



Resilience Gentrification: Environmental Privilege in an Age of Coastal Climate Disasters

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Climate change is exacerbating storms at the same time that humans are increasingly settling in areas most affected by such storms. In theory, post-disaster recovery offers opportunities to rebuild for sustainable development. However, in reality, responses to climate events often result in greater inequality through a process we term *resilience gentrification*. Three possible resolutions to the coastal resilience dialectic are managed retreat, denial, and structural mitigation. Structural mitigation has become the most popular response in the Anthropocene. This response raises the cost of coastal redevelopment, giving capital greater access and control over development decisions. These changes make coastal areas more expensive and more exclusive. We illustrate this process in the post-disaster recovery of two very different communities: Gowanus, Brooklyn and the Caribbean island of Barbuda. In both cases, attempts to build it back “green” —using selective aspects of “sustainable development” as a guide—come at the cost of exacerbating existing housing inequality. In this way, “resilience” gets equated with wealth, thus reinforcing a cycle of climate injustice. To achieve a “just sustainability,” government responses must consider and address the equity impacts of climate change resilience policies. Managed retreat and degrowth strategies for climate resilience offer greater potential for a just sustainability in the Anthropocene.

Keywords: resilience gentrification, green gentrification, sustainability class, climate justice, structural mitigation, coastal resilience dialectic

A PARADOX OF OUR TIMES

By the end of the second decade of the twenty-first century it has become evident that one of the key impacts of climate change is the increased frequency and intensity of storms impacting coastal areas. In the United States, two major coastal cities have already experienced major infrastructural collapse resulting from climate-change enhanced hurricanes: New Orleans in 2007, and New York in 2012 (Gotham and Greenberg, 2008; Bullard and Wright, 2009; Greenberg, 2014a). The impacts of those megastorms were exacerbated by climate change induced rising sea levels, which increased the severity of the storm surges that devastated the levee structures of New Orleans and the subway and highway tunnels of New York. The economic losses and loss of lives in these types of disasters are on the rise globally (Yi and Yang, 2014; Cere et al., 2017). These disasters will become more regular over time. Steadily increasing precarity, a result of a set of social arrangements, is the ecological reality of coastal development in the Anthropocene (IPCC, 2018).

Paradoxically, at the same time that coastal development is facing increasing ecological threats due to climate change, there is a surge in human population in coastal areas. A global socioecological reality of the twenty-first century is a rapid expansion of both the number and percentage of people at risk on the coasts (While and Whitehead, 2013). From 1970 to 2010 the population of coastal counties in the United States increased by nearly 40% (NOAA, 2018). In 2020, 127 million people lived in coastal counties, accounting for over 39% of the total population (NOAA, 2021).

The United States is not unique in this regard. Roughly 40% of the global human population lives within 100 km of the coast, with that percentage rapidly increasing (Neumann et al., 2015). Two out of every three of the world's megacities are located on the coast, and coastal population worldwide continues to surge as rural populations migrate to those cities. Added to the global pattern of population redistribution to the coasts is the steady increase in tourism, both domestic and international (WTO, 2018). Coastal tourism development further densifies coastal development, as does vacation home construction. Through these coastal settlement and recreation patterns, communities are creating "disasters by design" (Mileti, 1999). In an age of climate change, a strategy to reduce the human and economic costs of storms would suggest settling farther from the coast. However, that is the opposite of what is occurring worldwide¹.

Given the facts that (1) climate change is exacerbating storms and storm surges, and (2) humans are increasingly settling in the areas most affected by such storms, post-disaster recovery processes will become an increasingly regular occurrence. This paradox is a microcosm that represents the broader challenges that communities face in resolving the contradictions between the social system and the ecosystem. On the coast, tensions exist between the demands of the social system (population distribution toward precarity) and the reality of the ecosystem (increasing precarity for human populations). We call this the coastal resilience dialectic to highlight the social system-ecosystem dynamic. The resolution of the contradiction can be played out in at least three ways: managed retreat from the coast, climate denial, or rebuilding using structural mitigation to protect capital investment.

Analyses of recovery efforts following disasters have historically focused on the catastrophic consequences. For instance, Kai Erikson's (1978) classic study of what happened after the Buffalo Creek Flood of 1972 documented the individual and "community trauma" that followed flooding. In the current era of climate change, this sort of work continues (see for example, Bullard and Wright, 2009). Studies of disaster recovery efforts in the United States have demonstrated that powerful

institutional responses exacerbate pre-existing inequalities (Pais and Elliot, 2008; Greenberg, 2014b). Howell and Elliott (2019:465) summarize the findings of disaster researchers: "...Socially marginalized residents are vulnerable not just to damages from natural hazards but also to subsequent recovery efforts." The proliferation of disasters has led to recent calls by sociologists to mainstream the examination of "extreme events, infrastructure, and adaptation" caused by the climate crisis (Klinenberg et al., 2020: 655) and the consequent "climate-induced displacement and migration" (Dietz et al., 2020:146).

Post-disaster recovery is sometimes presented, at least theoretically, as an opportunity to rebuild for sustainable development; in other words, as a possibility for remaking communities in ways that promote equity and environmental sustainability. Agrawal describes "natural disasters as windows of opportunity... a natural 'reset button'" (Agrawal, 2011: 291). This is manifest in calls to "build back better" and "build back green." However, the United Nations Office for Disaster Risk Reduction (2017) explains building it back better in this way: "the use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment." The U.N. description is notable for two reasons. First, the description omits reference to equity impacts or outcomes, which is related to the second item of interest. It references the murky concept of "resilience." A growing literature seeks to define and operationalize the interdisciplinary concept of resilience (see for e.g., Olsson et al., 2015; Davidson et al., 2016; Meerow et al., 2016). In a critical analysis of the concept of disaster resilience, sociologist Kathleen Tierney describes both "sustainability" and "resilience" as "boundary objects" which "enable communication across disciplines and that can smooth the way for collaboration" (2015:1331). However, on the flip side, she argues, that these terms "can be used to legitimize the activities of groups with very different interests," which can in turn obscure tensions and power relations (1331). Geographers Popke and Rhiney (2019) examine the concept of resilience in light of the post-hurricane context in the Caribbean. They note, "The twin watchwords for this paradigm [of disaster preparedness and response] are 'resilience' (as a form of preparedness) and 'building back better' (as a means of response)... Ironically, the imperative to 'build back better' relies to a certain extent upon a normalization of climate disasters; its logic contains a built-in assumption that house-by-house, island-by-island, existing forms of infrastructure and the lives and communities that they bind together, must be destroyed in order for true resilience to be imported from abroad" (2019:4). Understood in that way, "building back better" is a neocolonial project. The work presented here aligns with these critiques by seeking to further uncover the meanings of "resilience" as carried out in post-disaster recovery.

To address post-disaster recovery in a way that prioritizes equity is extremely challenging in the face of existing social and economic structures. To disrupt historic structural inequality requires political will and intentionality; and to build it

¹ A further paradox inherent in this is that some attempts to live more "sustainably" actually exacerbate the process of coastal development. For instance, Sun (2011: 2,160) notes, "[O]ur current sustainability policies promoting urban living as a key method for decreasing greenhouse gas emissions may, in fact, be hindering efforts to adapt to the effects of climate change." Journalist Owen (2010) argues that environmentalists should move to the cities to cut down on their carbon emissions, based on lower transportation emissions, living with less, and the energy efficiency of dense building structures. Similarly, those who can afford to travel "sustainably," visit coastal eco-resorts built on at-risk shorelines.

back “green” is economically costly, especially in urban areas (Sabto, 2011). Nevertheless, the extent to which these goals can be achieved—greater equity and greater environmental sustainability—is important for disaster-stricken communities that must consider whether to relocate or how to rebuild post-disaster.

This paper has two main goals. The first goal is to contribute to the literature on post-disaster recovery, and specifically, the challenges to being able to build more equitable and sustainable communities. We examine and compare the post-disaster recovery and rebuilding processes of two very different communities: one in New York City and one in the small Caribbean nation of Antigua and Barbuda. We focus on how the recovery efforts affect housing equity of affected communities. Both cases represent explicit attempts to build it back “better” and in specific, to build it back in more “resilient” ways. However, the resilience is built into the actual physical structures rather than the communities and the outcome is that even building it back “better” comes at the cost of exacerbating existing housing inequality. Public-private partnerships, a sign of the neoliberal times, are key agents in producing and reproducing inequality in these sites.

Second, we elaborate on the concept of resilience gentrification to demonstrate the (mostly) unintended outcomes of (mostly) well-intentioned plans to build it back better/greener/more resilient (Gould and Lewis, 2018a). We argue that the most common path to recovery—namely, rebuilding with structural mitigation—leads to *resilience gentrification*. This parallels the process of green gentrification in terms of its (mostly) unintended effects: greening urban areas, while positive in an environmental sense, has had the consequence of exacerbating environmental inequality (Gould and Lewis, 2017; Anguelovski and Connolly, 2018). In this case, building it back “better” and more “resilient,” also has the consequence of exacerbating environmental inequality and housing inequality. When building it back better and more resilient (structural mitigation) is prioritized in recovery, it leads to resilience gentrification. Resilience gentrification is the result of natural disaster recovery processes that prioritize policies promoting structural mitigation. Structural mitigation costs further bifurcate the haves and have nots, leading to a recovery in which “resilience” is by default defined by wealth. Structural mitigation inflates housing costs. Access to housing is distributed by wealth in capitalist economies. As rebuilt, structurally mitigated, housing is distributed upward to the wealthy, resilient housing becomes a form of environmental privilege (Park and Pellow, 2011). Resilience gentrification is a subset of green gentrification processes stemming from resilient construction as structural mitigation. Coastal resilience efforts thereby become engines of green gentrification (Gould and Lewis, 2012, 2016, 2017, 2018a; Anguelovski et al., 2019).

A sub-goal is to connect the discussion of gentrification to colonizing processes. Angotti describes gentrification as the “appropriation of economic value by one class from another” (Angotti, 2008: 108). That appropriation is facilitated by growth coalitions of state and capital actors seeking to generate public and private revenue increases (Molotch, 1976). We have defined

green gentrification as the appropriation of the economic value of environmental resources by one class from another (Gould and Lewis, 2017). Resilience gentrification uses structural mitigation to displace local populations and replace them with wealthier settlers. As such, resilience gentrification (especially in the global south) is in some ways a greenwashed version of neo-settler colonialism.

RESOLVING THE COASTAL RESILIENCE DIALECTIC

We approach this specific tension—the clash between population distribution toward the coast and increasing coastal precarity for human populations—through the theoretical lens of the treadmill of production theory (TOP). TOP is a broader theory focused on how to resolve the clash between our political-economy and ecological systems. In brief, the treadmill of production theory argues that the logic of capital is both anti-ecological, routinely increasing ecological withdrawals and additions, and antisocial, routinely delivering fewer social gains per unit of ecological disruption (Schnaiberg, 1980; Schnaiberg and Gould, 1994; Gould et al., 1996, 2008). The result is that capital must constantly expand development (growth) in order to deliver the same level of social benefits (jobs). These processes are facilitated by the state whose economic and military power depend on growth, and labor whose access to employment depends on growth to counteract job displacing investment in labor saving technology. However, according to the TOP, this is not the necessary and inevitable outcome.

According to Schnaiberg (1980) resolving the dialectic between our economic system and our ecological system could be done in three ways (Lewis, 2016, 2018). The first, is through an ecological synthesis. In this formulation, the social system would accept the new ecological limits imposed by nature in the Anthropocene. The second, the economic synthesis, is chosen when economic values supersede environmental values, and ecological limits are ignored. In the third, the managed scarcity synthesis, ecological realities are recognized, and public policy is employed to facilitate some market adjustment to those realities (along a spectrum of less or more constraint on capital). These syntheses align with the three main resolutions of the coastal resilience dialectic of the last 20 years: managed retreat, climate denial, and structural mitigation. (1) Resolving the climate resilience dialectic through managed retreat from coastal areas represents Schnaiberg’s ecological synthesis. (2) Resolving the climate resilience dialectic through climate denial represents Schnaiberg’s economic synthesis. (3) Resolving the climate resilience dialectic through structural mitigation, the strategy preferred by both enlightened capital and pragmatic environmentalists, fits within Schnaiberg’s managed scarcity synthesis. We elaborate on each scenario.

Managed Retreat

In the first scenario—managed retreat from coastal areas—the logic of ecosystems trumps the logic of capital, and the

social system adjusts to the unfortunate ecological conditions it has generated (through fossil fuel combustion, deforestation, etc.). Managed retreat includes a staged withdrawal from coastal development, and a consequent rewilding of coastal environments (sponge parks, wetlands, mangrove forests, etc.). Such an approach is consistent with broader degrowth strategies. Managed retreat could happen before or after a disaster. The idea of retreating prior to an event has made it into the popular consciousness as evidenced by news coverage of such concerns. For instance, *The New York Times* has published articles with headlines such as this: “Climate Change Insurance: Buy Land Somewhere Else: In case global warming makes their homes uninhabitable, some millennials have a Plan B: investing in places like the Catskills, Oregon and Vermont” (Nov 30, 2018). However, retreat is not a particularly popular option. Policy-making bodies do not regularly propose retreat as a viable option, in part due to opposition from real estate interests. For instance, in North Carolina, the Coastal Resource Commission’s priorities for economic growth negated any proposal for retreat (Allen et al., 2018). When retreat has been a policy option, it hasn’t been chosen by homeowners. For example, very few residents took the offer of buyouts in Staten Island after Hurricane Sandy (Koslov, 2016). In addition, a national study of buyouts of flood-prone homes found that buyout options are not equitably distributed (Elliot et al., 2020). Sun (2011) summarizes the barriers of retreat: “Unfortunately, retreat from hazardous areas is notoriously difficult to implement given pre-existing property rights, the costs associated with voluntary buy-outs, the likely disruption of existing community ties that relocation entails, and local political opposition to relocation efforts” (2157). From a TOP perspective, through managed retreat, social actors acknowledge the reality of climate change and adapt social arrangements in an ecological synthesis.

Climate Denial

A second resolution to the dialectic would be climate denial. In this scenario, the logic of capital trumps the logic of the environment, and the economy proceeds as if ecological limits are not a factor in social decision-making. This was the primary resolution to the climate resilience dialectic in the late twentieth century and early twenty-first century as both the evidence of climate change and coastal development mounted (Norgaard, 2011). Climate denial has been official policy in some vulnerable coastal areas. The state of Florida ordered its Department of Environmental Protection to omit the terms “climate change” and “global warming” in official communications and reports (Korten, 2015). In response to a study by North Carolina’s Coastal Resources Commission indicating that sea levels will rise 39 inches by the next century, the state legislature passed a law banning the use of the study in coastal policy decisions (Harish, 2012). Climate denial either rejects scientific evidence altogether, or exploits scientific uncertainty to argue that economic costs should not be incurred until all unknowns are resolved. Investments are made in manufacturing and promoting scientific uncertainty in order to delay policy intervention in markets indefinitely

(Brulle, 2013; Farrell, 2016). In a climate denial scenario, coastal disasters are treated as “natural” and normal one-off events, with losses underwritten by federal emergency management relief and insurance claims. From a TOP perspective economic values trump ecological values, and a desire for short-term economic gains override concerns for longer term ecological, economic and social costs.

Structural Mitigation

A third resolution to the dialectic would be to “build back better/green/resilient,” which could take a number of forms; the dominant one has been focused on structural mitigation. By structural mitigation, we are referring to what the United Nations calls structural measures: “any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures...” (United Nations Office for Disaster Risk Reduction (UNISDR), 2017). In practical terms, these are practices such as raising buildings, and placing heating, cooling and electrical systems on roofs instead of basements, for example. It often includes more stringent building codes and requirements to harden shoreline infrastructure. Structural measures are in essence an ecological modernization approach to addressing coastal resilience (Mol et al., 2009). With structural mitigation, the logic of capital is applied to the ecological reality of increasing coastal precarity. Capital-intensive technological fixes are employed to make a pattern of increasing coastal density less vulnerable to the pattern of increasing coastal climate risk (Carmin et al., 2015). While these measures may promote short- or medium-term economic growth, they also increase social inequality. As is often the case with technological approaches to climate mitigation, the unanticipated consequences of implementation undermine efforts at genuine socioenvironmental sustainability, which requires inclusion of strong ecological and equity components (Jorgenson et al., 2018). Structural mitigation raises the cost of redevelopment of coastal real estate. Those costs raise the price of coastal residency². Despite these issues, this is the primary response to coastal precarity in the Anthropocene. From a TOP perspective, these processes are indicative of state intervention in markets (regulating capital through building codes) to manage the relationship between ecosystems and the treadmill, without fundamentally challenging the growth imperative of capital. Structural mitigation is also supported by state subsidies through higher public infrastructure costs (raised roads, hardened coastlines, resilient sewage and utility systems), the National Flood Insurance Program, and Flood Mitigation Assistance Grants. In this way those taxpayers who cannot afford to live in structurally mitigated coastal housing bear some of the costs for those who can, thus deepening climate injustice.

²Additionally, a problem with “structural solutions to disaster risk – such as strengthening building codes or building seawalls and levees-[is that it] can sometimes deceive communities into increasing their exposure to hazards by lending a false sense of security through the air of invincibility that surrounds much modern engineering and construction” (Sun, 2011: 2,158).

RESILIENCE GENTRIFICATION: WHEN STRUCTURAL MITIGATION IS THE RESPONSE TO CLIMATE CHANGE

All three responses to climate change on the coast are possible. However, climate denial and structural mitigation appear to be the dominant approaches, and structural mitigation is the one we focus on in the case studies. Even when the recovery goal is to build it back resilient, which is theoretically positive and logical, the outcome is still regressive and leads to increasing gaps in housing stock safety between the haves and the have nots. We will illustrate this in two very different processes.

Generally speaking, the process plays out like this: The impact of climate change on coastal real estate due to increased storm frequency, intensity, and sea level rise occurs in three stages following a disaster event. First, the disaster clears existing property and disperses residents, which frees the way for redevelopment. We call this stage of impact *climate demolition*. Climate demolition removes existing structures and populations, reducing political and economic barriers to the appropriation of coastal amenities. In the second stage, a response to the demolition, redevelopment designs are produced by governments and private capital interests that often include plans with resilient features to replace the climate-demolished structures. This phase may also include changes to policies that guide structural mitigation. In this phase, the cost of rebuilding is increased. In the third phase, the increased costs have the effect of distributing climate resilient structures to those with greater ability to pay, especially the sustainability class. We call this impact *resilience gentrification* (Gould and Lewis, 2018a). Resilience gentrification stems from more stringent building codes and requirements to harden shoreline infrastructure that are put in place in response to a disaster event. It allows the sustainability class, who are “well-educated, [hold] overt sustainability-oriented values, can afford sustainability themed consumption, and [tout] their green urbanism (such as living on the waterfront or near green space) to brand their lifestyle,” to take advantage of coastal residency opportunities generated by state and private capital interests (Gould and Lewis, 2018a: 12). This is related to what Pais and Elliot (2008: 1,423) describe as elite “upgrades” following hurricanes that result in “elite retrenchment” of coastal areas. Interestingly, Greenberg (2014b) describes similar elite upgrades following the non-natural disaster of the terrorist attacks on 9/11 in New York City. The wealthy rebuilt with “superior infrastructure” that then protected them during Hurricane Sandy. When this takes place in the context of a class stratified society, wealthier people live in more resilient structures and less wealthy live in less resilient structures and/or further from disaster prone areas like coasts³.

³Even without a storm or flooding, the threat of climate change can affect coastal real estate by increasing the prices of neighborhoods on higher ground. The value of property that is less susceptible to climate change-enhanced storms and sea-level rise is inflated as market demand increases. There is some evidence that this is happening in Miami, resulting in what observers have termed “climate gentrification” (Keenan et al., 2018).

COMPARATIVE ANALYSIS

We compare and analyze two cases: one from a global city where the economic elite live, and one from a tropical island where the economic elite play, both places where the environmental concerns with rebuilding are high, to illustrate the similarity in climate injustice outcomes from the structural mitigation synthesis of the coastal resilience dialectic. While the local contexts vary dramatically, the social forces and the social actors driving resilience gentrification came together in both cases to create similar outcomes: greater coastal capital investment, greater coastal population density and less economic/social equity. These very different cases are used as examples to illustrate the process.

We did not intend to do post-disaster research in either Gowanus or Barbuda. In both instances, we were already engaged in work in the sites when disaster struck. In Gowanus, we had begun research in 2010 to understand the causes and consequences of the canal being designated a Superfund site and how the designation intersected with green gentrification. Hurricane Sandy hit in 2012, which introduced an unexpected variable into the research, and, surprisingly, did little to alter the gentrification course. This analysis is based on the case history of the site we constructed using data from published research, media accounts, census data, and field work pre- and post-disaster focused on the relationships among the economic uses of the canal, the city’s growth machine, sustainability-related issues, real estate development, and demographic changes in the neighborhood (Gould and Lewis, 2017). Our field experience and photo-documentation in Gowanus has spanned many years.

In Barbuda, prior to Hurricane Irma, we were working with the elected Barbuda Council on the creation of a sustainable development program for the island linked to plans for foreign investment in ecotourism. We designed an island-wide participatory action research (PAR) to identify the types of development projects Barbudans themselves wanted to pursue.

Our initial work on-island took place in August 2017. Aided by the Council’s introductions, we had informal conversations with over 40 residents. We explained our role and sought initial understandings of their points of view. We toured the main touristic sites of Barbuda and proposed development sites. Weeks after that work began (September 5–6), the eye of Hurricane Irma passed directly over Barbuda, killing one and leaving widespread devastation. As had been originally scheduled as part of the PAR project, we returned to Antigua and Barbuda later that same month. Given the drastic changes in the context, rather than meeting with the full Barbuda Council in Barbuda, we were guided by an official of the Barbudan government in Antigua who took us to meet with government officials and some of the islands’ residents who had been evacuated to Antigua. While the context had changed, the overarching goals remained understanding Barbudans’ points of view regarding the development of the island. Our approach also changed, focusing on listening rather than asking, to acknowledge the trauma the people had experienced. Barbudans were sheltered with families and in two shelters. We visited both shelters where we met with the directors of the shelters who provided us with information

about the evacuees. The directors introduced us to evacuees who we met with informally in the facilities' general areas. We spoke with 14 evacuees about their hurricane experiences, their thoughts on their immediate needs for rebuilding, and their hopes for how future development would be the same/different from how the island had been prior to the hurricane. As noted in Peek and Tobin, 2020 "Tips for empathy," survivors wanted to tell us their story. We let them speak and did not ask intrusive questions. We did not conduct formal interviews nor did we take people's names⁴.

We also spent a morning at the ferry dock in St. John's (Antigua) observing and interacting with Barbudan residents who gathered to try to return on the first residents' ferry to Barbuda. We went to Barbuda on the second day of the commercial ferry's return and spent the day surveying and photographing the damage on the island and observing the few residents who were working on gathering possessions and securing their homes, along with workers clearing debris with backhoes and dump trucks, attending to powerlines, removing and treating standing water, dealing with stray animals, and doing work at the airport. We supplemented our field experience with published research and media accounts.

STRUCTURAL MITIGATION IN BROOKLYN'S GOWANUS CANAL

The Gowanus Canal is a 2.9 km waterway completed in 1869 as the centerpiece of one of the United States first planned industrial development districts. As such it became the repository of a wide range of industrial effluent, as well as a recipient of raw sewage when it was integrated as the outfall for one of the country's first municipal sewage systems (Alexiou, 2015). Although it was once the busiest industrial waterway in the U.S., by the end of World War II it began to be abandoned for deeper harbors. It is only in the twenty-first century that it was reconceptualized as waterfront property in the midst of Brooklyn's gentrification boom.

In October of 2012, climate demolition occurred in Gowanus. Hurricane Sandy, which killed 44 people and flooded 17% of New York City's land, pushed a thirteen-foot storm surge up the Gowanus Canal sending sewage-laden waters over the banks, and into the residential, industrial, and commercial spaces of the neighborhood. Floodwater spread out for more than a block on either side of the canal, submerging proposed sites for luxury condo and retail developments. Flooding and power outages took

the Gowanus Canal pumping station off line, causing 13 million gallons of untreated sewage to discharge into the floodwaters that covered the neighborhood. Test results indicated that the Gowanus floodwaters contained high levels of bacteria such as enterococcus due to raw sewage discharges. Levels of semi-volatile organic compounds of the type (such as PAHs) known to be a major component of Gowanus Canal sludge were found in on-land samples. However, neither enterococcus, storm surge flooding, or damaged homes and businesses proved much of a deterrent to the coastal development process. Little more than a year after Sandy, a sustainability-themed Whole Foods celebrated its grand opening on the banks of the Gowanus, and The Lightstone Group broke ground on a 700-unit apartment complex on the previously flooded development site (Alexiou, 2015). "Resilient" planning and gentrification ensued.

Following Sandy, New York City adopted a number of changes to its building codes based on the recommendations of the Building Resiliency Task Force report of June 2013. The report was produced by a non-profit comprised of and funded by engineering firms, real estate interests, architectural firms, construction interests and others poised to benefit economically from a structural mitigation response. The changes recommended included Local Law 29/13: Raising and Moving of Buildings, and Local Law 99/13: Raising Building Systems (Ackroyd, J., Eschenasy, D., and Sirakis, G.). Both of those building code changes required structural mitigation to raise living spaces and critical systems above projected flood levels. Flood prone locations were thus slated for continued occupation at higher building costs, rather than for non-residential use.

Arguing that its initial plans took full account of federal flood prevention standards, the development corporation building the 700-unit condo development on the Gowanus canal stated that, "The project was designed to exceed federal 100-year storm standards by significantly elevating the development above the 100-year flood plain" (WNYC News 2010). That is the primary response of developers bent on capitalizing on waterfront real estate by increasing coastal population density—build but elevate, to have flood waters wash under and around increasingly expensive residential development. While the logic of adaptation to ecological conditions argues for a staged retreat from coastal flood zones, the logic of capital argues for increased investment in real estate with water views. Private real estate developers have incorporated the price of the mitigated infrastructure into the price of the waterfront real estate. Some of the broader infrastructure costs are also borne by the local government, which is pressed to provide services to areas with high real estate values. The result is a public subsidy to private coastal development. Working class residents living in older homes in the flood zone had less financial capacity to structurally mitigate and less assistance to do so.

Demographic analysis of the Gowanus neighborhood reveals that structural mitigation, building "resilience," is linked to gentrification. In Gowanus, housing prices for new construction exceeds the rate of Brooklyn housing cost increases, while the neighborhood shifts from a working-class community of color to a wealthy white enclave (Gould and Lewis, 2017; Parks, 2019). A

⁴The ethical work involved in generating a PAR project align closely with what the CONVERGE project at the University of Colorado-Boulder summarizes as best practices for "ethical post-disaster community outreach and engagement" (Villarreal, 2020). They note that the work should be community situated, collaborative, and action oriented. Our pre-engagement and consultation with leaders prior to the PAR project, and our prior background research into "the historical, social and political context of the community" situated us well to engage in post-disaster Barbuda. Our data collection was "community-situated" in that it was framed around the Barbuda Council's interest in generating a Sustainability Plan. We collaborated with our partners by sharing our work with them And finally, the work was "action-orientated" — "meant to lead to positive social outcomes and to promote social equity for community members" by giving Barbudan residents voice, especially with their elected council (Villarreal, 2020).

structurally mitigated, climate resilient Gowanus is increasingly available only to the sustainability class.

Similar processes occurred in other neighborhoods of New York City. For instance, within weeks of Sandy, the developers of Hudson Yards, a former tidal wetland on Manhattan's west side, noted that "The inherent design of the Yards is resilient toward flooding due to the fact that our platform puts our first floor well above the flood plain." "All of our electrical and support systems are above grade." "Since Sandy, we've made some minor adjustments to the design to make it even more floodproof." (Dwyer, 2012). An architect on the project indicated to us that more substantial redesign was initiated later, and that these structural mitigation elements raised building costs substantially. Hudson Yards opened with a climate resilient luxury mall including Cartier, Dior, Piaget, Rolex and other shops geared to the global elite.

Hurricane Sandy should have been a wake-up call for Gowanus, and for New York City as a whole to begin the process of managed retreat. However, despite years of talk and largely superficial nods to climate resilience under the leadership of Mayor Michael Bloomberg (PlaNYC 2030, 2007), the dominance of real estate interests in New York City's growth machine militated against meaningful redirection of its development paradigm. The administration of Bill DeBlasio, elected in 2013, required a higher percentage of "affordable" housing in new developments, but did not reverse larger trends in coastal housing markets. The premium placed on waterfront property simply overwhelmed concern for the increased precarity of coastal development in the Anthropocene. Likewise, major new New York City waterfront developments including Manhattan's Hudson Yards, and the Domino Sugar site in Brooklyn proceeded as planned after Sandy, with added structural mitigation redesign due to increased coastal precarity (Rose, 2017). New York City took an approach to climate resilience that exacerbates already unsustainable levels of housing inequality.

STRUCTURAL MITIGATION ON THE ISLAND OF BARBUDA

Barbuda is a small island: 176 square kilometers and 1600 inhabitants. It is part of the nation of Antigua and Barbuda. On September 6, 2017, it suffered climate demolition. Irma hit Barbuda as a category five hurricane, with the eye of the storm passing directly over the island. The result was total devastation of the island's infrastructure; climate demolition. Nearly every structure was damaged, and homes that were not completely destroyed were left temporarily uninhabitable. Power, water service, and communications were knocked out, as was the only ferry dock linking the island to Antigua. The entire population of Barbuda was evacuated. With the hospital and schools badly damaged, and food supplies disrupted, return to the island for roughly 1600 Barbudan climate refugees was far off. While Barbudans were sheltered in facilities on Antigua, the government struggled to initiate recovery with minimal resources and organization. Barbudans' access to their island was tightly

restricted, and most were unable to return to patch roofs, apply tarps, or collect belongings for weeks.

Restoration of basic services was slow, and in the meantime the necessity of enrolling Barbudan children in Antiguan schools, finding jobs, and leaving shelters to stay with family and friends dispersed the Barbudan population, making it difficult to organize as a socio-political force in rebuilding plans. While Barbudans struggled to establish temporary normalcy, the Government of Antigua and Barbuda grappled with a \$250 million rebuild project on a \$1 billion national economy, primarily dependent on tourism for foreign exchange. In seeking to make Barbudan recovery pay for itself, the state moved to privatize communally held land to make home and business owners eligible for private sector loans, and to make Barbuda more attractive and available to global coastal tourism capital. Prior to this, land was leased from the community, not privately owned, part of the historical legacy of emancipation. In abolishing communal land tenure, Barbudans were told by Prime Minister Brown that they had been "squatters" on their own island (Gould and Gould and Lewis, 2018b). With land now part of the cash economy, capacity to invest is open to global competition in which Barbudans must outbid global capital to access land. The change in land tenure displaces Barbudans and facilitates the colonization of Barbuda by the global elite.

Hurricane Irma made it possible to recast development geared toward serving non-Barbudans as a humanitarian effort to rebuild and improve resiliency. Global developers teamed up with the national government to lead a "green" recovery. However, these actors are renewing the island to attract wealthy outsiders, not the displaced (Boger and Perdikaris, 2019). Land privatization and tourism development includes resilient second home developments, renewable energy projects, new parks, and "eco-friendly" luxury resorts. Prior to Irma, when residents were on the island, Barbudans approved a number of new development requests. They were able to control their island's development trajectory by controlling communal land use decisions. They limited the footprint of Robert DeNiro's Paradise Found vacation home and eco-resort project, and rejected the siting of another such development. With many Barbudans still displaced in Antigua, communal land ownership eliminated by the state, and the government lacking any public plan for recovery, the global elite with their access to transportation and resources, now wield the power. Billionaire John Paul DeJoria plans to build an eco-resort on the island named Peace, Love and Happiness (PLH). The target audience for PLH is high carbon footprint jet setters. Another 700-acre proposed development includes 500 vacation home residences and an 18-hole golf course (Boyle, 2020). A different billionaire investor has proposed a marina for super yachts. Clearly, plans to "build back better" have little to do with building back the community that existed prior to Irma which was based on a mixed subsistence and commercial economy and communal land stewardship.

The Caribbean version of green gentrification markets island paradise locations for vacation homes and resort retreats for global elites, some of the same people who own property in the greenest, trendiest global city neighborhoods like Gowanus. In the Anthropocene, climate change enhanced storms do

the demolition and population removal work, and set the stage for global capital to “help” desperate communities by buying up property and providing returning local residents jobs as service workers for the global sustainability class. Because resilient development is framed as hurricane relief, much of the green infrastructure construction to support private investors is subsidized by international donors. The first major redevelopment project on Barbuda is the construction of new larger airport, begun without environmental review. And that is the nature of green gentrification; using the visible markers of ecological concern to mask increased inequality and the servicing of higher consumption populations from outside the community. Barbuda’s experience with a post-climate disaster green gentrification scheme is not unique, and resilience construction priced beyond the reach of the local population is a key feature.

We asked evacuees what changes they recommended for the island’s recovery. Many suggested a better school and hospital. None suggested an 18-hole golf course and luxury second homes. Almost all of them did suggest that new residences have concrete roofs. A few advocated changes to building codes that would require a percentage of each structure be covered with concrete. As in New York City post-Sandy, governments often adopt regulatory changes involving structural mitigation following climate-related storm events. While the logic of this is unassailable from a real estate market perspective, from a sustainability perspective, it is problematic. One consequence is that it raises the cost of rebuilding, causing resilience gentrification: global investors can bear the new infrastructural costs while locals find the burden of resilience measures unaffordable. Structural mitigation to resist climate change increases the costs of living on Barbuda, makes formal sector employment necessary, and thus further limits access to coastal spaces on the island. Formal sector employment will likely mean serving as waiters and maids for vacation home and eco-resort residents, constructing structural dependency on their island’s use as a playground for the rich. Resilience is equated with wealth, and the sustainability class emerges as the new gentry.

COMPARISON

Here are two very different locations whose real estate was transformed by climate change enhanced hurricanes—climate demolition. Policy responses favoring structural mitigation exacerbated local losses, but created opportunities for outside developers promising greater “resilience.” But these strategies have the long-term effect of deepening inequality as the most vulnerable homeowners find it costly to rebuild or remain and wealthier outsiders can afford the demands of resilient construction. The social structural forces incentivizing structural mitigation as a response to climate change threats are global, and they imply that the Anthropocene will be an era of increasing inequality.

Whereas the island of Barbuda experienced dramatic climate demolition as a result of Hurricane Irma in 2017, the Gowanus neighborhood of Brooklyn experienced far less structural damage

TABLE 1 | Case comparison: Gowanus and Barbuda.

	Gowanus (urban neighborhood)	Barbuda (rural island)
Cause of real estate damage	Hurricane Sandy (2012)	Hurricane Irma (2017)
Type of change	Resilience gentrification: increasing the prices of building that incorporate resilient features	Climate demolition: clearing existing coastal property and residents, making physical and social space for new capital investment
Type of damage	Basements flooded and contaminated; prospective development sites flooded	Majority of structures (public and private) damaged
Population directly affected by damage (most vulnerable)	Homeowners	Island residents
Real estate interests affected by damage (least vulnerable)	Homeowners and national/regional real estate developers	Island residents and foreign resort developers
Policy responses	New building codes	Land privatization
Policy effects	For homeowners, recovery costs; for developers, continuation of multi-unit developments with higher costs of structural mitigation features	For residents, higher costs to rebuild; for resort developers, legal access to land for development
Long-term effects	Most vulnerable homeowners sell and relocate; least vulnerable homeowners structurally mitigate; wealthier newcomers rent and buy new development; neighborhood wealthier	Most vulnerable island residents remain “evacuated” in Antigua; least vulnerable that can afford to rebuild return; resorts built for wealthy newcomers; island wealthier

from Hurricane Sandy in 2012 (**Table 1**). Nonetheless, in both cases, the cost of redevelopment was greatly increased as climate resilience was built into future construction plans. In the case of Barbuda, the state intervened to clear the island of residents in the name of safety. In Gowanus, real estate market inflation, enhanced by the increased costs of new climate resilient construction, is taking a somewhat slower path toward the same outcome, the removal of the pre-existing lower income population. The ways that markets and states interact to make it difficult for long-term residents to remain in both cases is somewhat similar in that changes to building requirements imposed by states on private developers raise the costs of return (or remaining in place), and those costs are passed on to residents. The process is slower in Gowanus, as there was not state sanctioned forced removal, and the damage to homes in Gowanus was less extensive. Additionally, home lots in Gowanus

were already private and deeded, and land was already exchanged through market mechanisms. In Barbuda, the state intervened to impose those conditions on a population that had not been subject to private real estate markets prior to the climate disaster. In both cases, however, the most vulnerable residents will be unable to return, housing costs will increase due to the imposition of structural mitigation as a means of resolving the climate resilience dialectic, and both communities will be largely replaced by wealthier in-migrants. Also, in both cases, external capital is a primary agent of post-climate disaster decision-making.

Both cases demonstrate how recovery and rebuilding based in structural mitigation as a strategy for planning and actual redevelopment leads to resilience gentrification. In short, the use of structural mitigation both increases coastal development and makes structures more resilient, but increases housing inequality. In effect, it institutionalizes environmental privilege for the sustainability class by equating resilience with wealth. It also plays into the problems of neoliberalism, allowing the wealthy to quarantine themselves from the ecological conditions they play a significant role in creating, leaving the poor vulnerable to conditions that they have little opportunity to shift (Szasz, 2007). It is a private solution to a public problem that increases inequality and makes our communities less sustainable.

CONCLUSION

The Anthropocene has brought increasing climate change-caused disasters. This creates opportunities to reshape human patterns of distribution to protect society from future disasters. The dominant recovery response has been to build “resilient” buildings and infrastructure through structural mitigation. This response fits within the general category of resolving the ecosystem—social system dynamic that Schnaiberg (1980) calls the *managed scarcity synthesis*.

Consistent with the Treadmill of Production model of socioenvironmental relations, structural mitigation as a strategy for resolving the conflict between increasing coastal precarity and increasing coastal development is socially regressive. Structural mitigation requires more and more resources be dedicated to the construction of homes, roads, hotels, and other social amenities in order to provide the same social goods. Treadmill theory also argues that, as ecological withdrawals and additions expand, social inequality increases. As the cost of structural mitigation increases, in large part due to the increased requirement of resources for stronger buildings and elevated infrastructure, coastal amenities become less and less accessible to those lower in the social stratification system. By raising the cost of coastal development, structural mitigation institutionalizes environmental privilege (Park and Pellow, 2011) for the sustainability class (Gould and Lewis, 2017).

Coastal real estate, which in most areas is already priced so as to restrict access to elites, increases in cost under this managed scarcity scenario. In an ecological synthesis of staged retreat, coastal real estate values would decrease. In coastal areas where markets have not already priced the poor away from their environmental amenities, structural mitigation decreases

the capacity of the less wealthy to resist displacement. In this way structural mitigation equates climate resilience with wealth. By employing a private solution (stronger residences) to a public problem (climate change) within the context of a highly unequal stratified social order, what structural mitigation makes resilient is privilege. This process is reinforced by the system of insurance which allows the wealthy to protect themselves from catastrophic climate-related financial loss (Flavelle, 2018).

“Resilience” has become a dominant paradigm in post-disaster recovery and rebuilding. The way that resilience recovery played out in both Gowanus and Barbuda demonstrates that the concept of resilience obscures the processes of recovery/rebuilding that favors wealth at the cost of social equity. The current process that emphasizes resilience leads to gentrification, and more precisely *resilience gentrification*. “Resilient” recovery reinforces climate injustice. On the coasts, climate change paves the way for resilience gentrification as less wealthy coastal residents find themselves unable to remain in place, and public policy fails to adopt equity-based climate adaptation strategies.

This is just one example of climate injustice. Other consequences of climate change, such as heat waves, also disproportionately affect rich and poor, highlighting issues of unequal social vulnerability to disaster (Klinenberg, 2003). In a capitalist political economy, resilience—the ability to “bounce back”—is equated with wealth, and anthropogenic climate change aids capital by clearing out the less wealthy and precluding their return via climate demolition. Through their energy intensive lifestyles and fossil fuel investments, the wealthy support the climate change-generated bulldozers that clear the path for the construction of coastal enclaves of environmental privilege. In this way the rich reap benefits from climate change while the poor pay the price for conditions they did not create.

States favor adaptation strategies that meet the needs of private capital, opting for structural mitigation that is affordable to the sustainability class. The sustainability class coastal gentrifiers claim the mantle of ecological consciousness by building and occupying “resilient” structures on the coasts. This is the essence of resilience gentrification. Wealthy citizens that desire water views as an environmental amenity, and who often take pride in their willingness to “live with nature” in climate adapted homes, become the new coastal residents in the Anthropocene. In both Gowanus and Barbuda, they are able to imagine themselves as environmentally conscious citizens adapting to new ecological realities, while remaining unconscious of both their regressive social impacts, and the ways in which their high consumption lifestyles and investment strategies help to generate those new ecological realities that disadvantage the population they replace. This is but one example of the ways in which the rich create ecological conditions under which only the rich can survive.

Resilience gentrification is not an inevitable outcome of coastal adaptation in the Anthropocene. There are alternatives to a managed scarcity/structural mitigation/ “resilient” recovery. In Schnaiberg’s, 1980 lexicon, these would be *ecological syntheses*, which incorporate ecological principles and social equity.

A more ecological synthesis of the climate resilience dialectic would suggest managed retreat from the most vulnerable coastal

areas (O'Neill and Van Abs, 2015; Koslov, 2016; Hino et al., 2017). Where full retreat is not socially desirable, natural systems—“nature-based solutions” might be productively employed to blunt the impacts of sea level rise and storms, while supporting richer, more resilient ecosystems (Frantzeskaki et al., 2019). Retention and expansion of mangrove forests (instead of replacement with artificial beaches) in tropical zones, and the restoration or creation of sponge parks in lieu of hardened coastal infrastructure in more temperate climates could offer low-cost solutions, though the impacts on housing costs is unclear.

Managed retreat and degrowth can be encouraged through public policies that decouple resilience from wealth. These include policies to eliminate public subsidies for building on the coasts and in flood zones, buyouts and relocation (Cheong, 2011). Laws prohibiting private ownership of land in proximity to coastlines would also have equitable impacts. However, these, too, need to consider equity (Marino, 2018; Siders, 2019). For instance, in her analysis of post-Katrina New Orleans, Tierney (2015) has shown the clear ties that link neoliberal policies and disaster resilient strategies and their inequitable results: “The neoliberal turn in disaster risk management was never clearer than in Hurricane Katrina... The vaunted public-private partnerships that are viewed as central to community disaster resilience were on full display following Katrina, and with utterly shocking results...” (1337–1338). She describes corporate profiting around temporary housing, the firing of public employees including school teachers, the demolition of public housing, and the undercutting of wages. In general, lower levels of economic inequality mean a more equitable distribution of the capacity to withstand climate impacts, and a reduction of the incentives for structural mitigation by shrinking the potential market for resilience-inflated housing.

Buyout programs are another policy mechanism that could provide paths for residents to move to more ecologically sound and habitable areas, but again, equity needs to be a component of these programs. Elliot et al. (2020) investigated over 40,000 FEMA buyouts of flood-prone homes in the U.S. over 25 years. They found, “the federal buyout program disproportionately targets whiter counties and neighborhoods, especially in more urbanized areas where the program now concentrates. Yet it is neighborhoods of color that have been more likely to accept buyouts in urban areas...” (2). Raising the cost of flood insurance is another approach that would disincentivize living in flood prone areas. The same researchers point out that FEMA has acknowledged that the National Flood Insurance Program, “subsidiz[es] residential development in hazardous, flood-prone areas in ways that are not only dangerous to residents but fiscally unsustainable for taxpayers” (1). Despite this, there is political pressure not to raise rates. For instance, under Democratic President Biden, who is foregrounding policies to address climate change, the Senate Democratic leader, Representative Chuck Schumer from New York is resisting an increase in insurance rates because it would hurt his constituents (and campaign donors) in Long Island. When public subsidies sink costs into hazardous areas, the cycle continues. Sun (2011) explains this treadmill: “Once

redevelopment occurs, however, huge public investments in redeveloped areas (financed by borrowing against anticipated future tax revenues from the redevelopment), increased property prices, and reinvigorated communities will intensify calls for structural protections and make retreat far more difficult, even if sea level rise or other conditions ultimately make retreat the most viable option” (2157). These policy processes are common in the U.S. context. However, there are examples from Europe, for instance Garcia-Lamarca's (2021) work in Nantes, France, which illustrates how public policy reduced green gentrification.

An even broader social structural approach to climate adaptation would be social policies favoring degrowth (D'Alisa et al., 2015; Stuart et al., 2021). Degrowth strategies would not only incorporate staged retreat from the most climate vulnerable locales, but would also reduce (and ultimately reverse) the engines of climate change so that planetary conditions become increasingly, rather than decreasingly, favorable to human and other life. Less carbon emissions, less extraction, less consumption, less waste generation, less deforestation would all lessen the pressure on adaptation to an increasingly hostile environment of our own making. This requires a major reorientation of thought—part of the ongoing intellectual project to “decolonize.” Reflecting on analysis of the Caribbean experience, which seeks a “decolonial resilience” —not to “bounce back” but to “bounce forward,” Popke and Rhiney (2019) (5–6) suggest “to draw from local knowledge and experience to build an alternative model of disaster planning and response... through practices built around collective action, self-reliance, indigenous knowledge production, and principles of inclusion and equity.” Degrowth and decolonizing could go hand in hand to imagine recovery from the Anthropocene.

Addressing ecological crises requires an active and responsive feedback loop between social systems and ecosystems so that changes in the ecosystem result in the necessary adjustments in social organization to sustain ecological integrity and basic life support functions. A social system that responds to both increasing coastal storm frequency and intensity and sea level rise by densification of coastal development and shifting population to precarious zones is clearly dysfunctional. The feedback loop between the social system and the ecosystem has been disrupted by high levels of inequality, allowing the privileged to escape or even benefit from the negative ecological consequences of their economic decisions. Resilience gentrification is an indicator of this feedback loop disruption. Ecological syntheses rooted in decolonizing and degrowth, by necessitating redistribution, offer a path to repair the social system-ecosystem feedback loop that would open a path toward a more just sustainability (Agyeman, 2013).

At each level at which a more ecological synthesis to the climate resilience dialectic is sought, the approach is one that promotes public policy solutions to a public problem. In the long run, private solutions to the public problem of global warming are not viable. It will not be possible, even for the wealthy, to establish an inverted quarantine (Szasz, 2007) from the entire planet.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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AUTHOR CONTRIBUTIONS

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