

Land and the Built Environment

What would a large-scale coastal retreat policy really look like? A scenario planning case study on coastal Long Island, New York

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The idea of “managed” coastal has received considerable attention in the press and academic literature, and a growing literature has examined some of the more recent and noteworthy buyout and relocation programs in the U.S. seeking to develop useful models and experiential lessons (Binder & Greer 2016, Behr & Considine 2020, Bukvic & Borate 2020, Mach et al. 2019, Bukvic & Owen 2017, McGhee et al. 2020). But recent climate projections paint a much more dire picture for coastal communities in the United States, suggesting that in some highly developed areas of the eastern seaboard, entire neighborhoods and municipalities are at risk from sea level rise and more powerful storms. Public policy, meanwhile, continues to wrestle with the most effective and equitable mechanisms by which to address these growing risks. Assuming that large-scale coastal relocation will someday be necessary, however, there is very little clarity how such a program might work in practice and what challenges it would face.

We attempt to address these questions through the use of a novel scenario planning approach (Chakraborty et al. 2011) to address a series of critical questions that local, state and federal governments will need to address as coastal risks increase. This approach can begin to help quantify the costs and impacts of large-scale retreat programs in urbanized coastal counties. For this study we employ a combination of spatial and policy analysis and ask a series of important, policy relevant questions. We focus our analysis on the Town of Hempstead, a 120 square mile sub-county jurisdiction with Nassau County on suburban Long Island just west of New York City. The town, which contains 22 incorporated villages and a total population of 759,757, includes numerous barrier islands and more than 20 linear miles of coastline. The town was heavily impacted by Superstorm Sandy and significant portions remain vulnerable to sea level rise and storm-induced flooding. Using this single jurisdiction, we ask a number of key questions that will be central to developing effective coastal retreat and community relocation programs in the future.

Question 1: Which homes in the Town of Hempstead are vulnerable to coastal flooding? For this first question, we use USGS sea level rise projections, to identify which developed parcels in the county would be at risk under ten different sea level rise projections over the next century.

Question 2: What are the direct costs of a large-scale retreat program? A central challenge of large-scale retreat programs is the upfront costs required to induce relocation. In the United States, property rights law, the high cost of coastal property, the perverse incentives of flood insurance and the desirability of coastal locations means that coastal retreat programs will face perennial challenges (Henderson 2018, Craig 2019). Retreat programs may use combinations of mandatory (i.e. eminent domain) and voluntary approaches, which may also include incentives (Siders 2013). Based on interviews with coastal planners in the region, our experience suggests that in the current political climate “Making everyone whole” (i.e. government purchase of homes at full value or more) is currently the most effective strategy for facilitating acquisition. If that is the case, effective public policies will soon need to begin dealing with

the anticipated long-term changes that coasts will need to undergo. The first step in crafting effective adaptation policies will be understanding what the upfront costs will be for state and local governments and the federal government. We use local tax assessor Fair Market Value as a proxy value for the cost of acquiring individual homes. While this is admittedly a coarse proxy, coupled with the flood risk data from the first task, we can use these data to calculate costs for buyouts of at-risk homes under a variety of scenarios, developing a matrix showing anticipated public costs for large-scale retreat in coastal Hempstead under a variety of sea level rise scenarios and at various incentive levels (e.g. 75% of FMV, 100% of FMV, 110% of FMV etc.)

Question 3: What will the impact of retreat programs on local tax bases? Among the most salient challenges to the concept of coastal retreat is the effect on the local tax base when a large number of (often high-value) homes are removed from the local tax rolls. This has been a particularly vexing issue in coastal New Jersey, especially in small beach communities that rely on property taxes for most of their revenue (e.g. Coppola 2016). While Hempstead has a large and diverse tax base, the number of vulnerable properties nonetheless represent significant financial risk for the town as well as smaller jurisdictions within it, such as school districts, which we can quantify using this approach. Tax assessor data will be georeferenced to sea level rise scenarios and the long-term fiscal impacts of retreat will be reported both in dollar values and as a percentage of local tax income for affected taxing entities, along with discussion of the implication of these changes.

Fourth: Are local plans and policies in place to mitigate the effects of large-scale coastal retreat? When property buyouts do occur, they have both positive and negative effects. While buyouts predicated on a coastal retreat strategy may decrease physical vulnerability of a community, they also disrupt social networks and create new logistical challenges (e.g. new commuting patterns) in addition to the aforementioned loss of tax ratables. This is why many existing buyout programs such as New Jersey's Blue Acres program include an incentive for local relocation wherein property owners taking a government buyout offer can receive additional money if they relocate within the same jurisdiction (e.g. town or county). Some programs have even moved entire communities to new locations or to homes in close proximity to one another (Siders). However, such approaches can be challenging on many parts of the developed US coast where, like Hempstead, there may be little available land onto which to relocate residents. To assess how this issue might play out in Hempstead, we analyze local master plans and zoning codes to calculate how much developable land and as-of-right increased density is available in the Town of Hempstead that could theoretically act as a "receiving area" for coastal residents who accept buyouts but wish to stay within the town. Plan analysis also assesses the degree to which the town anticipates the issue of coastal retreat. Interviews with local planning officials also help provide context and nuance to understand how, or if, the community is attempting to proactively address these issues in long-range planning and public policy efforts.

Preliminary analysis suggests that the town and its municipalities stand to lose billions in tax ratables under even the least dire climate change projections due to the mismatch between the number of properties at risk to sea level rise and the limited amount of existing development potential due to restrictive zoning and development codes, a challenge that is poorly addressed, if at all, in existing plans and policies. We conclude by offering a set of actionable recommendations for planners facing the potential for coastal retreat in their localities and lessons for replicating and scaling this methodology for other locations.

Identifying Climate Gentrification Across the East Coast of the United States: A Machine Learning Approach

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Climate change may contribute to gentrification by creating and reinforcing new pathways of displacement in cities, especially in vulnerable coastal areas. This study aims to advance the scientific understanding of climate gentrification by combining environmental and socioeconomic data to investigate how environmental stresses in coastal regions in the East Coast of the United States may contribute to climate gentrification. Using publicly available data, we identify how rates of coastal land erosion and flood histories correlate with socioeconomic community changes associated with gentrification. We then seek to bypass limitations of traditional threshold-based methods of identifying climate-induced gentrification by using an unsupervised machine learning technique. We combine economic, demographic, housing, and environmental data to identify potential typologies of climate gentrification using a k-means clustering algorithm. The goals of this work are to (1) identify where climate gentrification may be occurring across the East Coast of the United States, (2) classify typologies of climate gentrification based on patterns in social vulnerability, housing, and environmental exposure indicators, and (3) provide insights into the most important predictors of climate gentrification. To address these questions, we have assembled an interdisciplinary team of graduate students from seven different institutions, supported by the National Socio-environmental Synthesis Center (SESYNC). Here, we present initial results of this work, including preliminary clustering analysis findings. By applying our methodology across the East Coast of the US, we are able to begin to capture the multi-temporal, multi-spatial, and multi-dimensionality of climate gentrification pathways. In this way, our analytical approach and results have the policy implications to improve environmental justice and outcomes for vulnerable communities by providing insight into drivers of climate gentrification.

The design and implementation of public space as a problem and opportunity for managed retreat iterations and risk reduction both in physical and knowledge territories: Lessons from urban design practice in Puerto Rico

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The design and implementation of public space as a problem and opportunity for managed retreat iterations and risk reduction both in physical and knowledge territories: Lessons from urban design practice in Puerto Rico to face climate change Fernando Pabón Rico, B. Arch., M.U.D., RA, CAAPPR
Keywords: Urban Design, Challenges posed by climate change, Solutions, Representation of change as an instrument of design
Over the past ten years several experiences and projects in Puerto Rico have brought greater clarity to the tasks required from urban design to address a warming planet, climate change, and associated changes in the extents of the oceans' surface. Successfully questioning various narratives that encourage the expansion of the built realm as opposed to its contraction or retreat, has steadily become one of the main challenges of any urban design project. The practiced discipline has been testing whether the design of public space can meet this challenge adequately. Proposed and built public space projects demonstrate that just as in the past, the urban future is defined by the intersection between land and water. The classic problem of water management, its presence, movement, and impact in public and private space has been observed to become a common theme and a central topic as well as an opportunity in the design of public space. Water has been embraced, grudgingly accepted, or

repelled by any means necessary. This opportunity is taken to re-examine the significance and pertinence of the questions and solutions posed in each project. What challenges were encountered in the process and how were they met? What has revealed itself to have become obsolete? Where did innovation take place? What questions remain unanswered? Bringing to light knowledge and instrumental gaps in addressing the problems associated with climate change has been the main result of engaging in urban design practice in the sensitive territory of the shore and neighboring drainage basins. This might be even more important than the physical result itself. Institutionally, we are not directing our energy and resources to yield that kind of product often enough, deeply enough, or in a coherent enough way. We are not designing for that objective nor objectively enough. We are not inquiring, measuring, testing, diagnosing, revisiting, or updating the prevalent state of knowledge adequately. There are significant institutional deficiencies in programmatic, regulatory framework, and master planning governance areas. However, the discipline is proving its extraordinary value at addressing the challenge of climate change through the design of public space which, like water, is demonstrating itself to be capable of absorbing changing circumstances and demonstrating both resiliency and adaptation.

Evaluating Land Use Tradeoffs on Agricultural Lands Affected by Sea Level Rise

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Coastal Maryland and Virginia have one of the highest rates of sea-level rise in the United States, which has caused increased inundation and saltwater intrusion on coastal land. Farmers and woodlot owners in the region have reported loss of arable acreage and decreased yields due to wetter and saltier soils. As part of a National Science Foundation Coastlines and People conference grant, we investigated how farmers and woodlot owners make decisions on how to manage their property when faced with chronic environmental change. Through semi-structured interviews, surveys, and virtual workshops, we learned about the priorities, goals, and challenges of about 20 different farmers and woodlot owners in coastal Maryland and Virginia with respect to sea level rise and saltwater intrusion. We specifically focused on eliciting information on how farmers and woodlot owners were weighing various factors in making decisions about how to manage their increasingly inundated land going forward. We analyzed our qualitative and quantitative data using a Resist-Accept-Direct framework; i.e. what are the inclinations or disinclinations to management options that attempt to (1) protect against flooding and saltwater intrusion, (2) accept wetter and/or saltier conditions, or (3) adopt a new type of land use. In this presentation we will share insights into the decision-making process of farmers/woodlot owners and its implications for policies for land use, agriculture, and managed retreat.

Decision-Support Tool for Testing Managed Retreat Policies: A Framework

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Sea level rise and advanced hydraulic modeling projections¹ have provided insights as to where future intense flooding is expected. However, researchers have yet to forecast where future housing will be located at a regional scale, and whether future housing construction patterns will conflict with future

flood risk areas. This talk will present a framework to forecast housing development under different policy scenarios to support decision-making surrounding managed retreat approaches. The tool will be based on the Dynamic Building Inventory Model (DBIM), currently in progress, which will predict the quantity and location of future housing units based on housing, socio-economic, and land use data for 1,000 counties in coastal states from Delaware to Texas. The DBIM will first predict where new houses are expected to be located under a “business as usual” scenario. The initial analysis will provide insights to policy-makers by identifying where future home construction will likely conflict with areas of increased future flood risk and will quantify the expected structural damage caused by future flooding. The DBIM will also provide a platform to test different land use management policies, such as building restrictions in areas with significant future flood risk, density bonuses in areas with lower flood risk, or other land management strategies. The greatest opportunity for the DBIM decision support tool is its ability to be joined with a stakeholder decision-making model². Similar to the model presented in Wang et al. (2020), the DBIM will link with decision models for households, government agencies, flood insurers, and other related stakeholders to simulate how housing construction dynamics are expected to change when additional managed retreat policies are put in place (buyouts, heightened insurance requirements, or community relocation incentives). The power in the proposed DBIM model comes from its ability to compare targeted managed retreat policies at a regional scale. For example, the model can test how targeted buyout subsidies for underserved communities in flood risk areas across a region could be implemented over time and could provide insights as to where the community member may relocate, how much these efforts may cost, and which stakeholders will best influence desired outcomes. This project is a work in progress and the presentation will introduce the conceptual framework of the DBIM alongside initial results for a “business as usual” future home construction scenario. We will present the opportunities and challenges for the presented decision-support tool for managed retreat policies and will provide a platform for engaging feedback from audience members across sectors.

You cannot unknow this: From the Cusp of Survival to Emerging Practice

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GSA manages climate-related and extreme weather risks associated with Federal real property and supply chain investments, which are critical to deliver government services to the public both today and in the future. This work is conducted for prudent fiscal and asset management and responds directly to GSA’s customer requests/needs while reducing mission risk over the asset service life and reducing costly emergency incident responses. This session proposal is submitted at the cusp of the transition of power in the Executive Branch of the U.S. Government and cognizant of significant change in prioritization of the topics of climate risk management and managed retreat. From this basis, the session is a technical practitioner’s overview (a licensed architect working with engineers, asset managers and building operators) of the implications of managed retreat in a large real estate portfolio of mission critical, historic, and long-term assets. From the view of a person licensed to protect the health, safety and welfare of the public, the session will cover: A. Definition of problem type to inform approach. GSA leverages best business practices and actionable science applicable to real estate development to anticipate future costs and risk reporting with forward-looking climate-information. These efforts increase climate-readiness and address a national “high” risk, but managed retreat does not have a plethora of best business practices or climate-justice informed governance at appropriate scales to the complexity of the problem. Audience Engagement/Prompt use of Menti or Audience Survey 1. To you personally, what kind of problem is this? Simple, Complicated, Complex, Chaos, Not a problem 2. To the organization that you support, what kind of problem is this? 3. Has your view of the problem type

changed in the past 4 years? If so how? B. Useful Communication for the past 4 years and an assessment for the Next GSA used risk-based framing and the determination of client risk tolerance and risk appetite-to sustain relevance over the past 4 years. Through experimentation, evaluation and repetition, several specific analogies were found to be effective to keep the attention of diverse audiences and stakeholders. COVID-19 provided additional ways to communicate common aspects of the problem type to maintain relevance. Moving forward from these methods, managed retreat needs communication methods which rise to the complexity and meaningfully engage audiences that are entrenched to maintain their safety and comfort. Audience Engagement/Prompt use of Menti or Audience Survey Provide specific examples and ask the audience: 1. Are these familiar? 2. Have you found them to be useful to date? 3. Are these useful for managed retreat? C. Emerging Practice with Inclusive Partners GSA uses science and model building codes to inform technical evaluations based on professional judgement to then inform asset management and investment needs. GSA follows a procedural and methodical process to evaluate exposure and sensitivity to changing loads over time so that assets are not impaired, fail or lost. There is room and need to expand capacity and capabilities in these technical procedures to inform investment decisions to manage retreat and stranded assets. There are also priority needs to effectively move forward. These span from science-informed site selection criteria to portfolio wide documentation of vertical datum information to enhanced monitoring and evaluation methods especially for inland sites (e.g. flood and riverine areas; drought and dryland expansion; temperature extremes; wildfire in the urban-wildland interface, population migration). These combined can make an emerging practice which is defensible and repeatable using forward-looking information. Yet, there is a need to communicate that these activities are not "One and Done." At the same time, there is a need to deepen partnerships particularly with and in the accounting sector that uses a racial and social equity lens to recognize, measure and disclose impacts from extreme weather and chronic change and activities to prevent impacts from extreme weather and chronic change. Audience Engagement Prompt use of Menti or Audience Survey 1. How many feels confident about their technical procedures to evaluate exposure and sensitivity around life safety, mission continuity and preservation of historic assets? 2. How many have similar barriers to overcome? 2. What is the appetite in your organization to establish similar technical procedures? 3. How many are successfully working with accountants on these matters for your enterprise?