

Risk, Vulnerability and Relocation

Enhancing the inclusion of vulnerable communities in adaptation planning

Author: David Samuel Williams (Istanbul Policy Center, Sabancı University)

Achieving the threshold of 1.5°C global warming set out in the Paris Agreement appears increasingly unlikely. There is ample evidence suggesting this global failure to limit global warming is already being experienced by vulnerable communities in the form of increasingly frequent and intense climate-induced extreme events undermining the struggle against impoverishment, loss of livelihoods, adverse implications on human health, food and water insecurity, and displacement. While the wealthy have the means of escaping these impacts, those less fortunate are left to suffer, exacerbating inequality and leading the United Nations Special Rapporteur on Extreme Poverty and Human Rights to forewarn of a burgeoning “climate apartheid”. Rapid and unplanned urbanization, in combination with the impacts of climate change, is increasing the vulnerability of the urban poor to climate-induced extreme events. Currently 3.9 billion people, or just over half of the world’s population, reside in urban areas. This number is projected to rise to 6.3 billion by 2050, when 66% of the world’s population will be considered urban. In absolute terms, this represents an addition of approximately 2.4 billion people to the global urban population. This rapid urbanization process, which will largely take place in cities and towns of the Global South, poses significant challenges to urban planners. The rapid growth of cities places pressure on the state and civil society organizations to provide adequate and affordable shelter and services for the urban poor, especially new migrants. Insecure employment and unemployment, poverty, the lack of alternate housing opportunities, social and economic exclusion, and the need to be located close to urban resources and opportunities, reinforces pre-existing patterns of urban marginalization. The origins of urban marginalization can be traced back to power imbalances resulting from shortcomings of historical development producing and reproducing intersectional impacts involving race, religion, sexual orientation, economic class, gender, language, or nationality. These conditions of socio-economic and political marginalization in urban spaces not only determine and enhance vulnerability to external hazards, but are also augmented and compounded by climate change dynamics. This explains why marginalization needs to be understood as a key underlying driver of vulnerability to climate change impacts. The challenge of climate change adaptation is to avoid adaptation outcomes in which past injustices resulting in communities being exposed to severe impacts are reinforced. When limits to adaptation are reached, community relocation is increasingly seen by decision-makers and policy planners as a necessary and viable response. Relocation may have the potential for reducing the exposure of vulnerable communities to climate change impacts and increasing development opportunities through close proximity to physical and social infrastructure. However, real-world examples show how the lack of appropriate relocation sites has actually in many cases hindered access to sustainable livelihoods and can lead to isolation and impoverishment of those forced to relocate. A determining factor in the few successful relocation processes has shown to be the involvement of affected communities in the decision-making and planning process. This is why the inclusion of vulnerable communities in climate change adaptation planning is so crucial. The aim of this research is to develop and apply a method for assessing and enhancing the inclusion of vulnerable communities in adaptation planning. Utilizing the concept of urban adaptation justice, this study is carried out in Istanbul, a coastal megacity at the interface of increasing urbanization dynamics and with significant exposure to climate change impacts. Istanbul has been identified as the most vulnerable city to climate change impacts in the Mediterranean, emphasizing the urgent necessity of an effective approach in

preparing for and responding to climate change. Frequent heatwaves, reduced precipitation, changes in seasonal climate, and a transition from semi-humid to semi-dry and dry conditions have already been observed in the eastern Mediterranean over the past 40 years. Recent climate-induced extreme events in Istanbul have been predominated by pluvial flooding, as well as heatwaves and droughts, causing loss of life, damage to infrastructure and disruption to urban transport systems. Projected climate change impacts include the intensification of precipitation events causing fluvial and pluvial flooding as well as landslides. As a coastal city, Istanbul is also vulnerable to coastal flooding from sea-level rise. This increases the risk of economic damage and reductions in human well-being. Overall, annual average precipitation rates are projected to decline, potentially affecting residential water availability. Water stress is therefore expected to increase, compounded by a rise in demand in times of more intense and frequent droughts and heatwaves leading to impacts on health and well-being, and further increasing the risk of wildfires. Urbanization has shown to exacerbate vulnerability to climate change impacts. In recent decades, Istanbul has undergone rapid urbanization as well as population and economic growth. These highly dynamic processes have resulted in the occupation of environmentally precarious land with high exposure to extreme weather and climate events, increasing spatial segregation and social and economic marginalization across the city. According to the Istanbul Climate Change Action Plan, the city is home to many vulnerable communities. It is important that vulnerable communities are not treated as victims, but as active managers of risk whose vulnerability is defined by everyday patterns of social interaction and organization, access to resources, and exposure to climate change impacts. The first objective of this research is to explore and assess existing approaches to climate change adaptation and how these address and consider vulnerable communities. This will be achieved by identifying the criteria for urban adaptation justice and subsequently relating them to current practices in Istanbul through a policy content analysis of adaptation plans and strategies, as well as expert interviews with municipality officials, civil society organizations, and academics with relevant local expertise in the field. The second objective is to identify and develop processes for enhancing the consideration of vulnerable communities in climate change adaptation practice. This will be achieved by comparing current adaptation practice in Istanbul to other municipal and national adaptation plans and identifying best practice examples.

Integrated Climate Risk Assessment and HyperLocal Approaches to Climate Adaptation for South Florida

Co-Authors: Tyler Harrison (University of Miami), Angela Clark (University of Miami), Amy Clement (University of Miami), Joanna Lombard (University of Miami), Gina Maranto (University of Miami), Abraham Parrish (University of Miami), Sam Purkis (University of Miami), Marcus Reamer (University of Miami), Olivia Collins (The CLEO Institute), Caroline Lewis (The CLEO Institute), Mayra Cruz (Catalyst Miami), Anaruth Solache (Catalyst Miami)

Government decision makers typically rely on a suite of approaches to elicit citizen input on policy issues, most of which have been shown to capture only limited subsets of stakeholders. Our interdisciplinary group, under the auspices of the University of Miami Laboratory for Integrative Knowledge, has developed a novel method for integrating high level map data with story-telling and design thinking to better facilitate community members' ability to participate in policy decision. Our process begins with the development of an Integrated Climate Risk Assessment (ICRA) for each community that, through hyperlocal scaled data, enables GIS mapping of vulnerabilities across the spectrum of environmental and social risks, including economic, health, food, water, flooding, housing, transportation, greenness, and social and cultural dimensions. This is followed by a series of online workshops (due to COVID

restrictions), implemented in conjunction with our community partners (CLEO Institute and Catalyst Miami), in two underserved Miami communities in South Florida - Little River and Homestead. Participants took photographs of climate-related subjects in their neighborhoods and crafted narratives around them using Photovoice. Neighborhood ArcGIS maps provided concrete data for assessing conditions. Design thinking then enabled participants to identify shared concerns, imagine better circumstances, and identify partners in the not-for-profit, government, and business sectors for making change. A final workshop involved presentations by participants to some dozen agency and elected officials' offices from Miami-Dade County and City of Miami. We report on how the ICRA was developed, the initial findings from these workshops, and how they advanced dialogue with key government and community officials around possible solutions and effective paths forward.

Optimal Coastal Protection Against Storm-Induced Flooding and Sea Level Rise Accounting for Stakeholder Input

Co-Authors: Yuki Miura (Columbia University), Philip Dinenis (Columbia University), Kyle Mandli (Columbia University), George Deodatis (Columbia University), Daniel Bienstock (Columbia University), Heather Lazrus (UCAR), Rebecca Morss (UCAR)

Coastal regions are threatened by storm-induced flooding, and this threat is only amplified by changing climate, such as rising sea levels. This will, in turn, cause smaller storms to become larger threats than would otherwise be expected, leading to possible catastrophic damage to regions that may not have experienced these types of events as often in the past. Coming up with an optimal mitigation strategy for these future events is therefore critical to the continued existence of coastal communities that are threatened by storms. However, finding these optimal strategies are far from trivial. The problem includes hydrodynamics, socio-economics, and budgetary constraints. The full breadth of strategies also must be considered, including barriers, wetland creation, and retreat, along with combinations of these strategies. Along with these mechanisms, the full methodology also uses stakeholder input that is then incorporated into the modeling so that knowledge and constraints not captured by the physical and economic models can still be captured. Here we will discuss how this optimization methodology was applied to New York City and how it may be applied more generally.

Socioclimatic Risk across the Conterminous USA

Author: Maximilian Stiefel (University of California, Santa Barbara)

Climate hazards will increasingly threaten human well-being across the conterminous United States (CONUS) as the geography of exposure to wildfires, floods, heatwaves, extreme storms, and droughts changes over the next few decades. These hazards vary by frequency (rate of return), intensity (deviation from average conditions), and duration (length of event), which human activity moderates through climate and land use change. Human activity also moderates hazard severity; living in exposed areas, building faulty infrastructure, and limiting the quality and availability of institutional support renders communities at higher climate risk, i.e., disaster probability and loss. Social vulnerability determines how well communities prepare for and cope with this risk. Although many studies have examined social vulnerability to climate change, there lacks a succinct yet representative analysis of index and factor-level social vulnerability to multiple climate hazards across CONUS. We measure social vulnerability at the Census Tract level using the Social Vulnerability Index. Socioclimatic risk analysis combines the

geographies of social vulnerability and climate risk to better understand where, who, and what is most at risk to a changing climate. Governments can implement climate adaptation planning to reduce socioclimatic risk, but will need to target resources towards social factors and places that need them most. We observe climate risk disparities across levels and factors of social vulnerability, locate socioclimatic risk hotspots, assess the internal and external validity of SoVI when applied in a climate hazard context, and identify the most important socioeconomic and demographic characteristics determining social vulnerability for each climate hazard. Our main research question is whether the burden of climate risk will increasingly fall on the socially vulnerable. We expect future risk to disproportionately increase in: socially vulnerable communities, already high climate risk places, spatial extent, intensity, frequency, duration, and severity (when measurable), all on average across CONUS. Climate hazards generate the greatest life and economic loss of all hazards. A changing climate demands greater attention towards documenting and analyzing the shifting impacts and inequities of climate risk. Coupling this with our current knowledge of social vulnerability will help communities become more resilient.

Tropical cyclone risk modeling

Co-Authors Adam Sobel (Columbia University), Chia-Ying Lee (Lamont-Doherty Earth Observatory, Columbia Univ.), Jane Baldwin (Lamont-Doherty Earth Observatory, Columbia Univ.), Suzana Camargo (Lamont-Doherty Earth Observatory, Columbia Univ.), Michael Tippett (Dept. of Applied Physics & Applied Mathematics, Columbia University), Kyle Mandli (Dept. of Applied Physics & Applied Mathematics, Columbia University), Katy Wilson (Columbia University)

Before permanent inundation occurs in low-lying coastal areas, sea level rise increases flood risk by exacerbating flooding from extreme weather events. In many coastal areas the most important such events are tropical cyclones, so decisions about managed retreat from such areas should be informed by the best available scientific assessment of tropical cyclone risk. In this presentation, we will review the state of the art on tropical cyclone risk modeling and introduce a new Columbia World Project on this topic.

Currently, the field is dominated by private sector models developed for the needs of the reinsurance industry. These models are proprietary, do not account well for climate change, and are best developed for the United States and other relatively wealthy countries where insurance coverage is greatest. Our project is based on the Columbia Tropical Cyclone Hazard Model (CHAZ) which is open source, global, and whose synthetic tropical cyclones are conditioned on large-scale climate so that climate change can be represented by “downscaling” results from earth system models.

Current efforts, in partnership with nonprofit, private sector, and academic partners, involve 1) assessing the climate change component of tropical cyclone hazard in the present and future, and 2) developing representations of exposure and vulnerability so that we can properly model risk, rather than just hazard. Representing exposure and vulnerability using publicly available data on the global scale poses challenges that we believe are worthy of much more study than they have seen thus far. The challenges are not just scientific, but also ethical, as demand for globally consistent information exists in some tension with the goal of incorporating local perspectives.

Understanding the Impacts of Managed Retreat and Resettlement on Informal Communities in Puerto Rico

Co-Authors: Santina Contreras (Ohio State University), Monique Lorenzo (Ohio State University)

Managed retreat and relocation are frequently discussed as approaches useful for improving the livelihoods of communities living in hazardous environments. However, in environments with highly vulnerable areas, such as informal communities, the relocation process may inadvertently uncover new risks, such as exposure to new types of hazards and disruption of community networks. In Puerto Rico, Hurricane María exposed widespread issues in the living and housing conditions of the urban poor, particularly within the informal sector. A key issue surrounding the vulnerability of informal communities across the island centered on their exposure to environmental hazards, such as storm surges, sea-level rise, erosion, and other extreme weather conditions. To deal with these issues, relocation and resettlement activities have been carried out in an attempt to minimize the risks associated with living in these hazardous areas. However, despite the potential benefits of this hazard mitigation approach, the relocation of these communities opens up questions surrounding the larger decision making and resettlement process and broader risk exposure of informal communities. This research addresses these issues through an in-depth qualitative case study assessment of the relocation and resettlement initiatives in two informal communities in Puerto Rico (Vietnam and Villa del Sol). Data collection included (1) hazard risk assessments, (2) in-depth semi-structured interviews with public officials, planners, and other contextual experts, and (3) focus groups with community leaders in Puerto Rico. Specifically, the research considers the following research questions:

- What decision-making processes inform the resettlement and relocation of informal communities in Puerto Rico?
- How do the hazard risk exposure and perceptions impact resettlement and relocation policies and practices in Puerto Rico?
- How are informal communities engaged in resettlement and relocation policies and practices in Puerto Rico?

Through the assessment of resettlement, relocation, and managed retreat of informal communities in Puerto Rico, this project aims to contribute to discussions surrounding the equitable implementation of hazard mitigation and planning efforts in informal and vulnerable communities.