "window of opportunity" for policy change has emerged in BC's post-disaster landscape, drawing upon theories of path dependency, focusing events, and multiple streams framework to better understand both the enabling conditions and barriers that influence transformative policy change. The 2021 AR event has prompted key governance and funding questions to emerge surrounding flood risk reduction and climate change adaptation. There is a growing recognition of the need to develop a collaborative watershed governance model and to move beyond the status quo of flood management towards more multi-benefit and holistic risk reduction approaches, including nature-based solutions and managed retreat. Although there have been promising policy advances to 'build back better,' some communities have largely defaulted back to the status quo. It is important to note that in the 1920s, Semá:th Xó:tsa, a large and shallow lake located at the confluence of both the Nooksack and Fraser River watersheds, was drained in order to advance settlement and agriculture in the region, with detrimental social, cultural, and ecological consequences. Questions were raised almost immediately post-flood as to whether the most appropriate course of action should be to retreat from this flood-prone area.

This presentation will examine the 'missed opportunities' for transformative change in Abbotsford's Sumas Prairie region and share some insights into the barriers that have prevented the City from considering the implementation of managed retreat. The continued reliance on protective structures, evident in the City's new Long-term Flood Mitigation Plan for Sumas Prairie, has meant that Abbotsford has yet to reconcile with the unsustainable legacy that was created when the community drained and settled on the former lakebed.

Who Benefits from Flood Adaptation?– Evidence from US wide time series data

- Lidia Cano, PhD Candidate, Massachusetts Institute of Technology (presenting)
- ChangHoon Hahn, Postdoctoral Research Scientist, Princeton University

Governments are racing to implement new climate change adaptation policies in order to prepare for the increasing damage and frequency of flooding events. In this rush, it is imperative to avoid implementing policies that perpetuate structural inequality and climate injustice. Policies must be evaluated not only for their effectiveness but also through a climate justice lens that considers the intersectionalities between climate and geo-demographics. In this work, we examine a nationwide US flood adaptation program, the FEMA National Flood Insurance Program Community Rating System (CRS), and evaluate how its impact on flood loss depends on the geo-demographics of a community. We conduct the first analysis of this kind by using a statistically powerful data set of 2.5 million flood insurance claims and a Machine Learning based approach with neural density estimation to overcome quantitative challenges that prevented such analyses in the past. We find strong evidence that the CRS is effective at reducing flood losses overall. Moreover, we show that the efficacy of the CRS flood adaption activities depends significantly on geo-demographic characteristics, such as income, flood proneness, and population. For instance, we find that lower income communities benefit the most from the flood adaptation measures, although the benefits are mostly seen by communities with larger populations and moderate to low flood risks. This work provides key insights for crafting and tailoring future flood adaptation policies to make them more effective and to ensure that their implementation advances climate justice.

Relating social, ecological, and technological vulnerability to future flood exposure at two spatial scales in four U.S. cities

- Jason Sauer, Postdoctoral Research Fellow, Portland State University (presenting)
- Arun Pallathadka, Portland State University
- Heejun Chang, Portland State University
- David Iwaniec. Portland State University
- Elizabeth M. Cook, Barnard College
- Gregory C. Post, Portland State University
- Idowu Ajibade, Portland State University
- Marta Berbés-Blázquez, University of Waterloo
- Nancy B. Grimm, Arizona State University

Flooding in cities occurs at different scales and unevenly affects populations, infrastructure, and urban systems based on a city's social, ecological, and technological systems (SETS) characteristics. As hydrological models improve in spatial scale and account for more mechanisms, there is a continuous need to examine the relationships between flood exposure and SETS variables of flood vulnerability. In this study, we related fine-scale measures of future flood exposure—the First Street Foundation's Flood Factor and estimated change in chance of extreme flood exposure—to SETS indicators, like building age, poverty, and historical redlining, at the parcel and census block group (CBG) scales in Portland, OR, Phoenix, AZ, Baltimore, MD, and Atlanta, GA. We used standard regression models and accounted for spatial bias in relationships. Flood exposure was more often correlated with SETS variables at the parcel scale than at the CBG scale, indicating scale dependence. However, these relationships were often inconsistent among cities, indicating place dependence. This study finds that inequalities in the burden of flood exposure may persist and possibly worsen unless mitigating measures are taken. It also indicates that, when available, parcel-scale SETS indicators are superior to indicators at coarser scales for revealing relationships with flood exposure.

Speakers

Pui Man Kam
PhD student
ETH Zurich

Andrew Zimmer
Postdoctoral Researcher
Montana State University

Felicia Watterodt
Graduate student
University of Waterloo

Lidia Cano Pecharroman
PhD Candidate
Massachusetts Institute of Technology

Jason Sauer
Postdoctoral Research Fellow
Portland State University

14B) Financial Aspects of Adaptation and Managed Retreat

8:30 AM - 10:00 AM, Jun 23

Room 555

Out of Africa, Few Green Bonds: African Sovereigns, Climate Action and International Finance

- Gautam Jain, Columbia University (presenting)
- Harry Verhoeven, Columbia University

Why are African states so reticent to tap international capital markets to fund climate action? While Africa is responsible for only about 3 percent of global cumulative emissions of carbon dioxide since the start of the Industrial Revolution, it is already suffering devastating consequences as evident from protracted droughts across the Horn of Africa and Southern Africa and record-breaking flooding in Nigeria and South Sudan. The gap between the rapidly growing needs to adapt to global warming and the continent's limited success in mobilizing domestic resources underlines the potentially pivotal role of external climate finance, whether provided by multilateral development banks, bilateral donors or private sector actors.

However, African sovereigns have so far shown themselves remarkably reluctant to explore and potentially capitalize on so-called 'green financial instruments'- a lacuna that is particularly pronounced when it comes to green bonds which raise working capital for states while the latter commit to spending (at least significant) part of the principal on targeted environmental action. Of the $2 trillion of green bonds that have been issued globally, Africa's share is a meager 0.2%. They make up 2% of the total green bond issuances by emerging market and developing economies (EMDE), whose share of the total global amount is itself low.

In this paper, we present new, comprehensive data on green bond issuing by various African governments in recent years. We complement the quantitative analysis by also providing robust qualitative evidence on the motivations (not) to do so based on extensive interviews with senior African officials in government, development banks, international organizations and leading financial firms. While the decision-making rationales of African sovereigns have mostly either been ignored or considered a black box in climate finance discussions, our paper identifies several key historical, structural and institutional factors underpinning the reticence of African states to address climate adaptation and mitigation through international financial markets.

Exploring price effects of sea level rise exposure across race and income: evidence from property sales in the southeastern United States

- Steven Koller, Environmental Science and Policy PhD Candidate, University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science

Global mean sea level rose approximately 8 inches from 1901-2018 and is rising at an accelerating rate. The National Oceanic and Atmospheric Administration projects an additional 10-12 inches of sea level rise (SLR) can be expected in the United States in the next 30 years. This study examines the price effects of exposure to projected future anthropogenic SLR across 637,451 coastal residential property transactions in Florida, Georgia, North Carolina, and South Carolina using Zillow ZTRAX data. A hedonic analysis with comprehensive fixed effects and difference-in-differences approach exploiting temporal variation in global scientific consensus about anthropogenic SLR is used to estimate the average price effects of exposure to three, six, and nine feet of SLR, respectively, over the sample period 1993-2022. Main results indicate the price effects of exposure to three and six feet of SLR are -4.7% and -2.5%, respectively, with no discernible price effect for exposure to nine feet of SLR. Further, the results do not suggest the estimated price effects of SLR exposure emerge discontinuously following the Intergovernmental Panel on Climate Change's Third Assessment Report, a key indicator of global scientific consensus on anthropogenic SLR. This submission is also the first to examine SLR exposure price effects across race and income. Some evidence suggests negative price effects from SLR exposure may be driven by transactions in relatively middle- and high-income census tracts. Empirical results suggest a coastal property in a 100% non-Hispanic Black or African-American census tract is expected to sell for 45.1% less than an observably equivalent property in a census tract with no non-Hispanic Black or African-American population. This paper's results have significant implications for climate policy interventions which seek to mitigate damages from anthropogenic SLR and/or meet equitable adaptation objectives.

Measuring the Impact of Managed Retreat

- Mark Rhoads, MBA Candidate, Bard College
- Sarah Haworth, MBA Candidate, Bard College
- Maria He, MBA Candidate, Bard College
- Shahbaz Soofi, MBA/MS Candidate, Bard College
- Nicole Jean Christian, Empire State Fellow, NYS Department of State
- Jordan Koster, Excelsior Service Fellow, NYS Department of State
- Carolyn Fraioli, Coastal Resources Specialist, NYS Department of State

The New York State Office of Planning, Development and Community Infrastructure has identified managed retreat as a priority topic for 2022-2023. The OPDCI has partnered with a student lead team from Bard College's MBA in Sustainability to review the environmental and financial impacts of managed retreat, and the potential long lasting effects it will have for individual communities and the State as a whole.

The identified objective of the team is to develop a robust and diverse template, based on research and case studies, that provides a tool for guidance to state agencies that will allow municipal and community leaders to form decisions on the economic and logistical impacts of planned retreat. The proposed presentation will summarize the partnership and include a discussion of the results of the team's analysis and the tools created. In addition, a poster will be developed, depicting the project process and outcomes.

Since Fall 2022 the NYS UPIC's team and BARD College have teamed up to work on a year-long comprehensive Community Adaptive Planning project where students, with support and guidance from the OPDCI UPIC's team, will develop a Managed Retreat Cost Benefit Analysis along with a community characterizations tutorial, a community survey template and a 'Best Practices' checklist for climate change community engagement. This project and its three deliverables are currently underway, and the results will be shared at the conference scheduled for June 20th – June 23rd, 2023.

The OPDCI will co-present with its graduate student teams the results of its University Partnerships for Innovative Climate Solutions projects for the 2022-23 school year. This program puts State policy at the intersection of contemporary practice and theory by tapping into the creative nature of students through project-based partnerships with institutions across the state. This is achieved by building the DOS talent pipeline while generating novel and innovative approaches to tackling climate change related issues affecting communities. This partnership is helping to train the future planners of tomorrow by providing students professional development opportunities while building the pipeline of professionals for state and other public service. Categories of focus will include:

• Climate change adaptation options and strategies, including managed retreat;
• Best practices to mitigate impacts of climate change;
• Community engagement approaches that enhance participation by disadvantaged (DAC) and environmental justice (EJ) communities;
• The financial impact of climate change mitigation, specifically Managed Retreat.

Who Pays? Emerging possibilities for resourcing managed retreat

- Michael Howes, Associate Professor, Griffith University (presenting)
- Andrew Buckwell, Griffith University
- Justine Bell-James, University of Queensland
- Margaret Cook, Griffith University
- Aysin Dedekorkut-Howes, Griffith University
- Ed Morgan, Griffith University
- Johanna Nalau, Griffith University

The impacts of climate change have increased the risks for many settlements to the point where policymakers and planners are having to consider more proactive adaptation options. Managed retreat, the strategic and pre-emptive withdrawal of settlements and infrastructure from hazardous zones, is now being considered in an increasing number of contexts and locations. The implementation of the necessary policies, strategies and plans faces numerous and complex challenges, not least of which is the issue of resource acquisition and allocation. This challenge is confounded by logistical, capacity, political, and equity issues. The failure to consider such issues can undermine implementation efforts and may even derail actions altogether. The objective of this paper is to promote key discussions about how to ensure the implementation and resourcing of effective, efficient, and appropriate managed retreat. This study reviews how resources can be mobilised from either the private and public sectors, or the two in partnership, to motivate effective managed retreat, for example, through product and policy innovation. Both sectors struggle with the long term and uncertain impacts of climate change and the ramifications of how to determine where the boundaries of residual risk lay, leaving both sectors looking at each other for solutions and resourcing. Local and regional governments, which are often responsible for planning and land use, are usually the most resource constrained, but they remain in a unique position with regards to climate adaptation responsibility. Local governments can be exemplary borrowers and act in collective interest given their role as planning authorities, forums for democratic debate and responsible government, and collectors of taxes and provider of services However, the research points to the limited capacity in the public sector to administer innovative resourcing schemes. The private sector, when provided the right incentives, can provide significant scale, flexibility, and dynamism to enable managed retreat, although there are also significant barriers to action at the likely scale required. As the frequency, extent, and magnitude of climate-related risks combine and compound, policymakers and planners will be left with fewer options for at-risk areas. They will need to mobilise the resources of communities and the private and public sectors to adapt.

Speakers

Gautam Jain
Senior Research Scholar
Center on Global Energy Policy, Columbia University

Steven Koller
Environmental Science and Policy PhD Candidate
University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science

Mark Rhoads
Principal
Bard College\Grimshaw

Michael Howes
Associate Professor
Griffith University

14C) Natural Disasters and Managed Retreat

8:30 AM - 10:00 AM, Jun 23

Broadway Room

Managed retreat due to natural hazards: A decision support framework based on case history analysis in Switzerland

- Flurina Dobler, Master of Science candidate, University of Zurich (presenting)
- Christian Huggel, University of Zurich
- Samuel Weber, WSL Institute for Snow and Avalanche Research, SLF Davos Switzerland & Climate Change, Extremes and Natural Hazards in Alpine Regions Research Center CERC

Due to changing conditions such as the climate, inhabited areas are increasingly threatened by natural hazards. Worldwide, the focus lies mostly on sea level rise of coastal regions, whereas in Switzerland, hazards such as rockfalls, debris flows, avalanches or floods can force people to relocate. Thereby, manifold difficulties arise for the affected community, such as social, financial, and legal aspects.

In Switzerland, the decision-making process on measures varies greatly and is typically conducted individually for each case concerned. Resettlement is only carried out if no other measures, such as technical measures, are possible. However, as the problem increases, resettlement of people at risk may not only be considered as a last option but should be included as a possible solution from the very beginning, as this may bring advantages.

In this study, a decision support and evaluation framework is developed, which should enable a structured, integrative and yet individual approach for decision making on managed retreat and serve as a guideline.
Case studies of historical and current cases from Switzerland, in which a relocation was evaluated or implemented, are analyzed. From the resulting scoping study, the influencing social, financial and legal aspects are elaborated, which form the inner core of the framework. The outer circle of the framework is formed by the whole evaluation and monitoring process which includes aspects such as communication. For this purpose, literature search, expert interviews, and interviews with affected people have been done.

This study shows that sustainable decisions on such sensitive issues as managed retreat can be facilitated and disentangled with the help of an integrative but individually adaptable framework. The relative importance of different factors for those affected

by a (possible) resettlement is also indicated.

As managed retreat and relocations will gain further importance in the future, it is important to approach and implement the measures in a comprehensive and coordinated way. Such an approach may also open opportunities for those affected, in addition to the (unavoidable) negative aspects.

How Does Housing Recovery and Relocation Process Disconnect or Reconnect in Neighborhoods? A Case Study of Relocation Program and Disaster Public Housing in a Tsunami Impacted City in Japan

- Kensuke Otsuyama, Project Lecturer, The University of Tokyo

Relocation Program and Disaster Public Housing (DPH) in Japan have played a major role in housing recovery through providing a housing option for those who lost and suffered from seeking a place to live, though past literature pointed out that resettlement in the new built environment caused social disconnections for those who relocated from other neighborhoods. Based on the lessons, the national and local government guided private and public housing mixed-use in new relocation sites and encouraged to (re-) organize voluntary based neighborhood organizations in the Great East Japan Earthquake in 2011. This study aims to identify the process of retreat and relocation causes presence or absence of Neighborhood Voluntary Civic Associations (NVCA) in a tsunami impacted municipality. The author employed quantitative and qualitative mixed methods through the questionnaire survey to all households (N=23,611) in Kesennuma City, paying particular attention to DPH residents with the variables such as relocation distance, moving experience, years of living in the city, and place attachment. The quantitative results indicated that variables of place attachment and years of living in the city for the short-distance relocation residents are stronger than long-distance relocation. The root causes of the bifurcation point between presence or absence of organized NVCA in DPH are not only long distance of relocation but diversified of newcomers around the city and non-mixed DPH with private recovery housing in the complex.

Stability and change in U.S. migrations systems after disasters

- Elizabeth Fussell, Professor of Population Studies and Environment and Society, Brown University; Editor-in-Chief, Population & Environment (presenting)
- Kathryn McConnell, Postdoctoral Research Associate, Brown University
- Jack DeWaard, Associate Professor, University of Minnesota and Population Council
- Katherine Curtis, Professor of Sociology, University of Wisconsin-Madison

A migration system comprises all the places connected through flows of migrants. Disasters have the potential to disrupt a migration system. In this paper, we investigate whether the migration system channels people through the system in ways that suggest stability in the system or whether a disaster changes the migration system by introducing new information. Using the IRS migration data from 1990 through 2011, we measure key features of migration systems – the size of flows, the number of tied counties, and entropy – for two places – Dade County, Florida and Orleans Parish, Louisiana – that were affected by extremely destructive hurricanes – Hurricane Andrew in 1992 and Hurricane Katrina in 2005. We find differences in the extent to which the migration systems were affected by these events, and use these case studies to extend our approach to study disaster effects on the migration systems of all counties between 1990 and 2011. We use these cases to consider migration systems affected by disasters more generally during the period 1990-2011.

How disaster recovery decision-making unfolds: Investigating retreat and rebuild options for post disaster recovery in Merritt, British Columbia after the 2021 British Columbia floods

- Shaieree Cottar, PhD candidate, University of Waterloo

In response, to the catastrophic flooding that occurred in British Columbia (BC), Canada in November 2021, the City of Merritt is facing a difficult decision about whether to rebuild or not. Although, no formal announcement of a property buyout program has been made for the city of Merritt by the Government of British Columbia, evidence at the municipal level indicates that decisions about buyouts will be made after preliminarily damage assessments. The emerging situation in Merritt, BC provides a unique opportunity to explore how the possible adaptations (i.e., investments in climate resilient infrastructure, rebuild/elevate properties, dykes, zoning, buyouts) are considered by policymakers in advance of final decisions will help researchers assess the factors that lead governments to decide on retreat/buyout options instead of rebuilding strategies in Merritt and other high-risk areas. Through qualitative research methods (e.g., interviews, open houses, town halls), the study explored some of those preliminary discussions had by decision makers surrounding long term risk reduction options including rebuild and retreat strategies, perceptions of flood risk, recovery challenges faced by small-scale municipalities, and recommendations for future scenario-based disaster planning. Conversely, it is equally important to capture homeowners' perspectives on the potential application of managed retreat, and the use of competing goals at the municipal, provincial, and federal levels. Preliminary results indicate that decisions about post disaster recovery are often independent of broader municipal climate change adaptation planning, communities are actively considering the use of buyouts as a risk reduction tool, and additional supports are needed by local governments in the recovery stages. The research will provide insights into both the factors that influence post-disaster recovery decisions, including managed retreat decisions by government authorities. Ultimately, this will contribute to further understanding and development of a broader Canadian property buyout/ relocation program.

Building a "wildfire managed retreat" research agenda

- Kathryn McConnell, Postdoctoral Research Associate, Brown University (presenting)
- Liz Koslov, Assistant Professor, University of California Los Angeles Department of Urban Planning and Institute of the Environment and Sustainability

Rapid growth of wildfire destruction around the world and model projections of intensifying fire impacts under climate change raise critical questions about the habitability of fire-prone regions. In response, calls for managed retreat are growing more common in public discourse around wildfires. Yet, there has been limited empirical or theoretical scholarship that attends to "wildfire managed retreat," in particular the ways that this hazard context may differ from the flood context. In this presentation, we propose a research agenda focused on wildfires and retreat, highlighting key areas in need of empirical study. First, we distinguish three scenarios of wildfire retreat, each of which has its own constellation of equity, logistic, and policy considerations. These scenarios are distinct from direct displacement resulting from wildfire-induced building destruction, which we do not consider managed retreat. Second, drawing on historical and contemporary examples, we outline key areas in

need of research: (1) the role of land management, (2) existing institutional and policy infrastructure, (3) the production of wildfire risk, and (4) the emergence of normative retreat narratives. Without sustained analytical attention to the specificities of fire, we risk implementing policies designed primarily to address flood hazards that may be ill-suited to address wildfire exposure.

Managed retreat following the 2010 eruption of Mt. Merapi, Indonesia: managing tradeoffs between volcanic hazard and livelihoods risks

- Brent Doberstein, Associate Professor, University of Waterloo

Mt. Merapi, one of Indonesia's most active volcanoes, erupted violently in 2010 killing >350 local residents and causing the temporary displacement of >350,000 people to evacuation shelters. Once the eruption subsided, the Indonesian government embarked on a managed retreat scheme wherein 2,700 families (>13,000 people) were moved to relocation villages outside of the immediate hazard zone of the volcano's central vent. In addition, the government rezoned more than 1300 hectares of former farmland near the central vent, from farmland/village land zoning to protected forest/national park zoning. This zoning change effectively meant that relocated survivors, mainly farmers, were not allowed to return to their farmland or rebuild in their former villages. This portion of the panel session will discuss the use of managed retreat to reduce volcanic hazard risks for local populations while simultaneously triggering livelihoods risks for former farmers.

Speakers

Flurina Dobler
Master Student
University of Zurich, Switzerland

Kensuke Otsuyama
Project lecturer
The University of Tokyo

Elizabeth Fussell
Stability and change in U.S. migration systems after disasters
Brown University

Shaieree Cottar
CCRF CoP Coordinator/ PhD Student
University of Waterloo

Kathryn McConnell
Postdoctoral Research Associate
Brown University Population Studies and Training Center

Brent Doberstein
Associate Professor
University of Waterloo

14D) South Pacific and Small Island States

8:30 AM - 10:00 AM, Jun 23

Room 569

Re-emplacement: the active remaking of climate-impacted place

- Carol Farbotko, Griffith University (presenting)
- Taukiei Kitara, Independent Researcher, Tuvaluan Indigenous knowledge holder

How is resistance to relocation practiced? Far from a passive form of immobility or an irrational response to risk, people facing possible uninhabitability can and do remake and actively reclaim their (im)mobilities, homes and places. Such practices need to be empirically documented and theorised if planned relocations and managed retreat are to be equitable and open to the voices of affected populations. Advancing such an agenda, this paper explores the concept of re-emplacement – the active remaking of climate-impacted place – in the context of Tuvalu. Subject to 'inevitable uninhabitability' narratives for three decades, re-emplacement in Tuvalu includes diverse but culturally, politically and economically consistent practices that together enact a clear message of voluntary immobility, from grassroots to state. These include migration from urban to rural areas, revitalising Indigenous senses of place, large-scale land reclamation, and sustained lobbying the international community for emissions reductions. Re-emplacement is suggested as a useful conceptual tool in understanding resistance to relocation.

Enabling conditions for planned relocation in Fiji

• Celia McMichael, University of Melbourne

This presentation focuses on Fiji, located in the Pacific Islands, a region often characterized by high climate change vulnerability and limited adaptation options. Impacts of climate change in the Pacific Islands include increasing droughts and water scarcity, and coastal flooding and erosion. Pacific Island communities are increasingly using strategies to adapt their lives and livelihoods to climatic changes and associated risks, including planned relocation and retreat from sites of risk. Yet there remains limited analysis of the 'enabling conditions' for adaptation and relocation/retreat, including in the Pacific Islands. Drawing on longitudinal qualitative research conducted since 2014, this presentation examines the conditions that enable (and constrain) relocation/retreat in Vunidogoloa and Nagigi villages in Fiji: e.g. asset and resource distribution; flexible adaptation options; social organization; agency; experiential and communicated learning; and worldviews and values. Notably, Fiji is one of the first countries in the world to develop National Guidelines for Planned Relocation, and this provides a relevant political and policy context for emerging cases of relocation.

Planned Community Relocations in Fiji: What Lessons Could Apply to the United States

• Barrett Ristroph, Ristroph Law, Planning, and Research

In the United States, there is no clear formula for community relocation. Assistance is often at the individual/household level, while community-scale relocations require a mess of environmental review and funding among siloed agencies. Fiji offers a different path. Following the development of Planned Relocation Guideline in 2018, the Fijian Government is developing standard operating procedures that include a procedure for culturally sensitive negotiation with villages considering relocation as well as a process for determining whether and where to move. Because most of Fiji lands are held traditionally through customary title, which cannot be bought or sold, relocation is a sensitive issue used only as a last resort, brokered through the ministry responsible for overseeing customary lands (Ministry of iTaukei Affairs). A request for relocation assistance must come from the village headman (the locally elected liaison to the Fijian government). This initiates a process where a Task Force of Fijian agencies with specialization in various aspects of relocation (consisting of individuals trained to collect data in a culturally sensitive manner) assess the status of the community. Ninety percent of current residents must agree to relocate and the Task Force must find that the village meets a specific threshold of uninhabitability based on geographic threat and deteriorated living conditions). Otherwise, the Task Force will assist with protect-in-place measures. If relocating, the Task Force helps the community negotiate with those who control potential receiving areas so that the relocating community gains the right to live on the new land. The new site must be approved by 60% of those in the relocating community. The Task Force assists with funding and guiding the relocation process and conducts monitoring and evaluation after the relocation. This presentation considers what aspects of the Fijian model could work in the United States.

Speakers

Carol Farbotko
ARC Future Fellow
Griffith University

Celia McMichael
The University of Melbourne

Barrett Ristroph
Owner
Ristroph Law, Planning, and Research

10:30 AM

15A) Pluvial flooding: Addressing the Risks of Heavy Rainfall

10:30 AM - 12:00 PM, Jun 23
Broadway Room

Pluvial flooding occurs when extreme rainfall events exceed the capacity of drainage systems and can occur far from the coast but is compounded by sea level rise and storm surge in coastal areas. The risks from this type of flooding are increasing in many areas as extreme rainfall events increase in frequency and duration; however, it is often not as well understood or communicated to the public. Existing flood maps typically only communicate coastal and riverine flood risks, while mitigating pluvial flood risk also proves challenging. Despite the considerable challenges, cities are taking on the responsibility of communicating and mitigating pluvial flood risk. Several cities have developed their own risk maps and are beginning outreach regarding the limitations of existing and future infrastructure, and the responsibilities borne by private property owners. While bigger pipes and pumps might be part of the solution, there are significant technical and economic limitations. Similarly, funding for these investments often requires increasing water or stormwater charges and securing Federal dollars. Increasingly, cities are also looking to nature-based solutions in addition to traditional infrastructure, and to the past—to understand where the functions of the pre-development landscape might be a cue for future mitigation, and potentially buyouts. This session will explore the challenges posed by pluvial flooding and solutions that are being explored to understand, communicate, and mitigate the increasing risks faced locally and across the globe.

Session Chair: Alan Cohn, Managing Director, Integrated Water Management, NYC DEP

Speakers

Amy Chester
Managing Director
Rebuild By Design

Angela Licata
Deputy Commissioner for Sustainability
NYC DEP

Dr. Eric Sanderson
Vice President for Urban Conservation
New York Botanical Garden

David Erdman
Director, Center for Climate Adaptation
Pratt Institute

Rebecca Pryor
Executive Director
Guardians of Flushing Bay

15B) New Data and Methods in Modelling Sea-Level Rise-Related Adaptation and Migration Decisions

10:30 AM - 12:00 PM, Jun 23

Satow Room

Global sea-level rise will affect coastal environments through permanent inundation, saltwater intrusion into soils and coastal aquifers, coastal erosion, and flooding due to extreme sea levels. Coastal communities will likely respond to these environmental changes by pursuing adaptation strategies: they may choose to implement local measures such as flood protection, or they may choose to adapt through managed or unmanaged migration. These adaptation decisions are made on different decision levels, with, for example, households flood-proofing their homes, or governments engaging in property buyout schemes. Currently there is a growing research interest to model these decisions in response to sea-level rise and to evaluate migration as an adaptation strategy against other adaptation options. However, the spatial scale often determines how these adaptation decisions are captured in such modeling efforts. On the larger regional to continental scales, gravity models are often applied to simulate aggregate migration flows. In local to national studies, descriptive analysis, agent-based models and surveys focus on the decision-making process of individuals and households. There is a research need to bridge the gap between these top-down and bottom-up approaches, integrating insights from local studies to inform and validate larger scale modelling efforts. Such work may also include the use of statistical or machine learning techniques for upscaling such local insights to regional to global scales.

Therefore, this session pursues three aims: a) to take stock the current state-of-the-art data and methods in simulating human adaptation and migration behavior in response to sea level rise at different spatial scales; b) to discuss the strengths and weaknesses of these methods in capturing human decision-making; and c) to reflect on how to couple existing social- and physical-science approaches in future research. Addressing these aims will help to improve existing adaptation and migration modeling efforts, thereby leading to more informed coastal decision-making in the context of adaptation planning when using the results of such modeling efforts.

Session Chairs: Lena Reimann, Postdoctoral Researcher, Vrije Universiteit Amsterdam; Lars Tierolf, PhD Researcher, Vrije Universiteit Amsterdam; Wouter Botzen, Professor, Vrije Universiteit Amsterdam; Jeroen Aerts, Professor, Vrije Universiteit Amsterdam; William Solecki, CUNY

Implications of global vs. local data for understanding populations at risk of seaward hazards and adaptation planning

- Yoonjung Ahn, University of Colorado (presenting)
- Deborah Balk, Professor, CUNY Institute for Demographic Research

Understanding spatial and temporal variation of population exposures to various spatially-delimited environmental hazards (related to climate change, but others too) over time is very limited. While we have a basic understanding about the built environment exposure, we know less about population and pop changes, particularly in LECZs, which does not conform to

observed units of population change. In order to evaluate trends of population exposure itself (population loss or growth, and ideally migration), and also to identify the determinants and implications of change in these vulnerable locations, fine-scale observations over time are necessary. This will help determine adaptation or mitigation responses to safeguard these locations, the people who live there and the natural settings themselves. To date, the key scientific investments in this area have been made at the global scale through population grids (Leyk et al. 2019) and placing them in the Low Elevation Coastal Zone (LECZ) (MacManus et al., 2021). However, given that global gridded population data have fixed spatial structures, based on settlement layers which model only positive growth or stagnation and are not able to detect negative decline (shrinkage), in this paper we compare with US Census data over four decades (1990-2020) to estimate differences in change in exposure and lay out the implications of any limitation in the global data suite in particular in geographically highly constrained places such as the LECZ or other sea-level rise or coastal zones.

Using fine-scale census data rather than a global population data product we validate the global population data sets under various aspects: (1) We evaluate whether and where they agree for the most recent time period. Where they do not agree, we will elaborate possible reasons. (2) We will examine whether they agree over time and how the derived trends differ e.g., between urban and rural areas. (3) These evaluations will allow us to estimate the fitness for use of global data for such type of analysis and will indicate places that show great differences between global and census data.

Recent research implicates the effects of building back bigger after storms. However, we have limited knowledge of migration flows (in/out) and global grids won't account for loss of population. New urban classes in the 2020 Census will be based on housing density (Federal Register Notice, 2022). This might provide new ways of differentiating between subregions for above analysis. We are experimenting with different approaches to decouple population and built-up land data to better understand how their trends can be differentiated and how they are linked over time. This will provide a basis to study coastal retreat trends under climate scenarios.

Data and communication challenges in co-producing knowledge for migration and adaptation under uncertain futures

- Andrew Bell, Assistant Professor, Earth and Environment, Boston University (presenting)
- Nic Choquette-Levy, Postdoctoral Researcher, Boston University
- Fabien Cottier, Postdoctoral Research Scientist, Center for International Earth Science Information Network, Columbia Climate School
- Alex de Sherbinin, Senior Research Scientist and Deputy Director, CIESIN, Columbia Climate School

Drivers of migration behavior under increased flood risk from sea-level rise: A cross-national study

- Sem Duijndam, PhD candidate, VU University Amsterdam

Elevated flood risk due to sea-level rise (SLR) is expected to increase migration from coastal areas, especially when in-situ adaptation is unfeasible. This presents an enormous societal challenge given the hundreds of millions of people living in low-lying coastal areas globally. However, the relationship between SLR and migration is not straightforward. People can decide to move away from SLR risk well before they are absolutely forced to do so, or can stay put even under seemingly dire conditions. People's migration decision depends on many more factors than SLR alone, including economic, social, political, and demographic factors, as well as individual/household characteristics and preferences. However, not much empirical research has been done on drivers of migration under increased flood risk from SLR, and cross-national studies are also lacking. To fill this research gap, we designed and implemented unique and comprehensive household surveys on migration behavior and their drivers in four different countries vulnerable to SLR, namely the United States (Florida and New York), France, Argentina, and Mozambique, and a fifth country where data still has to be collected (Vanuatu). 800-1100 household surveys are collected per country. To understand how migration behavior may change under sea-level rise we conducted experiments where we presented respondents with hypothetical scenarios of increased flood risk, and assessed their migration intentions under these scenarios. We included a wide range of other factors in our surveys to attain a comprehensive understanding of people's migration behavior and preferences, including: the location and duration of migration, capabilities and preferences for migration, previous migration experience, in-situ adaptation intentions and behavior (e.g. home elevation, wet/dry-flood proofing), preferences for government measures such as physical structures and managed retreat, constructs of life satisfaction, place attachment and community cohesion, behavioral parameters grounded in economic theory (e.g. risk aversion), social networks, perceptions of flood risk and sea-level rise, previous experience of flooding, and socio-economic indicators. In the presentation, we aim to discuss the results of our surveys: First, we identify how increased flood risk under sea-level rise is expected to influence (voluntary) migration and what type of people are expected to migrate or stay under different future flood scenarios. Second, we assess capabilities and vulnerability of respondents, and therewith identify potentially trapped populations and their characteristics. Because managed retreat can be a feasible solution in cases of trapped populations, we will also discuss our survey results about people's preferences regarding this. Third, being grounded in theories of human decision-making (protection motivation theory and subjective expected utility theory), our survey data are very useful for migration modeling. We will discuss the benefits and challenges of applying survey data in migration modeling research, and explain how our survey data will be incorporated in a newly developed agent-based model of migration and adaptation under sea-level rise.

Using agent-based modelling to explore pre-inundation impacts of sea-level rise in Bangladesh delta

- Roland Smith, Leverhulme Trust Doctoral Scholar at the University of East Anglia (UEA) and Tyndall Centre for Climate Change (presenting)
- Robert J. Nicholls, School of Environmental Sciences and Tyndall Centre for Climate Change Research, University of East Anglia (UEA)
- Mark G. L. Tebboth, School of International Development and Tyndall Centre for Climate Change Research, University of East Anglia (UEA)
- Avidan Kent, School of Law, University of East Anglia (UEA) and Tyndall Centre for Climate Change Research

There is a growing consensus that sea-level rise will have a significant influence on future patterns of population mobility. Populations across the globe are already experiencing the impacts of sea-level rise, particularly in small island developing states (SIDS) and low-lying coastal regions such as deltas. Despite an expanding body of research on the climate-migration nexus, however, there is a lack of consensus about the quality, magnitude and even direction that the impacts of sea-level rise will have on migration.

This study utilizes data gathered through the DECCMA (DEltas, vulnerability and Climate Change: Migration and Adaptation)

project (Nicholls et al., 2020) and employs agent-based modelling (ABM) (Speelman et al., 2021) to explore the potential impact of sea-level rise on patterns of migration across the Bangladesh.

In doing so, it addresses two themes that are under-represented in existing research. The first are the consequences of pre-inundation impacts of sea-level rise on drivers of migration. Studies have to date tended to focus on the impacts of frequent, persistent and permanent inundation, while exposed populations are already likely to be experiencing the pre-inundation impacts of sea-level rise through increased storm surge, coastal erosion, and saltwater intrusion into agricultural soils and freshwater. These changes have the potential to influence patterns of mobility well in advance of timescales and magnitudes suggested by modelling inundation impacts alone.

The second is that modelling approaches often implicitly characterise migration as a discrete and singular atypical action that is undertaken by otherwise static populations in response to a specific external stressor or shock. For those populations that are most vulnerable to sea-level rise, however, mobility is already a well-established strategy for pursuing economic opportunities, as well as for coping with socio-economic and environmental shocks and stressors. Thus, the relationship between sea-level rise and migration at any given location will be shaped by pre-existing patterns and flows of mobility.

The data that provides the foundation of this study is drawn from a cross-sectional household survey canvassing 1,382 households across Bangladesh (Adger et al., 2021). This captured migration histories of household members and their future migration intentions, in addition to collecting data on their well-being and household assets, as well as their perceptions of environmental degradation, both in terms of its impact on household security and the rate of degradation over recent time periods.

Using this data, this study takes the following five steps:

i) maps existing flows of migration and demographic change - particularly from rural to urban - formulating a baseline pattern of pre-existing patterns of mobility, including magnitude of flows and places of origin and destination;

ii) analyses the historic influence of slow-onset environmental degradation (erosion; salinization) and rapid-onset events (floods) on existing drivers of migration, and the relationship between this and mobility decision-making - particularly the respondents stated ‘migration intention’ - at a household level;

iii) develops an agent-based model informed by these insights which simulates population flows and distribution and is calibrated and sensitivity tested against the historical record;

iv) simulates demographic futures under a wide range of scenarios of sea-level rise and other associated changes such as environmental change;

v) explores whether such conditions have the potential to lead to non-linear shifts in in patterns of migration, such as the emergence of new pathways of mobility or the abandonment of specific settlements

Ultimately, this study assesses the impacts of sea-level rise on human mobility in the context of pre-existing drivers and patterns of migration. In doing so it questions whether these have the potential to create ‘threshold’ conditions, leading to significant shifts in migration well in advance of timescales suggested by projections of inundation, or whether mobility will continue to be dominated by socio-economic drivers and demographic change. By considering the impact of sea-level rise within the context of a wider dynamic system of human mobility, this study aims to provide new insight into how populations in low-lying coastal locations across the globe could respond to the cumulative impacts associated with sea-level rise.

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DYNAMO-M: A global agent-based model of adaptation and migration decisions in face of sea level rise

- Lars Tierolf, PhD candidate, Institute for Environmental Studies, VU University (presenting)
- Toon Haer, Vrije Universiteit Amsterdam
- Jens de Bruijn, Vrije Universiteit Amsterdam
- Wouter Botzen, Vrije Universiteit Amsterdam
- Lena Reimann, Vrije Universiteit Amsterdam
- Marijn Ton, Vrije Universiteit Amsterdam
- Jeroen Aerts, Vrije Universiteit Amsterdam

Sea-level rise (SLR) may impact exposed global coastal communities and cause increased migration towards safer areas. Coastal areas will experience more frequent and severe coastal flooding and losses of land and flood protection due to coastal erosion. As a response to these environmental impacts, people may choose to adapt locally by implementing damage reducing measures or adapt by migrating to another region. Although the observed effect of SLR on internal migration patterns is limited at present, future SLR induced migration may increase. This research, therefore, develops a global model to simulate plausible projections of coastal adaptation and migration in order to support policies managing migration flows in both sending and receiving regions.

Migration and adaptation decisions are individual decisions influenced by a variety of socio-economic and environmental factors. For example, pull factors drive people to other areas (e.g. economic attractiveness of other areas) and push factors (e.g. risk perception to flood risk) may force people to migrate if adaptation measures are not sufficient. For this, we have developed a global agent-based model grounded in subjective expected utility theory, and include factors such as vulnerability, risk perceptions, wealth and place attachment in driving adaptation and migration decisions. We then simulate these decisions for households facing coastal flood risk and coastal erosion, in addition to modeling interregional migration flows using a gravity-based migration model. The model is empirically calibrated using survey data on risk perceptions and on people’s willingness to implement adaptation measures or to migrate using survey data gathered from different coastal zones worldwide. To develop

future projections of coastal adaptation and migration (2020-2080), we use the Shared Socioeconomic Pathways (SSP) to estimate future changes in demographic composition, socioeconomic development and vulnerability and the Representative Concentration Pathways (RCP) to estimate changes in sea level. The coupled gravity- agent-based model presented in this study simulates coastal adaptation to SLR on the global scale, and functions as a platform for further development of 1) more realistic decision models and 2) global modelling approaches of both coastal adaptation and migration under projections of future development.

Forced coastal migration due to 21st century sea-level rise induced land loss under cost-benefit optimal coastal protection

- Daniel Lincke, Global Climate Forum, Germany (presenting)
- Jochen Hinkel, Division of Resource Economics, Albrecht Daniel Thaer-Institute and Berlin Workshop in Institutional Analysis of Social-Ecological Systems (WINS), Humboldt-University

Forced coastal migration due to rising sea-level and induced increased coastal flooding will be a consequence of local lacks of large scale protection. Using a wide range of sea-level rise scenarios projecting 21st century coastal sea-level rise of 29 to 190 cm, socio-economic pathways to project socio-economic change and discount rate assumptions 21st century forced coastal migration as reactive last-resort retreat response to sea-level rise is assessed on global scale assuming local cost-benefit optimal protection decisions. Costs of protection decisions are assessed using the DIVA framework and a global database of 12.148 coastal segments. Costs include expected annual damage to assets by events that overtop existing protection, costs for protection investment and maintenance and migration cost. Robust protection decisions are found for 4.5% of the global coastline, covering 85% of global coastal population and 92% of global coastal floodplain assets. For the remaining 95.5% of global coastline accumulated 21st century land loss ranges from 42,000 km² to 360,000 km² and forced coastal migration ranges from 6.7 to 52 million people. Big countries with long uninhabited coastlines suffering the biggest land losses on country-level. In absolute numbers big countries in South and South-east Asia account for highest forced coastal migration, while in relative numbers island nations have the biggest effects. Global cost of 21st century sea-level rise can be lowered by factor two to five if the cost of forced coastal migration is included in accounting for local sea-level rise response strategies.

Moderator

Lena Reimann
Postdoctoral researcher
Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam

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Speakers

Yoonjung Ahn
University of Colorado

Andrew Bell
Assistant Professor, Earth and Environment
Boston University

Sem Duijndam
VU Amsterdam

Roland Smith
University of East Anglia

Lars Tierolf
PhD student
Vrije Universiteit Amsterdam

Daniel Lincke
Global Climate Forum, Germany

15C) Putting Retreat into Context: Housing and Infrastructure in Flood-Prone Areas

10:30 AM - 12:00 PM, Jun 23

Room 555

Most of what we know about managed retreat has come from contexts where infrastructure and housing development has occurred in hazardous areas, damages from extreme events have mounted, and communities have subsequently incorporated retreat into portfolios of flood risk reduction. We know much less about the other pathway for keeping people and infrastructure out of harm's way: communities that have grown without developing housing and infrastructure in floodplains in the first place, where needs for retreat are more targeted or even non-existent at present.

This session will reflect on how and why some communities are able to avoid developing housing and infrastructure in flood-prone areas. We will report on new systematic, nationwide measurements of municipal floodplain development. These measures combine remote-sensing capacities and data science tools to answer long-standing questions about where development is taking place in communities across the United States. The measures will be open access once completed. Based on these novel floodplain-development measures, we will discuss how municipalities have successfully limited development in the floodplain, including social, economic, and geographic factors, the law and policy tools that are relevant for both avoidance and retreat, and lessons learned across cases. In this way, the session will situate retreat into the broader contexts of land-use planning, affordable housing development, and flood risk management—where successes have been historically missed and may have much to teach us.

Perspectives in the session will combine both research and practice, spanning from federal agencies to local government. The exchanges will be question driven and lively.

Speakers

A.R. Siders
Director, Climate Change Science & Policy Hub
University of Delaware

Katharine Mach
Professor
University of Miami

Miyuki Hino
Assistant Professor
University of North Carolina Chapel Hill

Eric Letvin
Deputy Assistant Administrator for Mitigation
DHS/FEMA/Mitigation

Linda Shi
Assistant Professor
Cornell University

Vincent Mazzei
New Jersey State Floodplain Manager
New Jersey Department of Environmental Protection

John Miller
Mitigation Liaison, New Jersey FEMA Integration Team
FEMA

15D) Resettlement and Planned Relocation in the Global South

10:30 AM - 12:00 PM, Jun 23

Room 569

Equity and risk tradeoffs of managed retreat from volcanic hazard: Mt. Merapi, Indonesia

- Brent Doberstein, Associate Professor, University of Waterloo Department of Geography and Environmental Management (presenting)
- Beth Palmer, Research Associate, University of Waterloo Department of Geography and Environmental Management

Mt. Merapi, one of Indonesia's most active volcanoes, erupted violently in 2010 killing >350 local residents and causing the temporary displacement of >350,000 people to evacuation shelters. Once the eruption subsided, the Indonesian government embarked on a forced managed retreat scheme wherein 2,700 families (>13,000 people) were moved out of the immediate hazard zone to relocation villages away from the volcano's pyroclastic flow risk zone. In addition, the government rezoned more than 1300 hectares of former farmland near the central vent, changing the zoning from farmland/village land to protected forest/national park. This zoning change effectively meant that relocated survivors, mainly farmers, were not allowed to return to their farmland or rebuild in their former villages. This presentation will discuss the tradeoffs and equity concerns inherent in using managed retreat to reduce volcanic hazard risks for local populations while simultaneously triggering livelihoods risks for former farmers. The research involved a combination of key informant interviews, content analysis of grey literature (primarily government and NGO reports), site visits to relocation villages, and participant observation of the 'retreat lands' – the land formerly occupied by farmers which has now been rezoned as protected forest/national park. Farmers' place attachment, former livelihoods, and the social capital built through life in the former farming villages was damaged by the managed retreat process, while at the same time, risks from volcanic eruption have been reduced. These tradeoffs are discussed in the context of residents' livelihoods transitions and their transition from living in rural settlements to more urbanized settlements.

Knowledge and implementation gaps for inclusive and equitable relocation practice as assessed by researchers and practitioners

- David Durand-Delacre, Senior Researcher, UNU-EHS

The past few years have seen an explosion of interest in climate-related relocations. Recent work has mapped case studies around the world and synthesised insights from them. Drawing on lessons from these past experiences, and in conversation with stakeholders at various scales, from national governments to communities themselves, practitioners have also identified and formulated guiding principles for planned relocations. However, the context-specific details of community relocation processes – the how of relocation – largely remain to be defined, with rare exceptions such as Fiji's soon-to-be-published standard operating procedures (SOPs).

In this presentation, I will outline key research and implementation gaps on inclusive and equitable relocations processes, as identified in a qualitative literature review, a partially formalised expert elicitation (informal interviews with leading managed retreat / relocations researchers and practitioners), and a survey of selected participants in the upcoming Climate Academy 2023 (CA23). The CA23, to be held in September, will focus this year on community-led relocations at various scales (global, national, local). It is an initiative of the UNU-EHS and the Munich Re Foundation, with the support of partners such as the IOM.

The role of relocation in the context of limits of adaptation to climate change - A case study in the Salkantay catchment in the Peruvian Andes

- Isabel Hagen, PhD candidate, University of Zurich (presenting)
- Christian Huggel, University of Zurich
- Sanne Schnyder, University of Zurich
- Inés Yanac León, Wayintsik
- Sirkku Juhola, University of Helsinki
- Veruska Muccione, University of Zurich

In the Salkantay catchment in the southern Peruvian Andes, the population is highly impacted by compound climate-related risks. Climate change adaptation can bring risks to an acceptable level, as determined by the local population. However, due to increased magnitude and frequency of risks, together with a complex interplay between socio-economic, cultural, political, institutional, technical, and biophysical factors, adaptation limits are surfacing. Relocation is often seen as a last resort, and is either viewed as a transformational adaptation measure, or as a consequence of reaching adaptation limits (no other option is available). Whilst there is an emerging conceptual understanding of adaptation limits, there is little empirical research investigating limits in real-world settings. The aim of this study is to identify and define the limits of adaptation on a local scale, and the role of relocation in the context of reaching limits.

In this contribution we investigated adaptation limits and relocation in the Salkantay catchment in Cusco, Peru. The valley has elevation differences of more than 4000 meters, and very steep slopes characterize the landscape. The most prominent climate-related risks are from landslides, floods (riverine and GLOFs), and water scarcity. Data was collected through semi-structured in-depth interviews, conducted in June-July 2022, with local residents as well as local to national institutions and NGOs. The interviews were analysed in Atlas.ti using a content analysis approach.

Our results show that climate-risks had a negative impact on basic needs and wellbeing, for example considering economic security, safe housing and work environment, social cohesion, physical and mental health, and safe drinking water. Identified limits to successful adaptation included financial constraints, misinformation, distrust towards authorities, insufficient participatory methods, and lack of cooperation among institutions and NGOs. One planned relocation has already taken place in this catchment, the city of Santa Teresa was relocated to a terrace 60m higher up than the original area, after 3 consecutive debris flows wiped out almost the entire city in 1998. However, further upstream in the town of Sahuayaco, the residents don't currently have a safer option to relocate to whilst staying in the same valley. We investigated the current perception of relocation among residents in the catchment. The residents' perceptions of relocation were in general positive, but depended heavily on where they would be relocated, with a preference to stay in the same valley. Other factors included what connections they had in another place (e.g., an alternative livelihood, housing, and/or social networks), and what governmental/non-governmental support they would receive, especially in rebuilding their home and finding work (and school for people with children). We can conclude that several adaptation limits are approaching or already reached in this catchment, with severe impacts on basic needs and wellbeing for the population. Relocation of the city of Santa Teresa was considered successful, however the options for further relocation in the same valley are limited.

Speakers

Brent Doberstein
Associate Professor
University of Waterloo

David Durand-Delacre
Senior Researcher
UNU-EHS

Isabel Hagen
PhD Candidate
University of Zurich

1:30 PM

16A) Displacement in NYC: Making Space for Our Neighbors

1:30 PM - 3:00 PM, Jun 23
Room 555

This session will explore the relationships between multiple climate hazards, displacement and social vulnerability in NYC and the ways that governments and practitioners can address future displacement. The current body of research on climate risk often focuses on the interplay between a climate hazard *and* vulnerability, a climate hazard *and* displacement, or vulnerability *and* displacement . However, understanding where the three actors – climate hazards, displacement and social vulnerability – compound each other is key to understanding the dynamic processes driving the impact of climate change on the most socially-vulnerable people.

Building on the work carried out within the framework of the New York City Panel on Climate Change (NPCC) and Rebuild by Design, we present results concerning the development of indices focusing on integrating multiple climate hazards with socio-vulnerability and displacement, show maps of such indices, and discuss the results of our analysis. This aspect will take the first 20 minutes of the session.

The remaining portion of the session will encourage an inclusive and interactive discussion that will aim to address questions such as, *what can we learn from the analysis of combined socio-vulnerability, displacement and climate hazards in terms of policy actions that have worked in the past? How can these indices be used to identify areas at high, short-term risk ? What are the next steps to identify ways to move forward ?*

Speakers

Amy Chester
Managing Director
Rebuild By Design

Marco Tedesco
Lamont Research Professor
Columbia University

Ana Baptista
Associate Professor of Environmental Policy and Sustainability Management & Co-Director of the Tishman Environment and Design Center
The New School

Sheila Foster
Georgetown University/Columbia Climate School

16B) Relocation and Transporation Infrastructure

1:30 PM - 3:00 PM, Jun 23
Room 569

On the Edge of Something Big - San Diego's $3 Billion Project to Relocate a Railroad off Coastal Bluffs

- Laura Walsh, California Policy Manager, Surfrider Foundation

A hugely ambitious (read: expensive) project is underway to relocate 1.7 miles of coastal rail in Del Mar, San Diego County. Local, state and federal leaders will discuss the various commitments that are making this project a reality. These include state and federal funding commitments to relocation planning, as well as inter-agency collaboration on a plan that balances the short-

term need for stabilization of eroding bluffs with real demonstrated commitments towards track realignment. While bluff stabilization comes with negative tradeoffs for the beach below, project leadership is demonstrating how to ensure that a more sustainable long-term plan is in motion. Surfrider expects this $3 billion project to set the bar for collaboration when it comes to managed retreat of public infrastructure.

Going Off the Rails with Climate Change: How Railroad Closures Along California's Coast are Impacting Equity, Land Management, the Economy, and Recreation—and the Solutions at the End of the Tunnel

- Stefanie Sekich, Sr. Manager, Coasts and Climate Initiative, Surfrider Foundation

The Los Angeles, San Diego and San Luis Obispo (LOSSAN) railway is the second busiest corridor in the nation, moving commuters and commerce that fuel the world's fourth largest economy—in California. While the scenery along the corridor is unparalleled, segments of the rail are extremely vulnerable due to chronic erosion and extreme storms associated with climate change. In fact, in Orange County, CA the ocean is literally lapping up near segments of the railway, causing closures that impact millions of people.

The economic impacts of these closures cannot be overstated. Commerce is affected by the lack of movement of goods and services, and the situation is compounded because some commuters are unable to get to work. While Amtrak has set up a bus route for the closures, the Metrolink has canceled trains, forcing thousands of people who rely on that service to find alternative transportation. Unfortunately, those who are economically disadvantaged might not be able to fund alternative transportation—meaning some people could lose income, or worse yet, lose jobs.

From an environmental and recreational standpoint, certain beaches near the railway shockingly look like wastelands (see attached photos, news article, and this video—fast forward to minute 16). The coastal ecosystems and beaches that were once vibrant have vanished—leaving habitats unhabitable for marine and coastal species. In addition, beachgoers can no longer access these beaches. The loss of beach access is clearly unfortunate for the general public, but communities that rely on visitors to spend money locally are also taking an economic hit.

Fortunately, there are solutions on the table such as relocating vulnerable segments of the railway and using nature-based solutions to adapt to sea level rise and extreme weather events. In fact, Orange County decision-makers can look to the neighboring community of San Diego to see how decision-makers there finally came to the conclusion to realign the railway.

Using San Diego's railway relocation as a case study is imperative. For nearly two decades, the local community and San Diego decision-makers argued over managed retreat being a solution. However, due to chronic erosion and continuing impacts related to climate change, they finally realized moving the railway was inevitable. Plans to move the railway in San Diego have been approved by state and federal agencies and the project has received funds. My colleague Laura Walsh on this panel will be presenting about the track relocation in San Diego.

Orange County decision-makers must glean lessons from San Diego as quickly as possible because the tracks there are in imminent danger. While the solutions are on the table, Orange County decision-makers have languished, allowing the problem to grow. They rely on using short-term, band aid approaches, such as dropping boulders and sandbags that exacerbate erosion on the beach.

The Surfrider Foundation is spearheading a coalition that is working with several local, state and federal agencies to craft a long-term plan and ensure lessons learned from San Diego carry over to track relocation in Orange County.

The Port Authority of NY & NJ's Approach to Addressing Complex Infrastructure Interdependencies

- Josh DeFlorio, Chief, Resilience & Sustainability, Port Authority of NY & NJ

Cascading hazards—which propagate through complicated infrastructure systems and networks, yielding potentially unforeseen consequences often far from the primary hazard zone—present a vexing challenge for those seeking to manage climate-related risks to infrastructure. Particularly in a complex urban context, one needs to know not only which infrastructure assets are directly vulnerable to climate-related hazards, but also the role of these assets in broader infrastructure systems.

As a major, multi-modal transportation infrastructure owner, the Port Authority of New York & New Jersey (PANYNJ or PA) is currently tackling this issue across its aviation, port, urban rail, and bridge and tunnel facilities. To meet this challenge, the PA has launched an agency-wide Climate Risk Assessment (CRA) initiative, a proactive, engineering-based process to analyze, quantify, and mitigate multi-stressor climate-related risks through 2100.

A defining element of the CRA initiative is its network-based approach to risk analysis, which repurposes common asset management software to uncover the direct and indirect consequences of asset failure—both internal and external to PANYNJ facilities—focusing on the relationship of assets as contributors to complex systems. This enables the PA to 1) reveal complex infrastructure dependencies and redundancies, 2) understand the true scope of impact associated with the failure or disruption of a given asset or assets, and 3) effectively target risk mitigation measures for maximum potential benefit.

Attendees of this presentation will learn from the CRA Program Director how the Port Authority is carrying out—and acting on—its assessment of infrastructure interdependencies. The presentation will commence by describing the general methodology and resources associated with the CRA, and then provide a detailed overview of the methods for identifying critical infrastructure dependencies, featuring the complementary contributions of Enterprise Asset Management, field data collection, data science and technology, and stakeholder engagement. The presentation will conclude by demonstrating how the outputs of this exercise are used to prioritize risk mitigation measures and, ultimately, contribute to formulation of a resilience-focused Capital Plan.

Considering Climigration in Transportation Infrastructure Investments in Receiving Communities

- Allie Reilly, Lead Consultant, Climate, Resilience, and Sustainability, WSP USA (presenting)
- Catherine Prince, Director, Climate, Resilience, and Sustainability, WSP USA

Climigration is a reality in some areas of the United States. In Southeast, Florida, climate gentrification—the concept and phenomenon that certain properties will become valuable due to changing climate conditions, like sea level rise making higher ground more valuable—is visible. For example, Liberty City, Florida is experiencing an influx of wealthy Miami investors and

homeowners eager to invest in areas with less risk of flooding. In the past decade alone, the increase in land and home values have tripled the cost of single-family homes, and the cost of renting. This trend has exasperated Miami-Dade County's affordable housing crisis. As a result, there is a need to consider these trends when planning and making investments in anticipated receiving communities.

The Jackson Street corridor in Escambia County, FL, which sits at a higher elevation than the surrounding coastal area, is one of these potential receiving communities. For the Jackson Street Corridor Improvement Project the WSP project team considered the risk of climate and investment induced gentrification as part of the transit improvement project. The team conducted a climate gentrification analysis to understand how current/future climate risk might place additional stress on communities along the corridor and possibly result in displacement. The analysis considered change in demographics over time in the region over the past ten years and site visits/community meetings. The analysis informed a set of recommendations for how to mitigate gentrification and center socially vulnerable people in climate adaptation planning for the Jackson Street Master Plan.

This presentation will guide participants through the methodology we developed to assess future risk of climate-induced gentrification in Escambia County, Florida. We will define climate gentrification, why it was identified as a concern for the location, and how it informs the corridor planning, design, and implementation. We will conclude by summarizing the strategies and recommendations that were developed with County and City staff.

Racing against floods: novel estimates of vehicle flood exposure and vehicle flood damages in the United States

- Steven Koller, PhD candidate, Environmental Science and Policy, University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science

Climate change and urban development in floodplains are leading to increasing frequency, intensity, extent, and duration of flood exposure in urban areas along the United States (US) coast. By many estimates, flooding is the most costly and frequently-occurring natural hazard in the United States, with average annual losses of approximately $34 billion (Wing et al., 2022). While much research to date has understandably focused on flood damage to housing and other real estate assets, relatively little attention has been paid to flood damages and vulnerability vis-a-vis another widely-owned and economically-important asset type: vehicles. In 2021, approximately 91% of US households had access to at least one vehicle, compared with 65% of households who owned their primary residence (US Census Bureau, 2022). For many households—particularly low-income renters—vehicles are the household's most valuable non-financial asset or asset in general. According to the 2019 US Federal Reserve Bank's Survey of Consumer Finances, owned vehicle assets represented approximately 73% of household net worth for the median US household in the bottom 20th income percentile, while vehicles represented just 17% of household net worth for the median household in the middle 20% of US households by income. According to the US Army Corps of Engineers, a single flood event with one foot of inundation can result in damages equivalent to approximately 28% of a sedan's value, while a single five-foot flood event would be expected to result in the vehicle's "total loss." This suggests flood damage to a vehicle, especially uninsured flood damage, could be a substantial financial blow to a financially vulnerable household.

In this study, I produce novel estimates of past vehicle flood damage in the United States using administrative data from the Federal Emergency Management Agency's (FEMA) Individuals and Households Program (IHP). These FEMA data are not yet represented in academic literature. I also highlight key aspects of the flood insurance market for vehicles, which are not eligible for coverage under FEMA's National Flood Insurance Program (NFIP), and not peril-specific. Further, in this study I will provide a first-of-its-kind national stocktake of vehicle flood hazard exposure in the US and provide estimates of the number and value of vehicle assets located in US floodplains. According to FEMA's IHP data, at least $130 million in federal disaster assistance has been disbursed to applicants in connection with vehicle flood damage since 2007, with the greatest volume of funds disbursed in connection with Hurricanes Sandy (2012) and Harvey (2017). Of the 161,565 observed applications for disaster assistance in connection with vehicle flood damage in the FEMA data set analyzed, only 17.7% successfully received financial support from FEMA, suggesting considerable unmet needs and net losses post-disaster among those experiencing vehicle flood damage. Approximately 70% of households who applied for FEMA disaster assistance in connection with vehicle flood damage had annual incomes of less than $30,000 per year, suggesting successful and unsuccessful applicants come from financially vulnerable households. This study's estimates of vehicle flood damage based on FEMA IHP data surely underestimate overall vehicle flood damages for a number of reasons, including 1. FEMA does not keep exhaustive data on vehicle flood damage cases in IHP applications, 2. IHP awards are only disbursed to a subset of the population experiencing vehicle flood damage in the US who meet certain criteria, including being uninsured, and 3. data on insured vehicle flood damages are proprietary and difficult to access given the private market for vehicle flood insurance coverage in the US.

In addition to vehicle flood damages, early findings from this study indicate a large number of vehicles are located in US floodplains. For example, in Miami-Dade County alone, an estimated lower bound of 750,000 vehicles valued at approximately $14.9 billion are located in the 0.2% annual exceedance probability floodplain according to FEMA flood mapping products, which are often outdated and do not capture certain aspects of flood risk (e.g., pluvial) [Sanders et al., 2022]. By June 2023, I am confident I will have produced similar census tract-level estimates for the number and value of vehicles across US floodplains.

This study's findings will contribute novel scholarly estimates of vehicle flood exposure and damages, an important but understudied household asset type. In particular, this study sheds light on the potential for uninsured vehicle flood damages to significantly impact low-income and other vulnerable households in coastal areas projected to experience more frequent and intense flooding in the coming years absent adaptation interventions. This work also includes discussion and analysis of potential policy alternatives, such as flood risk disclosure laws, reforms to IHP or NFIP, peril-specific private vehicle flood insurance coverage, or technological applications that may mitigate vehicle flood damages and/or associated financial losses. Overall, the purpose of this work is to generate actionable, valuable knowledge for policymakers, researchers, and interested residents.

Speakers

Laura Walsh
California Policy Manager
Surfrider Foundation

Stefanie Sekich
Sr. Manager, Coasts and Climate Initiative
Surfrider Foundation

Mary Kimball
Senior Planner, Urban and Coastal Resiliency
Arcadis

Allie Reilly
Lead Consultant, Climate, Resilience, and Sustainability
WSP USA

Steven Koller
Environmental Science and Policy PhD Candidate
University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science

16C) Ecosystems and Managed Retreat

1:30 PM - 3:00 PM, Jun 23
Satow Room

Co-adaptation- Pairing the Relocation of Plant and Animal Species with Human Resettlement

- Jared Enriquez, University at Albany, SUNY (presenting)
- Lijo Varghese, NY Department of Environmental Conservation
- Tyler Bobko, Student, University at Albany

Various coastal and shoreline ecosystems are beginning to migrate inland, but most communities are not yet actively prepared for managing ecological migrations. Complex regulations and concerns over native species generally make the translocation of many species impractical, so scientists have generally favored the preservation and restoration of landscapes to protect or repopulate aquatic, animal, and plant species. Nevertheless, the translocation and establishment of populations of organisms outside their historical range could prove necessary to facilitate some species' survival. Plans for managed retreat could employ land use strategies that facilitate the migration of species from their shrinking climate refugia to new locations that have the conditions needed for their persistence.

This paper addresses the research question, what is the role of local government in assisted migration, and how do private property systems and risk management policies complicate the movements of non-human species? We conducted interviews with local planners and public officials to analyze how local governments and non-profits are coordinating the co-adaptation of their citizens with local plant and animal populations. Our case studies of local experimentation on Long Island, NY and in the Adirondacks and North Country regions of NY State reveal that resilience strategies for risk management have heavily impacted the effectiveness of assisted colonization efforts because place-based mitigation strategies can deter the landscape design options needed to maximize inland migration. To achieve co-adaptation, future local experimentation with managed retreat will need to administer DEIJ approaches for human-natural systems and establish legal protections to non-human entities to better pair plant and animal migration with human resettlement.

Managed Retreat and Wetland Migration: Vulnerability Interactions Between Moving People and Wetlands

- Celina Balderas Guzman, Assistant Professor, University of Washington

In the United States, the long history of filling wetlands for urban development and agriculture has placed people in low-lying areas at risk of flooding and fragmented these important ecosystems. Now under climate change, both low-lying communities and remnant wetlands could adapt to sea level rise by moving upland. In many cases, wetlands could be allowed to migrate into upland areas vacated through managed retreat. This opportunity could represent an adaptation synergy between facilitating managed retreat to protect human communities and preserving wetland migration corridors to maintain habitat and ecological functions. Yet wetland migration and managed retreat could also shift or create new vulnerabilities between humans and ecosystems. Based on a systematic literature review and geospatial analysis focused on US coasts, this research explores the potential opportunities and constraints presented by wetland migration and managed retreat. This research applies an analytical framework —called the Vulnerability Interactions Framework —to identify how the adaptation of one actor could produce adaptation synergies or shift vulnerabilities to other human or non-human actors. The overarching goal of this research is to illustrate specific ways in which the adaptation of humans and ecosystems are interdependent. Understanding this interdependency is critical to creating adaptation policy that is more effective and encompassing of human and non-human needs.

Legal mechanisms for managed retreat of coastal wetlands: an Australian perspective

- Justine Bell-James, Associate Professor, University of Queensland

As sea levels rise, some coastal ecosystems such as saltmarsh and mangroves will need to migrate inland to keep pace with rising seas. Where hard structures prevent this natural migration, these wetlands may be lost through a process known as 'coastal squeeze'. Setting aside areas to accommodate future landward migration has therefore become an important area of research, and in some instances, has translated into government policy; for example, some Australian states include within their

planning schemes land required for future wetland migration and protect it from further development.

A more complex and legally fraught issue is how to allow coastal wetland migration in areas that are already developed or subject to an existing lawful land use. Planning schemes cannot operate retrospectively, and changes to or abandonment of land use must be negotiated or encouraged with financial incentives.

The emerging blue carbon market in Australia offers a unique opportunity to create these financial incentives through the private market. However the success of such a scheme depends upon the development of robust legal instruments to secure carbon rights. In this context, we have considered the use of whether 'rolling covenants' can be used in Australia. These instruments would be based upon the 'rolling easement' concept developed in the United States and would allow landholders, governments and investors to balance the need for long-term conservation of land for future coastal wetland migration with shorter-term opportunities for land use.

This presentation will outline the challenges faced in the Australian context, the opportunities offered by the blue carbon market, and the potential for rolling covenants to facilitate the preservation of land for future coastal wetland migration through a blue carbon lens.

Strategic Retreat and Nature: Untapped Role for Conservation Organizations

- Alyssa Mann, Climate Resilience Project Director, The Nature Conservancy (presenting)
- Olivia Won, University of California Santa Cruz
- Piper Wallingford, The Nature Conservancy
- Walter Heady, The Nature Conservancy

Sea level rise and other climate change impacts will have profound effects on our coastline and its natural resources. California harbors high numbers of native, rare, and imperiled species in an array of unique coastal habitats. The Nature Conservancy and the California State Coastal Conservancy developed a report which found that approximately 59% of the area of California's coastal habitats is vulnerable to losses from sea level rise. Conserving and restoring adjacent areas suitable as migration space for coastal habitats is a critical adaptation approach to mitigate anticipated losses due to rising seas. This will require strategic retreat to restore vulnerable land uses with varying levels of development to coastal habitat as sea levels rise, increasing the risk of coastal flooding and natural disasters. Minimally developed areas that are vulnerable to sea level rise impacts such as coastal agriculture and minimally developed lands are opportunities for conserving migration space as potential future coastal habitat. Strategic retreat in areas with more developed shorelines such as the San Francisco Bay Delta and the California South Coast will also be important if California is to achieve its ambitious goals for the coast, including conserving 30 percent of the state's lands and coastal waters by 2030. Some of the coastal built environment — including roads and other infrastructure — are also vulnerable to sea level rise and create barriers that prevent coastal habitats from moving inland. Strategic retreat and adaptation of the built environment when combined with natural infrastructure has the potential to simultaneously protect human communities and enhance the extent and resilience of coastal habitats. There is a role for conservation organizations, in partnership with governments and community organizations, to help identify and implement equitable climate adaptation strategies, including strategic retreat, that protects and restores nature and provides resilience and other benefits to communities. This session will discuss The Nature Conservancy's effort to identify opportunities in California for equitable strategic retreat and/or built environment adaptation that benefits nature and communities by enhancing existing coastal habitat area or function and/or providing room for natural infrastructure. We will also discuss how we are integrating social equity as a critical pillar to ensure resilience and other benefits go to coastal communities that have been historically burdened with negative environmental impacts. We will also explore how California policy is (or isn't) exploring realistic, transaction-based pathways for strategic retreat.

The social dimensions of managed realignment of agricultural dykes and restoration of tidal wetlands on the Bay of Fundy coast

- Kate Sherren, Professor, Dalhousie University (presenting)
- Brandon Champagne, MA Student, Department of Geography and Environmental Studies, Saint Mary's University
- Yan Chen, PhD candidate, School for Resource and Environmental Studies, Dalhousie University
- Lara Cornejo, Postdoctoral fellow, School for Resource and Environmental Studies, Dalhousie University
- Isabel Cotton, PhD candidate, Tyndall Centre for Climate Change, University of East Anglia
- Samantha Howard, PhD candidate, School for Resource and Environmental Studies, Dalhousie University
- Paria Movaghati Nashta, MES student, School for Resource and Environmental Studies, Dalhousie University
- Kara Pictou, Community-based Monitoring Coordinator, Department of Environment and Natural Resources, Confederacy of Mainland Mi'kmaq
- Emily Wells, MES student, School for Resource and Environmental Studies, Dalhousie University
- Danika van Proosdij, Professor, Department of Geography and Environmental Studies, Saint Mary's University
- Qiqi Zhao, PhD candidate, School of Geography and Ocean Science, Nanjing University

As climate change causes sea level rise and increased storm surges in the already-megatidal Bay of Fundy at the top of the Gulf of Maine, the agricultural dykeland system can no longer be maintained at its current scale. The dykelands were created starting in the 1600 by early French settlers to the region (Acadians) by dyking and draining tidal wetlands, resulting in some of the richest agricultural soils in the region. Hundreds of years later a system designed to protect agricultural land now protects a range of land uses, including areas recognized by UNESCO, and the dykes are locally valued for recreation and coastal access. Resources will not extend to raising all dykes to new climate change requirements, and interest is growing in returning to the nature-based protection and other benefits provided by the erstwhile tidal wetlands. The social dynamics of decisions currently being made to modernize the dykes—variously reinforcing, removing or realigning dyke and in places restoring tidal wetland—have complex trade-offs for people depending on their proximity, identity and patterns of daily life. This presentation will synthesize research done on the Nova Scotia Bay of Fundy coast using Q-methodology (2016), social media images and text (2018-2022), farmer and traditional knowledge interviews (2020-23) and survey methods (2022-23) to explore attitudes about and implications of the managed retreat of this coastal infrastructure and its related landscapes and ways of life. The more recent phases of this work uses cultural ecosystem services and relational values for synthesis purposes, consistent with the region's use as one of six national case studies in the NSERC ResNet project that seeks to explore the utility of such frameworks to guide sustainable decision-making in working landscapes. The wide range of methods we used were required to capture stakeholder and rightsholder perspectives across a wide range of demographics, and to better understand perceptions of tidal wetlands that were otherwise elusive. Tidal wetlands—being largely extirpated thanks to longstanding dyking activities—are less salient to most settler populations than the anthropogenic dykelands. By contrast, for local Mi'kmaw people, those who have occupied the area for time immemorial and for whom the Bay of Fundy and its wetlands are the foundation of many important stories, the dykelands lack salience. Dykeland decision-making is thus an issue of treaty rights and decolonisation as

well as risk and environmental management.

Speakers

Jared Enriquez
Assistant Professor of Planning
University at Albany, SUNY

Celina Balderas Guzman
Assistant Professor
University of Washington

Justine Bell-james
Associate Professor
University Of Queensland

Alyssa Mann
Climate Resilience Project Director
The Nature Conservancy

Kate Sherren
Full Professor
School for Resource and Environmental Studies, Dalhousie University

16D) Climate and Social Science for Managed Retreat

1:30 PM - 3:00 PM, Jun 23

Broadway Room

Atoll Habitability Thresholds

- Mark Stege, Maloelap Atoll Local Government (presenting)
- Michael B. Gerrard, Andrew Sabin Professor of Professional Practice and Director, Sabin Center for Climate Change Law, Columbia Law School
- Benjamin Orlove, Professor, School of International and Public Affairs and Senior Research Scientist, Columbia University
- Jon Barnett, Australian Research Council Laureate Fellow, School of Geography, Earth and Atmospheric Sciences Faculty of Science, The University of Melbourne

Sea-level rise and increasingly variable rainfall resulting in more frequent prolonged droughts pose a risk to the habitability of atoll nations, compelling government leaders, citizens, and many observers to ponder whether migration may be necessary. Knowing when managed retreat should be a response to sea-level rise and droughts requires understanding the locality and thresholds of change at which the ability of people to adapt-in-place on atolls is compromised. Flooding in particular will be a major driver of habitability thresholds on atolls, and while the literature suggests that coproduction of flood risk science can achieve both scientifically and socio-politically favorable results, there is a paucity of any such flood risk science conducted in atoll nations. Similarly, prolonged droughts due to multiple El Nino events in the past decade have spurred major investment projects that aim to expand water storage capacity in rural communities, yet the central role of remote communities in defining and implementing their own water safety plan has not received adequate attention. To this end, this paper explains the development of the Reimaanlok framework, which is endogenous to the Marshall Islands and is ideally suited to the coproduction of flood risk science and water safety plans to support isolated atoll communities who wish to advance adaptation and migration planning. Based on the author's experiences in implementing the Reimaanlok framework in the Marshall Islands, I will propose some guidelines for engaging locals in the coproduction of flood risk and water safety knowledge. These guidelines and the Reimaanlok framework can enable accurate and locally-owned knowledge to help people on atolls plan for climate change.

Traditional Ecological Knowledge in targeting a culturally meaningful retreat in the Arctic

- Jaimlyn Sypniewski, PhD candidate, Oregon State University (presenting)
- Jamon Van Den Hoek, Associate Professor of Geography in the College of Earth, Ocean, and Atmospheric Sciences, Oregon State University

The effects of climate change impact the livelihoods of geographically remote Native communities across the Alaskan Arctic, causing several villages to undertake forced or managed retreat. Although there have been numerous forecasts on likely changes to temperature and precipitation regimes in the Arctic, there have been few studies that explicitly consider how to sustain traditional Tribal land use and natural resource use following managed retreat. Moreover, as environmental hazards such as rapid erosion and flooding more frequently motivate managed retreat, understanding, and planning for both environmental and societal impacts is necessary for deciding between reinforcement or relocation; and, for the latter, the selection of a new settlement location. Working with Tribal communities, we are co-producing a risk map that identifies how the magnitude and timing of climate events may shift where traditional Tribal practices can be sustained under future climate conditions. Identifying the key environmental variables that underpin these traditional practices is a crucial step in this effort and relies on integrating Traditional Ecological Knowledge and coproduction with Indigenous partners at each stage in the research process. We complement the often-qualitative Traditional Knowledge framework by including quantitative assessments of climate variables that support Indigenous activities (e.g., hunting grounds, berry harvest, fish harvesting). By understanding the influences of climate, physiographic, and biophysical factors (e.g., precipitation, temperature, elevation, soil type) that currently support these activities, we seek to model the suitability of key places to sustain traditional activities now and predict future shifts in the suitability of these sites, as well as identifying potential new areas based on expected climate change. By comparing the conditions at the places that have sustained culturally meaningful activities with a map of climate

risks such as food insecurity, erosion, and drought, this research offers new insights into planning for a culturally sensitive managed retreat that sustains the traditional practices of Alaska Tribes.

Anthropocene im-mobilities: exploring the materiality of 'thick time.'

- Giovanna Gini, PhD candidate, Queen Mary University of London

This paper discusses 'thick time' in the process of the forced relocation of the community Enseada de Baleia affected by 'anticipated' climate change impacts. Neimanis and Walker (2014) refer to 'thick time' as the intertwining of different timescales in the everyday. In 2016, the small fishing community of Enseada da Baleia off the south coast of Brazil was forced to relocate because of coastal erosion and rising sea level. These phenomena were widely interpreted as effects of anthropogenic climate change, which in addition to real estate speculation, restrictive laws, and declining fish stocks continues to threaten the livelihood and sustainability of the community. In this context, I explore how climate mobility is a process embedded in past, present, and imagined futures.

The paper argues that thick time is immaterial and material: immaterial as memory emerges in the encounters between humans and fish's bodies and flesh; material as the connection with the land inhabited time ago by the elders. The memory of the eldest member of the community was the determinant in choosing the site to build the 'new' place; the future which is characterised by uncertainties and abrupt changes; and the contemporary experience of climate change coalesces in materialities, actions, and narratives on every day of the community. The experience of the community highlights how intergenerational histories and stories merged. The material and immaterial aspect of the temporalities in which the relocation took place takes the form of resistance to being washed away by the forces of late capitalism and climate change.

To challenge the inevitability of linear time, I use allegories of water, waves, and deepness to articulate the notion of "thick time" in which a philosophy of time as knotted and circular emerges, connecting the community to ancestral lives and practices. As tides come and go mobilising sediments bringing the past to the present, the community relocated to a place that elders used to habit. For the community, this is a way to ensure continuity after the destruction of a home, going back to the uncertain future.

Coastal Adaptation Pathways – The case of Folly Beach, South Carolina

- Tess Doeffinger, Postdoctoral Researcher, University of Delaware

A historical pathways analysis is conducted for a barrier island off Charleston, South Carolina – Folly Beach – to highlight how decision makers have invested in coastal adaptation. This includes investments in infrastructure, institutional policies, and information. Semi-structured interviews and a literature review are utilized to inform the case study and to develop a narrative and timeline for the community. Initial results show the community has several adaptation pathways focused on beach nourishment, development, and flooding that have all coevolved through time to shape the island's risk profile and habitability. In addition, not all pathways found were linear, with beach nourishment operating in a cyclical pattern and development not following a strictly linear pathway either. By identifying these historic pathways, we can better understand path dependencies and triggers of change. We can also begin to understand at what point in these pathway cycles we can act to induce the most change and alter an island's trajectory towards a more sustainable development pattern by implementing policies such as larger setbacks from the oceanfront and marsh side of the island or limiting new development.

Speakers

Mark Stege
Maloelap Atoll Local Government

Jaimlyn Sypniewski
PhD Student
Oregon State University

Giovanna Gini
Researcher
RESAMA

Tess Doeffinger
Postdoctoral Research Fellow
University of Delaware