CAN IT HAPPEN HERE?
IMPROVING THE PROSPECT FOR MANAGED RETREAT BY US CITIES

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Managed retreat is a strategy that most effectively eliminates risk.[1]
—Urban Land Institute

Communities have generally focused on actions that address risks from current climate variability and recent extreme events . . . Fewer communities have focused on actions to address the anticipated scale of future change and emergent threats, such as reducing exposure by preventing building in high-risk locations or retreating from at-risk coastal areas.
—"Fourth National Climate Assessment" (2018)[2]

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Overview

By failing to prepare, you are preparing to fail.
—Attributed to many

This research report provides city government and civic leaders with new reasons to consider the use of managed retreat as a way to strengthen their cities' climate resilience.

As mounting destruction by rising seas, hurricanes, and wildfires drives the dangers of climate change deeper into public awareness, more and more US cities are trying to figure out how to strengthen their resilience against climate shocks and stresses. They are using two approaches to protect public infrastructure and private property from climate risks: Armoring—building physical barriers to flooding, for instance—reduces the exposure of physical assets and people to climate hazards. Accommodating—raising roads and building sites, for example—alters physical assets to reduce their vulnerability to climate hazards.

But few cities are using, or even considering, a third approach known as "managed retreat." This approach uses public policies, including regulations, investments, and incentives to remove existing development—buildings, infrastructure, entire neighborhoods—over time and prevent future development in parts of the city that cannot, should not, or will not be armored or accommodated for potentially devastating climate hazards. (See Appendix for an inventory of tools cities use for managed retreat.)

It's not hard to understand why managed retreat is overlooked: it is an irrational decision under the current rules of the urban-development game. Cities *are* their development: housing for residents; stores, offices, factories, and warehouses for businesses; transportation, water, energy, and waste infrastructure for everyone. Existing development provides enormous financial value for owners and businesses and a large portion of a city government's revenue. New development generates profits for developers, investors, and lenders and boosts the local economy. It signals that the city is attracting people and investment, indicators of urban health.

City leaders can foresee that considering retreat would produce substantial political, financial, and emotional pain locally—an array of immediate and intimidating difficulties with little gain in the short run. Property owners and real estate developers will worry that retreat will reduce the value of their assets; some will accuse the city of trampling on their private property rights, People will refuse to abandon their homes, businesses, and neighborhoods, citing a deep attachment to place and neighbors. Civic leaders will be concerned that retreat will shake public confidence in the city's future. Renters will fear they will be displaced and left with no affordable housing options. City officials will be uneasy about losing future property tax revenue when private development is eliminated and future development is prohibited. And so on.

The inclination to avoid retreat is strong even in cities that have undergone a destructive climate disaster; the civic reflex of city leaders is almost always to rebuild everything as it was. After Hurricane Sandy pounded New York City in 2012, for instance, then-mayor Michael Bloomberg declared that "we cannot and will not abandon our waterfront. It's one of our greatest assets. We must protect it, not retreat from it."[3]

But these calculations are changing.

This report examines the role that managed retreat will increasingly play as more and more cities wrestle with how to deal with the growing risks of destructive climate changes. It is organized around three insights:

1. ***Many cities will not be able to avoid retreat, but they can choose what kind of retreat to have.*** Whether or not to retreat is a false choice for cities facing certain climate risks such as rising seas. Politicians don't want to make decisions about who gets protected from climate risks and who doesn't, notes David Titley, head of the Center for Solutions to Weather and Climate Risk at the University of Pennsylvania. "We saw this in New York with Mayor Bloomberg. 'We don't retreat.' Well, guess what. The ocean gets a vote."[4] The question is which of three kinds of retreat will occur in the city: traumatic post-disaster retreat; chaotic, market-driven retreat; or forward-looking planned retreat. In this light, the alternatives to managed retreat may be "greater evils" that cities will want to avoid.

2. ***There is an emerging roadmap for generating community acceptance of managed retreat as part of building a city's climate resilience.*** The limited experience of cities that have taken on managed retreat suggests that an effective process depends on critical actions that move the community from denial and anger to acceptance. It's especially important to reframe retreat as not simply a loss of what was, but as part of a larger and inspiring vision for what can be, for the city's future. Five lessons learned are:

    - A city's community-engagement process for resilience planning should be designed for the emotional and social aspects of considering managed retreat.
    - A city's assessment of its climate risks and vulnerabilities should expose, not hide, the potential implications for retreat.
    - Cities should reframe retreat as not just a loss, but as part of a positive and inspiring vision for the city's long-term development and success.
    - A city can help to normalize retreat by starting with the relocation of essential public infrastructure and revising city rules that steer new development.
    - Consideration of retreat should include recognition of its potential impacts on economic and social disparities in the city.

3. ***Until more cities seriously consider using managed retreat, it is unlikely that crucial support from state and federal governments will occur on other than a sporadic, special-case basis.*** Retreat can involve implementation challenges that cities cannot resolve by themselves, such as legal, regulatory, financial, and planned resettlement concerns. So far, though, state and federal governments mostly treat retreat as a unique episode, usually only responding after a climate disaster. They have not institutionalized policies and resources that cities can rely on for managed retreat—nor has a critical mass of cities pushed for such policy changes.

The next sections of this report lay out the basis for each of these insights and how cities might be able to act on them.

Insight #1 -- Many cities will not be able to avoid retreat, but they can choose what kind of retreat to have.

We are not wired to make decisions about barely perceptible threats that gradually accelerate over time.
—Jeff Goodell (*The Water Will Come*)[5]

You don't have to be a doomsayer to see that a great deal of urban America could be subject to retreat due to climate changes. Some already has been and it's certain that more will be. Probably much more than anyone has imagined.

So far, the biggest retreat-inducing climate threat is rising sea levels. By 2100 rapid sea-level rise could chronically inundate nearly 670 coastal communities, including parts of 50 heavily populated cities, according to a 2017 study by the Union of Concerned Scientists.[6] In similar vein, the 2018 "Fourth National Climate Assessment" estimated that about $1 trillion in coastal real estate is threated by rising seas in combination with storms, floods, and erosion.[7] Zillow Research projected that by 2050 more than 386,000 homes in coastal areas could be at risk of permanent inundation or chronic flooding from sea level rise; by 2100 the number could reach 1.3 million to 2.5 million homes. In a scenario projecting moderate sea-level rise for 2100, some cities—Galveston, Texas, Ocean City, Maryland, and Miami Beach, Florida, for example—could have about 50 percent of homes in risk zones.[8] A study of the North Atlantic coast by the US Army Corps of Engineers noted that in coastal communities "human systems may have to relocate in a responsible manner to sustain their economic viability and social resilience."[9]

How much of this vulnerable urban development will be unprotected and, therefore, on its way to becoming submerged, unsuitable for living and working? Similar existential questions can be asked about the increasing amount of development at risk from more frequent and intense rainfall that inundates communities on a recurring basis; waves of extreme-heat days that jeopardize human health and life; wildfires that consume structures at the urban-rural intersection; and prolonged droughts that diminish water sources for households and businesses.

These and other hazards are projected to become more widespread and frequent in the US. "The impacts of climate change are intensifying across the country . . . climate-related threats to Americans' physical, social, and economic well-being are rising," reported the "Fourth National Climate Assessment."[10] More than half of the houses damaged by Hurricane Harvey—100,000 houses in Houston and Harris County—were outside of any flood-plain designation.[11] A year earlier, rainfall-driven flooding displaced 100,000 people in the Baton Rouge area, with a third of the flooding occurring outside of FEMA's designated 100-year flood zone.[12] The share of the US population facing substantial damages from hurricanes is likely to grow fivefold by 2075 due to climate change, according to the Congressional Budget Office.[13] Los Angeles is projected to have triple the number of 95-degree days by

2050. Across California, higher temperatures could result in twice as much forest area being burned.[14] More than half of one California utility's service area of 70,000 square miles is now considered to be in "extreme or high fire-risk areas."[15] El Paso, Las Vegas, Phoenix, and other cities in the southwest US are located in arid environments that have natural scarcity of water and precipitation and are becoming hotter and drier, a 2017 Arup report noted, adding that the nation's arid zone is expanding.[16]

Meanwhile, more urban areas significantly at risk from climate impacts have been experiencing increases in population and development. Between 2000 and 2016, for instance, population in the Atlantic and Gulf Coast regions—subject to sea-level rise and hurricanes—increased by 7.7 million people.[17] In Austin, Texas, 89 percent of the fast-growing census tracts in the city are in areas of elevated or highest wildfire potential, mostly in the ring around the city center.[18] In New York City, at the beginning of 2018, more than 12,000 apartments were under construction or planned in high-risk flood zones. Some of these buildings are designed to be flood resistant, but their neighborhoods are not, as critics pointed out in *The New York Times*: "These new buildings might remain unscathed in a flood, they say, but what about the damage caused by the torrent around them?"[19] Some 1.2 million people in the metropolitan New York region live in coastal surge zones and riverine floodplains at greatest risk of inundation—and, the Lincoln Institute for Land Policy reported, that number is expected to nearly double by 2050 due to sea level rise, increasing frequency and intensity of storms, and population growth.[20]

Climate Hazards

Various climate risks pose different threats to development. With the global average sea level very likely to rise by as much as 4 feet by 2100, and perhaps by more than 8 feet, according to the "Fourth National Climate Assessment,"[21] it's not hard to see how low-lying coastal communities face serious risk of inundation. But other and/or concurrent climate hazards may also trigger changes in urban land use and footprints.

Extreme Rainfall. Flooding due to extreme rainfall from storms and hurricanes can also be devastating—as cities in Texas, Florida, North Carolina, and Puerto Rico experienced in 2017 and 2018 alone. Ellicott City in Maryland, with 65,000 residents living in a river valley, suffered two deadly "1,000-year" floods in 2016 and 2018 due to extreme rain; the water inundated the historic downtown, killing people, toppling buildings, and sweeping away cars.

Wildfires. Although the start of wildfires is not predictable—most are sparked by human actions—the conditions for their spread are understood and can be prevented. The 2018 Carr Fire in California that consumed nearly 1,100 homes and charred 229,000 acres ignited accidentally, but the risk and potential toll of a ferocious fire in that area "had been forecast and worried over for years," according to a ProPublica report.[22]

Aridity and Extreme Heat. Climate changes are increasing the aridity of regions—disrupting the frequency and intensity of rainfall, increasing temperatures and more extreme heatwaves, bringing prolonged droughts. Extreme heat events can be dangerous to health and even fatal—triggering heat stroke, to which children, the elderly, chronically ill, and outdoor workers are especially susceptible. Cities in arid environments "face complex challenges such as water scarcity, inadequate infrastructure, rapidly growing populations, and impacts on public health from the effects of urban heat islands," according to Hrvoje Cindrić, Middle East Urbanism Leader for Arup.[23] When temperatures soar, the electric grid comes under serious strain. Parts of Southern California lost power in July 2018 after temperatures reached 110 degrees.[24] Worldwide, the number of air-conditioners is

predicted to increase from 1.6 billion units today to 5.6 billion units by midcentury, according to International Energy Agency.[25]

Thawing Permafrost. The thawing of permafrost, ground that is frozen year-round, can result in mud instead of solid earth beneath built structures. A 2018 report on this risk noted that In Alaska about 340 miles of the trans-Alaska oil pipeline traverse ground where near-surface permafrost may thaw by 2050.[26]

Not all vulnerable urban development will get the protection it needs. The forces of nature—especially rising seas and chronic flooding—may be too powerful to be countered by any armoring or accommodation solutions. Louisiana's coast provides a dramatic example: buffeted by sea level rise and big storms, it is predicted to lose 1,450 square miles (928,000 acres) of land during the next 50 years, even if marsh-regeneration and flood-control plans are implemented.[27] "The 'relocation' of individuals in Southeast Louisiana is inevitable," concluded a 2014 study by the Tulane Institute on Water Resources Law & Policy.[28]

Some solutions may be unacceptable because they lead to other problems such as environmental degradation—especially of beaches and wetlands—or increased climate vulnerability for neighboring properties. For instance, a 2016 analysis for Imperial Beach, California, a city of 27,000 residents with 30 percent of its structures at risk from sea level rise, found that armoring the coast—building seawalls—"leads to loss of beach recreation and ecological value."[29] Flood walls that protect against coastal flooding may trap waters, prevent drainage, and exacerbate flooding caused by extreme precipitation events. Proposed infrastructure projects must go through environmental reviews and permitting processes that may reveal unacceptable negative impacts.

Some cities may need to return land to an undeveloped condition as part of plans to use open space to soak up flood waters, buffer storm surges, or check the spread of wildfires. After an historic flood in 2008, Cedar Rapids, Iowa, population 132,000, removed 1,300 houses and other development to clear the way for flood control measures that included green infrastructure: a new park and greenway space, a 4.4-acre rainwater-detention basin, and recreation area.[30] A decade earlier, Grand Forks, North Dakota, organized a buyout of 802 properties after a severe flood and turned the land they had occupied into a 2,000-acre greenway.[31] Miami has considered buying out and removing houses in one flood-prone neighborhood to create a park and retention basins to hold back excess water. [32] In the wake of Hurricane Maria's damage, a 100 Resilient Cities report for Puerto Rico promoted a strategy to acquire open spaces in private lands in high-hazard areas—to reduce spending on the construction and maintenance of infrastructure for flood control and government spending on emergency response.[33] In other cities, open space is a key land-use tool for reducing the extent of wildfires at the edge of cities—using agricultural lands to shield development and restricting development on steep slopes and other fire-transmission pathways.[34] In Paradise, California, with 26,000 residents, a 2018 wildfire consumed most of the buildings. The head of the city's parks department, responsible for 500 acres within the community, acknowledged that the city's land use had to change, with more open spaces

and smarter building codes. "If [Paradise] grows the same, you're going to have the same type of event, whether it's 10 years or 20 years or 50 years from now."[35]

But it's money that will probably be the biggest factor in determining just how much urban development becomes unusable due to climate changes. Will city governments, utilities, private property owners, real estate developers and investors, property insurers and lenders have the means and the will to pay for infrastructure and other resilience-building solutions? Some cities' armoring plans require billions of dollars and assume that much of the investment will come from state and federal governments, but these sources are not certain. The US Army Corps of Engineers flood-management study for Norfolk, Virginia, a city of 244,000 severely threatened by sea level rise, projected a $1.8 billion cost for solutions and assumed the federal government would provide two-thirds of the money—but this would require an act of Congress and doesn't address where the rest of the funding will come from. In most cities, much of the local cost of resilience building will have to be paid for by increasing local taxes and/or utility rates, which will almost always raise political challenges. A 2018 study of how Boston could pay for $2-4 billion in climate-resilience projects noted that even if the city obtained 50-60 percent of the money from state and federal governments, it would still need to borrow private capital backed by property taxes and/or fees on water and sewer users to cover the gap.[36]

The difficulty of financing projects can result in implementation of potentially insufficient solutions. In New Orleans, for instance, the $20-billion flood protection system put in place after Hurricane Katrina, mostly with federal funds, was designed against a 100-year flood. But the bigger, 200- and 500-year floods that climate change storms may bring could breach these protections and, according to some projections, submerge half of the city with as much as 5 feet of water. "What we should have done is build to a 10,000-year flood standard," said New Orleans Mayor Mitch Landrieu. "We didn't, and that was for the country a monetary decision."[37]

No one knows what the bill would be to protect cities' development as much as possible, but the amount is sure to be hundreds of billions of dollars and likely more. When Mayor Bloomberg denounced retreat, he unveiled a plan to defend New York that would cost $20 billion. Defending Houston/Galveston with a nearly 60-mile "spine" of concrete seawalls, earthen barriers, floating gates and steel levees on the Texas Gulf Coast would cost an estimated $12 billion.[38] San Francisco has a $5 billion plan for seawall repairs and improvements.[39] Miami is spending $900 million for drainage, road elevation, and flooding pumps,[40] while Miami Beach is spending $650 million for storm drainage improvements.[41] Construction of a *temporary* 20-mile berm to protect the industrialized coastline in Jefferson County, Texas, where land loss due to sea level rise is averaging 4 feet a year, could cost $65 million.[42] Completely protecting Houston/Harris County from 100-year storms could require as much as $30 billion in investment.[43] Boston needs $2-4 billion, Norfolk $1.8 billion. But this is just a list of cities that have assessed their vulnerability and made detailed plans for strengthening their climate resilience—something that most US cities have not yet done.

It's possible, of course, that all the money that cities need will be available during the next decades. But it's not probable. The nation already has run up an enormous deficit in maintaining, upgrading, and expanding public infrastructure—an investment gap approaching $2 trillion, according to the American Society of Civil Engineers.[44] Annually, the federal, state, and local governments invest $375 billion to $450 billion in infrastructure construction and maintenance but, as Earth Economics noted in a 2018 study of green infrastructure, much of the money is used for highways and roads and potential tax increases are "hotly politicized."[45] Most cities have other crucial priorities for spending local dollars, such as creating more affordable housing or upgrading public transit systems. New York City's transit system needs a $40-billion investment during the next decade after years of underfunding and neglect, according to the head of the city transit authority.[46] When Miami voters considered approving a general obligation bond in 2017 to finance $192 million of projects for sea-level rise protection, local labor unions opposed the proposal. They argued that the city should not be taking on debt when it might owe its police and fire pension funds nearly $250 million in back-benefits. Finally, decisions to pay for resilience projects will depend to some extent on what the "business case" for return-on-investment shows the about relationship between the cost of projects and the financial value of the assets and potential losses the projects would protect against.

Here's the bottom line: cities that are short on funds will have to decide what will not be protected. Norfolk, one of the cities most threatened by rising sea levels, started doing this in a 2016 resilience strategy for climate change. Home to 63,000 structures and the world's largest naval base, it mapped out parts of the city—waterfront and historic districts mostly—where certain protection solutions "may prove too costly—in both the financial realm and in their impact on the natural and built environment." Instead, the strategy stated: "development intensity should be reduced wherever feasible."[47] The 2017 Army Corps of Engineers study for the city confirmed that retreat could be in the cards. It identified "real estate acquisition and relocation" as a "potential non-structural measure" in neighborhoods at high risk of flooding.[48] In Houston after Harvey, more than 1,000 houses were being purchased and torn down in areas that local officials described as "hopelessly deep in the floodplain where structural projects to reduce flooding are not cost-effective and/or beneficial."[49]

In cities where development is vulnerable to climate hazards and unprotected, retreat will happen. But it can occur in three different ways:

- ***Driven by disasters.*** An actual climate catastrophe wipes out land, buildings, and infrastructure beyond repair, scattering people into permanent migration and forcing businesses to shut.

- ***Driven by financial fears in markets.*** Concern about potential financial losses due to climate changes propels a cycle of disinvestment and abandonment by property owners, developers, insurers, and financial institutions.

- ***Driven by community planning.*** Anticipation of unavoidable climate risks results in initiation of an intentional city planning process.

Disaster-Driven Retreat

After a 2018 wildfire destroyed much of Paradise, California, forcing most of the 26,000 residents to flee, local officials worried that many people, perhaps up to a third of the population, would not return.[50]

A decade after Hurricane Katrina demolished New Orleans in 2005, the population in about three-quarters of the city's 72 neighborhoods was below pre-Katrina levels. The city's overall population in 2016 was down by about 90,000 people, 20 percent below the 2000 census count.[51]

In the five months after Hurricane Maria in Puerto Rico in 2017, at least 400,000 island residents left, according to smartphone tracking data, with each of 10 counties in Florida, New York, Pennsylvania, and Massachusetts receiving between 5,000 and 34,000 of the climate migrants.[52]

Permanent loss of population after a climate disaster is an indicator of retreat under duress. People abandon property they own or rent; the property remains in damaged condition, deteriorating. Businesses die; FEMA data indicate that about 40 percent of small businesses never open their doors after a disaster, and 25 percent more fail within a year.[53] Public infrastructure may not get enough investment for rebuilding and maintenance, and public services—water and electricity, for instance—may become more expensive to deliver because of the reduced number and spatial density of users. Public housing that is damaged may not be repaired or replaced. Harvey damaged or destroyed 1,500 public housing units, according to the US Department Housing and Urban Development, and there is no requirement that they be replaced by local housing authorities.[54]

Many of the people who are displaced in disasters but don't leave for good end up living with relatives, in temporary structures, or in their damaged houses. For some, rebuilding their homes may not be a financial option. For instance, many of the residences destroyed in Mexico Beach, Florida, by Hurricane Michael were older structures; rebuilding them to meet new construction codes designed to protect against future storms will be expensive and, *The New York Times* noted, could be beyond the means of working-class property owners.[55] "Economic factors drive decisions" about whether to stay or leave, found a post-Sandy survey

by Rebuild By Design and the Institute for Public Knowledge: the cost of flood insurance and concerns over future financial security topped the list of survivors' worries.[56]

In a disaster aftermath, people struggle with the rules for getting government emergency relief aid and may have to wait long periods to obtain state and federal government funds for repairing, rebuilding, and buyouts. After Hurricane Sandy, it took four months before New York State announced federally funded home buyout programs, but by then many homeowners had submitted applications for federal emergency assistance or started to repair their homes, while any who had received other federal aid were ineligible for buyout funding.[57] A year after Hurricane Harvey flooded Houston, more than $1.14 billion in federal disaster-recovery funds for housing approved for Texas had not been received. "You can't disperse what you don't have," griped Houston Mayor Sylvester Turner.[58] Meanwhile, many local residents, including 27 percent of Hispanic Texans, reported in a survey that their badly damaged homes remained unsafe to live in.[59]

It's hard to predict how long it will take to get federal and state governments to approve and deliver funding for buyouts of damaged houses and businesses, but it may take years in some cases. In Cedar Rapids, for instance, it took five years to buy out all of the 1,300 flooded properties, mostly using federal funds. In Conway, South Carolina, 43 homeowners volunteered to be bought out after being flooded during Hurricane Matthew in 2016. Two years later, when Hurricane Florence swamped their city, they were just reaching the end of the federally funded buyout process.[60]

A city's low-income households and neighborhoods are especially hard hit by lingering stress. A year after Harvey, a survey of 1,600 adults in 24-damaged Texas counties found that half of low-income respondents said they weren't getting the help they needed, compared to 32 percent of those with higher incomes.[61] In Puerto Rico after Hurricane Maria, federal small assistance grants to help people get back into functioning homes "failed to take into account the poverty that plagued the island even before the storm," according to one media report. Potential recipients had no financial savings or credit to use with the FEMA small assistance grants. Only 15 percent of those who applied for the assistance had homeowner's insurance and just 3 percent had flood insurance.[62]

Occurrences like these happen after nearly any large-scale disaster scenario. They amount to a retreat because they show that living in certain high-climate-risk parts of a city is unsustainable, physically and/or financially. It's not a scenario that a city's leaders would want to face. It would be better, of course, to have armored and accommodated before a climate shock. Better also to have retreated from places of the city where protections cannot, should not, or will not materialize.

Market-Driven Retreat

A second type of unmanaged retreat has not yet occurred. It could happen if property owners, developers, investors, financial lenders, and insurers in a city all anticipate climate disasters and their potential negative financial impacts on the value and cost of existing and future development that is at risk. Fear of financial losses—reduced value of houses, for instance, increased mortgage foreclosures, and mounting insurance payouts—could trigger a cascade of disinvestment in local development, resulting in abandonment of property, decline of neighborhoods, and other distress.

Many cities have experienced a prolonged wave of extensive disinvestment and ensuing abandonment, but for other reasons. It may be triggered by a national economic downturn, such as the Great Recession; local business failure, such as the closing of a major employer; environmental toxicity that contaminates parts of a community; or "white flight" from neighborhoods and business districts. Once the degeneration begins, it can continue for decades. But could the threat of climate problems lead to this urban decline?

Patterns are emerging that indicate cities may be more financially vulnerable to climate change than they think, challenging an "it can't happen here" mindset.

- ***Some houses at risk of climate disaster are losing financial value compared to houses not at risk.*** In 2018, two unprecedented studies shed light on the way that climate risk could reduce the value of at-risk property. A Harvard University study of sales of more than 100,000 houses in Miami-Dade County since 1971 concluded that lower elevation houses had gained value slower than higher elevation houses. A University of Colorado study of the sale of 500,000 houses across the US since 2007 found homes vulnerable to sea level rise sold for less than similar homes safe from rising seas.[63] These trends may threaten the financial well-being of many Americans because home equity is the largest asset for most Americans, amounting to 70 percent of the net worth of low- and moderate-income families.[64]

  Real estate professionals in Miami-Dade County pushed back against the two studies. They argued that potential buyers were more concerned with taxes and schools than climate change and that demand for expensive waterfront property had not slowed.[65] But as evidence grew that the market for scarce higher-elevation property was heating up in Miami, the city stepped in. At the end of 2018 it commissioned research to determine if climate risks or other factors such as population growth and the typical ebb and flow of housing markets were driving changes in financial value of property.[66]

  A third study, released in January 2019 by First Street Foundation, a New York City nonprofit, also found that climate risk is depressing the value of at-risk property. It estimated that the value of homes in Massachusetts has potentially been eroded by $273 million since 2005 because of concerns about flooding and sea level rise. "Increased tidal flooding leads to a loss in home value appreciation," said coauthor Jeremy Porter, a professor at City University of New York. "As sea level rise

accelerates, we expect the corresponding loss in relative home value to accelerate as well."[67]

- ***A substantial amount of private investment in real estate development is in urban areas with known climate risks.*** A study by CoreLogic, a leading provider of property data, found that 6.9 million homes along the Atlantic and Gulf Coasts are at risk for hurricane storm surge damage, with 67 percent located in 15 metropolitan areas. The cost to completely rebuild at-risk homes in a 100 percent destruction scenario in 2018, including labor and materials—was pegged at $1.6 trillion.[68] According to another private sector analysis, $130 billion in real estate lies in high-risk parts of the US metropolitan areas most exposed to sea-level rise.[69]

- ***Private property insurers are racking up substantial climate-related losses.*** "This year is shaping up to be one of the worst in terms of catastrophe losses the insurance industry has ever incurred," reported *Insurance Business America* in November 2018. The industry magazine pointed at Hurricanes Florence and Michael, which together caused more than $31 billion in economic damages, and wildfires in California and elsewhere.[70] At the end of 2018, Allstate Corp. announced that it had paid out more than $1.2 billion to victims of two wildfires in California. CEO Tom Wilson noted that severe weather events across the US have put "customers in danger and at risk of losing their homes and hard-earned money."[71]

  Mounting losses due to climate events may increase the insurance industry's attention on and concern about climate risks. "As risk increases," reported climate-resilience consultant Joyce Coffee in *Money for Resilient Infrastructure,* "insurers may abandon or decrease their exposure in certain high-risk markets or, in an extreme scenario, insurers may find themselves unable to cover the payment of damage claims."[72] This has happened in the national flood insurance and California seismic insurance markets. In the 1960s, after insurers began excluding flooding from homeowners insurance policies, the federal government created the National Flood Insurance Program, which became the primary flood-insurance provider for property. In California, after insurers abandoned the earthquake insurance market following $17 billion in payouts due to the 1994 earthquake, the state created the California Earthquake Authority to fill the gap.[73]

- ***Taxpayers and ratepayers are already bailing out enormous amounts of losses due to climate hazards.*** In 2017, Congress made $120 billion in *additional* disaster aid available to areas affected by Hurricanes Harvey, Irma, Maria, and wildfires in the Western US. The same year, Congress forgave $16 billion of the $30.4 billion that the National Flood Insurance Program (NFIP) had borrowed from the US Treasury to cover flood-damage payouts. "NFIP was not designed to handle catastrophic losses like those caused by Harvey, Irma and Maria," said Mick Mulvaney, then-White House budget director. Since 2005, NFIP has run a $1.4 billion average annual deficit

because the total premiums it charges homeowners don't cover the total payouts it makes. Two years after Congress approved a big increase in NFIP premiums in 2012, it rescinded much of the boost because of the outcry when policyholders received the bills.[74]

As a result of these and other government policies, massive financial losses in at-risk private property and development are being borne by taxpayers. There's a growing understanding that the public is paying the costs of risky development, said Thomas Ruppert, a coastal planning specialist at Florida Sea Grant and lawyer who specializes in property rights and the environment. "You get privatization of the benefits and the public pays the bill – socialization of the costs. And until we change that dynamic, we're in trouble."[75]

At the same time customers of essential utility services are being hit with rate increases to cover huge climate-related losses. In early 2019, for example, California's Pacific Gas and Electric utility, the primary supplier in the state's northern part, announced that it faced an estimated $30 billion in damages due to wildfires for which it was partly blamed—a liability that greatly exceeded its insurance coverage. It asked the state legislature to allow it to pay the cost of wildfires by increasing rates, a policy the state had approved for the previous year's losses. It also filed for bankruptcy.[76]

- ***Millions of people live uninsured in flood-risk zones.*** Research in 2017 found that 41 million people lived in 100-year flood plains—more than three times the number enrolled in NFIP. The number is expected to rise due to climate change.[77] In the New York area, 80 percent of the people who suffered flood damage from Sandy did not have flood insurance.[78] "There continues to be a substantial insurance gap, even in a highly developed market like the United States where, for example, the vast majority of home and small business owners do not purchase flood insurance," said Tony Kuczinski, president and CEO of Munich Re, US, one of the nation's largest reinsurance companies.[79]

- ***Cities are under increasing pressure to assess, disclose, and reduce their climate risks—or face financial consequences.*** Moody's Investors Service, which rates the financial quality of municipal bonds, announced that the physical risks of climate change could impact a local government's ability to pay back debt and, therefore, would be a factor in rating the quality of bonds issued by cities. Downgraded credit ratings would increase a city's cost to borrow long-term private capital and potentially reduce its ability to undertake armoring and accommodation projects.

These patterns are just data points so far, but they can be woven into a scenario in which an unmanaged, chaotic retreat drives a widespread, unchecked, downward spiral in a city's fortunes. The distress might unfold, before a climate catastrophe occurs, along lines that some analysts and city officials have begun to warn about.

1. ***Real estate markets weaken due to heightened awareness of climate risks.*** As public awareness of the climate vulnerability of certain properties increases, demand for the purchase or rental of development and for future development of property falls. The weakening real estate market drives down prices and rents, or leaves owners and investors with property they cannot sell or rent. "As communities become more susceptible to flooding," noted a Lincoln Institute of Land Policy report, "market forces may generate lower property values and greater disinvestment. . . . Without any intervention, individuals within the community may be left with few resources and fewer options."[80]

   More and more data about the climate risks of specific properties is becoming available—information of great interest to insurance companies and property owners. A start-up company, Jupiter, combines analysis of local weather and hydrological data with climate model projections to assess potential risks. Another startup, 2014 Coastal Risk Consulting, opened in south Florida to offer flood assessments for homeowners nervous about sea level rise.[81] Hawaii's "Sea Level Rise Vulnerability and Adaptation Report," published in 2017, provided the public with an online tool showing where coastal areas will be inundated with water at 1- to 3-feet of sea level rise during the next 30 to 70 years.[82]

2. ***Investment declines.*** As a result, property owners and investors become less willing, and perhaps less financially able, to invest in maintaining their property and protecting it from climate risks. Lenders become less willing to finance property improvements and mortgages for new buyers.

3. ***Insurance becomes less available.*** The real estate market is further weakened because private or government insurance for at-risk property becomes either unavailable, capped at an amount far below the value of the property, or unaffordable for many property owners due to rising premiums driven by climate risks. The price-sensitivity of some homeowners was underscored when New York City challenged the scientific basis of FEMA's redrawn flood-zone maps for the city, which would have doubled the area in which insurance was required. "We don't want to jack up insurance rates and cause a foreclosure crisis," said a top city official.[83]

4. ***Property tax declines weaken public services.*** The decline in property value results in reductions in property tax revenue for the city, which forces cuts in public services and investments in maintaining public infrastructure—even as the need for local revenue to invest in climate-resilient solutions increases. When, for instance, schools and fire stations in a neighborhood are closed due to budget strains, the neighborhood's viability can be compromised. At a community scale, these sorts of cuts can reduce the public's confidence in the city's viability and prospects.

5. ***More owners try to sell.*** The decline in public support prompts more at-risk property owners to try to sell, and an ensuing supply-side glut of properties further reduces prices, value, and city tax revenue.

6. ***Out-migration accelerates.*** Property owners and renters who can afford to leave at-risk locations move elsewhere. Lenders are increasingly unable to collect payments on mortgages and are stuck holding properties with declining or no value. Depopulated neighborhoods become plagued by social problems. "People with money leave, pirates and con artists arrive. . . . you get crime and lawlessness" is how Jeff Goodell portrayed this in a Miami-based scenario in *The Water Will Come*.[84]

Disinvestment along these lines was depicted by Philip Stoddard, the mayor of South Miami, a city of 12,000 and 2.3 square miles severely threatened by rising seas. "We won't see whole areas abandoned but neighborhoods will get sparse and wild looking, the tax base will start to crumble," he said in 2018. "We don't have the laws to deal with that sort of piecemeal retreat. It's magical thinking to think someone else will buy out your property. We need a plan as to what will be defended because at the moment the approach is that some kid in a garage will come up with a solution. There isn't going to be a mop and bucket big enough for this problem."[85] Smaller cities may be especially vulnerable to a climate-induced cycle of abandonment and disinvestment, noted Amy Chester, managing director of Rebuild By Design. After Hurricane Sandy, coastal communities in New Jersey seeking to sustain their tax bases worked to persuade departed residents to return.

Others warn that what starts as a trickle of negative impact can become a torrent. In 2016, the Federal Home Loan Mortgage Corporation (Freddie Mac) said that rising seas were likely to displace millions of people from homes: "Non-economic losses may be substantial as some communities disappear or unravel. Social unrest may increase in the affected areas."[86] Harriet Tregoning, former deputy assistant secretary of the Office of Community Planning and Development at the U.S Department of Housing and Urban Development, noted that a slow decline in property value could accelerate: "There's going to be a point where the value of homes in neighborhoods that repeatedly flood decline suddenly and precipitously."[87] "We're going to get to a threshold," said David Wrathall, a geographer at Oregon State University investigating future migration from sea-level rise. "There will be low levels of migration, and then suddenly there's going to be these moments where lots of people are going to come into the system all at the same time. Not just from one location, but from lots of coastal locations simultaneously."[88]

When cities slip into decline of this sort a heavy burden falls on low-income households. They don't usually have the financial resilience of more affluent people and communities. They are less likely to be able to invest in protecting their property and to afford higher insurance premiums. They are less likely, as an at-risk area declines and local businesses face difficulties, to find new employment elsewhere or to sustain their businesses. They may need

to leave to survive. Just as it is harder for them to rebuild after a climate disaster, it is harder for them to avoid or rebound from financial disaster.

In a market-driven retreat, individuals and families, especially property owners, must make stressful, deeply emotional decisions about whether and when to move away from at-risk locations without the support of local government resources and community-based resources, such as facilitated processes, technical information, financial analyses, and partnering. Because each person's household resources differ, including money, social capital, and the ability to engage with local institutions, this dynamic will produce unpredictable and often inequitable outcomes for the individuals and within the community.

In these and other ways, climate risk in cities could stress the financial resilience of local real estate, financial, and insurance markets, with damaging, snowballing impacts on households, businesses, and government that amount to an unmanaged retreat.

Plan-Driven Retreat

Advocates for urban retreat—mostly urban-planning experts, climate scientists, and environmental activists—see it as a prudent way to reduce damage that climate change is likely to cause. Managed retreat can benefit a city by:

- Preventing future injuries and loss of life.
- Ensuring the availability of roads and other crucial physical infrastructure that have been relocated, which avoids disruption of business.
- Avoiding severe financial losses due to damage to property and infrastructure and reducing the cost of responding to, recovering from, and rebuilding after a climate disaster.
- Preventing damage to other development and to essential local ecosystems.
- Avoiding the devastating damage that can force residents—even entire neighborhoods—to hurriedly and permanently migrate to other places.
- Preventing the burden of climate disasters from falling predominately on disadvantaged and low-income residents of the city, who often live in a city's most climate-exposed areas and have limited resources with which to recover.

Other benefits come from being able to retreat over a longer time period than would make sense after a climate disaster. "Anticipatory managed retreat, rather than just post-disaster action, will allow people to think through their decisions more thoughtfully instead of in the midst of stress and trauma of disaster," noted Elana Sulakshana in an analysis of post-Sandy buyouts: "Taking buyouts out of the context of disaster also allows for more flexible and creative ways of funding and operationalizing buyouts."[89]

Cities may also face legal liability for failing to adapt to known climate risks, which could include taking retreat actions. This topic—municipal climate liability related to resilience building—has received little attention so far. But in 2017 the Conservation Law Foundation examined the question in Massachusetts for the Boston Green Ribbon Commission. Its research found that while municipalities may have "no statutory duty to act" specifically to climate change, they could face liability "for failing to act when they have sufficient knowledge that inaction could result in injury to people or property," especially since cities have "substantial authority" to pursue adaptation actions.[90] The legal situation has uncertainties: "Whether existing information about climate change constitutes sufficient knowledge" to support a claim against a city "is not yet settled."[91] The CLF report noted that the potential of litigation could prompt city decision makers to act more swiftly on climate adaptation, but it could also discourage them from gathering climate data or doing analysis that might be used in court against them. At the same time, the study said, "As the state government continues to pursue adaptation efforts and provide resources for municipalities, the knowledge component of tort claims will be easier for plaintiffs to establish."[92] Sufficient knowledge, it added, could also trigger the "affirmative duty" of a city to act on climate change, even if the duty is not spelled out in statute.

It's better to get people and infrastructure out of harm's way before either a climate disaster or a financial crisis driven by climate risks occurs. In the past, cities have often chosen to limit their spatial development in high-risk zones, at least to some extent. They have prohibited new development in earthquake-, flood-, and wildfire-prone areas and along sea coasts, and offered incentives to steer development elsewhere. They have also kept land free from development where it was needed for flood or fire protection, to provide green space and agricultural land, or to keep natural ecosystems functional. But these land-use decisions usually occur in anticipation of development, not after development has occurred. And they are seen as delivering immediate benefits—recreational space and environmental services—not just avoiding long-term risks.

Most city decision makers are unwilling to take near-term actions that may be contentious and costly in order to avoid long-term risks that may not be realized and lie well outside of election cycles. Instead, they decide to wait-and-see. Perhaps the dire climate forecast will change, or less disruptive and expensive solutions will emerge, or other levels of government will act, or the community's acceptance of the necessity for retreat will strengthen. In any case, there are other uncertainties: how much retreat would cost, how it would be paid for, where people who are retreating would go, what legal entanglements the city might find itself in. Besides, other approaches for strengthening the city's climate resilience—armoring and accommodating physical infrastructure and bolstering emergency response capacity—deserve attention and resources. Why invite the nearly certain pain of even considering retreat?

One answer to the inertia is to insist that cities study managed retreat. California's Coastal Commission, which protects the state's beaches for the public and regulates coastal

development, is developing a policy that guides coastal city and county governments to include managed retreat in their adaptation plans. The commission wants communities to establish triggers for retreat from designated zones, such as setting a minimum beach width that maintains optimum public recreational access. All new development and major redevelopment in the zone would be permitted on the condition that modification or removal would occur when needed to maintain the beach width. The commission's guidance would be advisory, but it has leverage over communities: it must certify or reject local adaptation approaches that communities add to their Local Coastal Program. If a city does not have a certified program, then the commission may exert greater control over permits in coastal areas.[93]

Another answer is to show cities that there are ways to successfully address the political, economic, and other problems they fear would come with managed retreat. Show them, in other words, that managed retreat can be managed.

Retreating Before There Were Cities

In Australia, Jeff Goodell explained in *The Water Will Come*, many Aboriginal stories tell of a time when the seas rose and forced coastal people to move inland. Some stories' details—named landmarks now underwater—can be traced back to the last Ice Age, before global warming raised sea levels and flooded coastal settlements. And long before the first cities were established.

"Our expectation originally was that the sea level must have been creeping up very slowly and not been noticeable in an individual's lifetime," linguist Nicholas Reid, who studies dying languages of Australian aboriginals, told Goodell. "But we've come to realize . . . there must have been constant inland movement, reestablishing relationships with the country, negotiating with inland neighbors about encroaching on their territory. There would have been massive ramifications of this."[94]

But, as Goodell noted, retreat is not as simple these days: "We modern humans have poured a lot of concrete and asphalt and erected a lot of steel on the beach, and that makes it far more difficult for us to just fold up our tents and move to higher ground."[95]

Insight #2 -- There is an emerging roadmap for generating community acceptance of managed retreat as part of building a city's climate resilience.

The joy in disaster comes . . . from an affection that is not private and personal but civic: the love of strangers for each other, of a citizen for his or her city, of belonging to a greater whole, of doing the work that matters.
—Rebecca Solnit (*A Paradise Built in Hell*)[96]

When should a city consider managed retreat? As soon as possible, for two reasons. First, cities cannot know with certainty when climate disaster may strike; a blow could arrive soon, not many years from now. Second, cities cannot instantly accomplish a managed retreat; it will probably take many years, maybe even decades, to implement.

The best time for a city to consider retreat is, of course, before a climate disaster strikes or before the next disaster strikes if there has already been one. But a city cannot be sure when the climate risks it faces might actually materialize. In most cases, climate-science analysis only tells a city how much more likely than in the past it is to be hit by a hurricane, heat wave, or other climate event. Sea level rise is something of an exception, because it is a gradual, relentlessly increasing stress, rather than a sudden shock like a hurricane or cloudburst. But the ocean's actual rise has been accelerating and climate scientists' predictions of the pace have considerably underestimated actual increases. In 2015, Charleston, South Carolina, used predictions of sea level rise for the next 50 years to recommend a 1.5-2.5-foot elevation increase for new facilities and infrastructure. Just three years later, after the city considered new sea level rise projections and precipitation trends, it increased the recommendation to 2-3 feet.[97] Since a city can only know the probability of climatic events, it must bet on whether such events will or will not happen. More and more cities are betting that something unacceptably damaging is likely enough to happen that they should start planning their climate resilience now.

It will take most cities many years to plan and implement a managed retreat that involves substantial relocation of buildings and infrastructure, and the planning for and maintenance of land that is being returned to undeveloped condition. Each specific project—buying out private property, designing and constructing new roads and public facilities—will require planning, legal approval and regulatory compliance, funding, and implementation. It can take communities many years to update the plans and ordinances required to reduce development in high-risk areas, and then many more years for the changes to affect land-use decisions. Just making a plan for climate resilience that includes retreat can take years. For instance, Norfolk started working on its climate resilience in 2010[98] but didn't have an overall protection plan, provided by the US Army Corps of Engineers and including retreat, until 2017. And at that time the city still didn't have the funding to implement the plan. In another setting, it took the Corps four years to recommend a plan to protect the Texas coast.[99]

How long planning and implementation of retreat will take may depend on whether, when, and how much funding is available. The Alaskan village of Newtok tried to move away from rising seas for a decade before the federal government approved $18 million for the relocation in 2018.[100] A report for the Coastal Protection and Restoration Authority in Louisiana calculated that 2,400 households could flood more than 12 feet during a major storm and laid out a $1.2-billion plan to buy them out, with the state paying fair market value for houses, demolishing them, and paying for new houses. But state funds available for coastal restoration cannot be used to buy people's homes and move them.[101] In New York after Hurricane Sandy, homeowners in 10 damaged Staten Island neighborhoods formed buyout committees, but only two neighborhoods were given access to the limited federal funds managed by the state's Office of Storm Recovery.[102]

Charlotte, North Carolina, is one of the few cities that uses locally generated funds for retreat, collecting a $1.25 a month charge on customers of the Charlotte-Mecklenberg stormwater utility. It has spent $68 million to buy and demolish 400 buildings on its floodplain. But it has taken 20 years to achieve this scale of retreat and the county's program manager says it still wants to remove 500-1,000 more houses.[103] The slow pace of locally funded retreat prevailed in Harris County/Houston where the flood-control district has been buying out flood-plain properties for 33 years. After Hurricane Harvey, local voters approved a $2.5-billion bond package that included $184 million in local money for buyouts, which will leverage $552 million in outside funding for the same purpose. In all, the funding will purchase around 3,600 buildings—more than the number bought out in the past three decades.[104] But that expanded scale of retreat will not be enough, contended environmental law professor Jim Blackburn, codirector of Severe Storm Prediction, Education and Evacuation from Disasters Center at Rice University: the city hasn't produced "a definitive concept of what a flood-resilient Houston will look like. . . . We have accepted that we will have to buy out some, [but] I don't think we've come close to realizing how large of a buyout that's going to be required."[105]

Even after funding for property purchases has been obtained, implementing buyouts and other retreat measures can take years. For example, Cedar Rapids needed five years to complete the purchase of 1,300 properties after its devastating 2008 flood. Just two years after coastal Isle de Jean Charles, Louisiana, received $48 million in federal funds to resettle its 99 residents, the process was already behind schedule.[106]

If cities do realize that there are good reasons to consider retreat in the near future as part of a comprehensive climate-resilience plan, they still may fear that the "r word" will only create controversy and pain. But considering retreat may not be as problematic as most city leaders might assume.

Cities have retreated before, constraining their development footprint for various reasons. Some have removed public infrastructure to solve a safety problem. Seattle and San Francisco, for instance, have both demolished highways along shorelines that were damaged

by earthquakes. Some cities have relocated water treatment and electricity generating facilities severely threatened by flooding or coastal erosion. Moreover, many cities have prohibited future development in areas targeted for green space, wildlife refuges, public beaches, and park land or to preserve wetlands and other ecosystems. Perhaps more cities will follow the example of Stuttgart, Germany, which has prevented new development on certain hillsides so it can maintain nighttime air flows into the city to cool temperatures.[107] These types of retreat decisions may not have been without controversy and difficulties, but they were implemented nonetheless—because they provided obvious and short-term benefits for the community.

But public infrastructure is not private development with its enormous financial stakes for owners and investors. And existing development is not future development. Immediate safety concerns are not projections of climate risks years away. Green space and environmental protection offer tangible positive benefits, not the hypothetical benefit of risk reduction. These factors make retreat in the face of climate risks a more difficult proposition to sell in any city, especially one that has not experienced a climate disaster.

Still, the limited experience of cities that have taken on managed retreat suggests that an effective process can move the community from denial and anger to acceptance.

A Roadmap for Retreat

On June 13, 2008, Cedar Rapids, Iowa, suffered the worst natural disaster in its 170-year history. The swollen Cedar River, which flows through the heart of the city, crested at 31 feet, more than 19 feet above flood stage and 11 feet above the previous record. Flood waters covered 14 percent of the city, surging over protective levees and more than 1,100 city blocks, severely damaging half of them. Most of the downtown business district went underwater and 310 city facilities were damaged. The flood swamped more than 5,300 residential properties and dislocated an estimated 18,000 people. In one neighborhood, hundreds of homes were damaged beyond saving.[108]

In 2013, Norfolk, Virginia, a 400-year-old coastal city, was becoming nationally known as a poster child for places seriously threatened by climate change. "Rising sea levels torment Norfolk," read a headline in *USA Today*: "Flooding has become so common in this city, where water is the lifeblood, that residents talk about it in the supermarket." The flooding would only get worse, various scientists predicted: Norfolk, partly built on filled-in marshes, was sinking even as seas were rapidly rising and the number of coastal storms was increasing. A study released a little earlier found that the Norfolk naval station's infrastructure wouldn't survive the storms and flooding expected in the second half of the century.[109] A later analysis by the Union of Concerned Scientists projected that a 6.5-foot rise in sea levels by 2100 would inundate 40 percent of the city at least twice a month.[110]

In subsequent years, both Cedar Rapids and Norfolk considered managed retreat as a part of their responses to climate disasters and risks.

Following the flood, Cedar Rapids purchased, demolished, and removed more than 1,300 residential and commercial properties from its flood zone, at a cost of about $128 million, nearly all of it obtained from the federal government.[111] Most purchases were voluntary acquisitions of properties prone to flooding or so isolated that it was inefficient to continue to provide them with city services. But the city did not financially support rebuilding projects where it needed open land for its flood protection plan.

Norfolk produced a 2016 plan for its long-term future, *Norfolk Vision 2100*, that identified places—waterfront and historic districts mostly—where certain protection solutions could be too expensive or have unacceptable environmental impacts. Instead, the strategy stated that "where facilities cannot be reasonably protected from the impacts of rising water, they should be relocated to higher ground."[112]

How these and a few other cities have navigated to include managed retreat in their climate-resilience strategies provides an initial roadmap for cities that recognize they should not wait before considering retreat.[1]

Do Communities Experience Stages of Grief?

The actuality or prospect of permanently leaving one's home or community may produce a deep emotional response, a powerful sense of loss and sorrow. Fifty years ago, psychiatrist Elizabeth Kübler-Ross was inspired by her work with terminally ill patients to conceive of five stages of grief—not necessarily in linear progression—to describe how people cope emotionally with personal loss:

- *Denial.* Individuals believe that the diagnosis/forecast is mistaken and cling to a preferred reality.
- *Anger.* Individuals realize that denial cannot continue; they become frustrated, feel victimized, and look for something to blame.
- *Bargaining.* Individuals hope they can avoid the problem by changing their behaviors and lifestyle.
- *Depression.* Individuals despair at the recognition of the problem's inevitability.
- *Acceptance.* Individuals embrace the inevitable and prepare for it.

As more Americans acknowledge that their local area might be harmed by extreme climatic events, it may be worthwhile to pay attention to how people in communities react to the dangers of climate change and the prospect of retreat, a wrenching loss of their place and stability.[113] For many people who have acknowledged climate change for some time now, emotions of anger, bargaining, depression, and acceptance may have already been a part of their personal experience and affected their political actions.

In communities hit by serious losses due to climate disasters, these emotions may also present socially, not just in individuals. Groups of people, entire communities, may be moved to anger and blaming, bargaining and depression. "People and communities who emerge from a storm often identify as 'survivors,'" noted a Lincoln Institute of Land Policy report. "This sentiment makes them more likely to oppose retreat."[114] The idea of retreat,

[1] Our roadmap for retreat is based on what we've learned about the experiences of 13 US cities: Cedar Rapids, Iowa; Charleston, South Carolina; Charlotte, North Carolina; Fort Lauderdale, Florida; Houston, Texas; Imperial Beach, California; Key West, Florida; Miami, Florida; New Orleans, Louisiana; New York, New York; Norfolk, Virginia; Phoenix, Arizona; and Sarasota, Florida.

of "giving in," of "losing what was," may reinforce these negative feelings and this, in turn, may delay or prevent a community's acceptance and preparation for climate risks.

Lessons Learned About Managing Managed Retreat

Managed retreat should be one of the strategies that cities routinely consider in developing their long-term climate resilience. Consideration of retreat should arise during the typical long-term climate-resilience planning process in which a city assesses its climate risks; identifies its physical, social, and economic vulnerabilities; establishes goals, strategies, and actions to take; and prioritizes what it will do—before implementation occurs. However, as described earlier, there's nothing normal about considering retreat. Mere mention of the idea can spark a heated outcry from some members and sectors of the community. It's not unusual to hear from city government staffers that "our elected officials are not ready for a retreat discussion." There is a widespread assumption that retreat is for city leaders like Kryptonite for Superman, something hazardous that will drain away their powers.

But this assumption may be wrong.

Lessons Learned About Managing Managed Retreat

1. A city's community-engagement process for resilience planning should be designed for the emotional and social aspects of considering managed retreat.
2. A city's assessment of its climate risks and vulnerabilities should expose, not hide, the potential implications for retreat.
3. Cities should reframe retreat as not just a loss of what is, but as part of a positive and inspiring vision for what can be, for the city's long-term development and success.
4. A city can help to normalize retreat by relocating essential public infrastructure and revising city rules that steer new development.
5. Consideration of retreat should include recognition of its potential impacts on economic and social disparities in the city.

1. A city's community-engagement process for resilience planning should be designed for the emotional and social aspects of considering managed retreat.

Climate-resilience planning is designed to be a highly rational exercise driven by the collection and analysis of enormous amounts of data and the careful weighing of options to determine the best course of action. But if the possibility of retreat is going to be on the table, the planning process has to account for more than rationality. Other dimensions of the process have been described by the Climigration Network, an affiliation of urban planners, engineers, artists, academics, social workers, and people from other fields that is addressing questions about relocating in response to climate change impacts.[115]

- *Expression of emotions.* Given the feelings of loss, grief, and fear that come with retreat, the planning process has to provide what the network called "thoughtful avenues for the expression of strong emotions." The effects of rising sea levels "for cities like Miami," reported a 2016 Miami Foundation study about how to communicate with the public about sea level rise, "are both physical and psychological." It noted that denial and fear obstruct understanding of the complexity and scale of the sea level rise problem and that "We need 'the opposite of panic.'" But engaging the community's emotions is not just about holding venting sessions. A good rule of thumb, the foundation said, is "1/3 'fear' for urgency + 2/3 'hope' to motivate and empower." A top communication recommendation it offered was to "have frequent, genuine conversations . . . the more transparent, open, and two-way the conversation, the better."[116]

  An example of an emotion-oriented process would be to focus on people telling each other their stories of anxiety or disaster, not just on data. It's a humanizing process even if people have differences of opinion.

  It's also important to use different modes for group engagement: public meetings, town halls, social media, and more. Cedar Rapids, Norfolk, and other cities have recognized that neighborhoods may be "impact zones" for climate hazards and, therefore, a locale for emotional and social expression of loss and hope. Looking at resilience as a neighborhood-specific process "encourages diverse interpretations and applications that are tailored to community circumstances," explained post-Sandy researcher Sulakshana.[117]

  Engagement processes should allow for more intimate, personal discussions, and for collaborative, solutions-oriented efforts—unlike a typical public hearing in front of local officials that is likely to foster heated advocacy and confrontation. When city officials in Imperial Beach, California, ran a land-use workshop in late 2018, hundreds of residents turned up to oppose the city using the term "managed retreat" in the city's General Plan due to fears that this represented a step toward use of eminent domain to take property threated by sea level rise. The topic dominated the hours-long session after, according to a news report, "social media whipped up" the worries. But city officials responded that they had not committed to such a course of action. "People just made things up and decided it's what they have to fight and it just isn't true," said Mayor Serge Dedina. "We're going to keep communicating," he added. "We have real issues to address."[118]

- *Embrace of community.* The process also has to ensure that a wide range of stakeholders in the city come together for a "whole-community conversation" focused on asking tough questions and creatively solving problems, the Climigration Network explained. "We're all in this together," the Miami Foundation report stressed, as a way to address the feeling of disconnection and powerlessness of economically vulnerable

communities in the city.[119] This point was underscored by Sulakshana's post-Sandy research about decisions people in different neighborhoods made about staying or relocating: "Factors at the community level, not individual, determined the choice. These factors included community perceptions of resilience, the history of previous disasters, and the experience of Hurricane Sandy. The residents of Oakwood Beach pursued relocation because their attachment to the neighborhood was dwarfed by fears that their physical safety was in jeopardy and that they would not be able to withstand future damage. In contrast, Rockaway Park chose to rebuild because they concluded that Sandy was a 'freak event.'"[120]

- *Commitment of leaders.* The planning process has to have a credible commitment from local leaders that they will, as the Climigration Network put it, "collaborate and stay engaged in the conversation even when challenges arise." Otherwise, why should anyone else in the city engage seriously? The skepticism "about the capacity of city/county officials to prioritize [action for sea level rise] and handle it is high," said the Miami Foundation study. Many people "feel powerless in the face of entrenched commercial and political interests." The community needed "clear leadership and accountability. . . . People are looking for fearless leadership and trustworthy sources."[121]

2. *A city's assessment of its climate risks and vulnerabilities should expose, not hide, the potential implications for retreat.*

A city's framework for assessing its vulnerability to climate change sets up the community's subsequent understanding, discussion, and opinion forming about what to do. Because this is a fairly new planning practice for cities, the elements of the framework continue to emerge. For instance, cities have gradually expanded their definition of vulnerability to climate hazards to include social and economic, not just physical, vulnerabilities: the children and elderly and low-income and chronically ill residents, and others, who may be more susceptible than others to harm from flooding or heat waves.

For reasons described earlier, city leaders may be tempted to downplay or avoid the prospect that some parts of the city could remain unprotected from climate hazards—because of engineering or financial limitations or environmental considerations—and could, therefore, become unusable. But an analysis that presents the "brutal facts" to the community—including retreat—has several purposes. It signals the true risks to everyone in the community, not just to those in the know.
It builds awareness and counteracts instinctive denial, at least for some members of the community who don't understand the complexity or scale of the climate dangers. It provides ammunition for those who advocate that the city should take action. It also lays the groundwork for considering what the city should do to reduce or eliminate vulnerability.

A number of cities, especially those facing severe sea level rise threats, have looked at their climate futures in ways that acknowledge the prospect of having to retreat.

Norfolk's *Vision 2100* report signaled the city's climate risks when it decided to categorize the city into four zones, including yellow areas where the city cannot afford expensive flood protection but would have to rely on a combination of adaptation and retreat. "There are parts of the city that are vulnerable and cannot be effectively protected," said George Homewood, the city planning director. "And then there's other parts of the city where you've got to scratch your head and say, you know, maybe we could protect it, but what's the cost-benefit of that?" The signaling, he added, has driven a productive conversation in the city. "The good thing is, there's an awful lot of discussion going on. . . . We don't have all the answers, but we're beginning to ask the right questions."[122]

The discussion in Key West, Florida also faces up to the city's extraordinary climate risks. With 27,000 residents, $22 billion in property, and 3-million visitors a year, Key West sits on land between the Gulf of Mexico and the Atlantic Ocean, an average of 4.7-feet above sea level atop porous limestone through which seawater can flow. Sea level rise is an existential threat for the entire community, a brutal fact that is hard to miss. Already at monthly full moon high tides, storm drains back up and inundate 11 traffic intersections. An unchecked 3-foot increase in sea level could cut the city's land area by perhaps 50 percent. An 8-foot-high hurricane storm surge could inundate all but the city's highest spot, 18-foot tall Solares Hill. The city's airport, built in the middle of a wetland and serving 362,000 passengers yearly, would be 94 percent underwater with 2-feet of sea level rise.[123] The city's miles of beaches, coastal natural areas, and main evacuation highway have limited or no protection from the rising sea.

When city officials participated in a "resilient redesign" retreat to contemplate what might be needed by 2060, they considered moving the highway inland and relocating the airport—big ticket items. Many of their other adaptation ideas—increasing the coastal mangrove and dune systems, raising the level of houses, capturing and reusing rainwater—all require money too.[124] But in the longer run, given sea level rise projections, retreat is unavoidable. The city's sustainability coordinator, Alison Higgins, acknowledged the city's predicament: "We might as well make the transition as slow and painless as possible… And we'll search for the way to stay here as long as we can."[125]

Imperial Beach, the southernmost city on the California coast, with a population of 27,000, could have 30 percent of all structures and parcels and 40 percent of its roads impacted by 6.5 feet of sea level rise by 2100, according to a 2016 consultant's study. The City is vulnerable to changes in sea level due to its low laying elevations and unique geography where it is surrounded on three sides by water. Coastal erosion could destroy 5.4 miles of roads and 1 mile of the city's stormwater system. The report examined the physical and economic impacts of retreat, including the removal of a seawall, and the impacts of armoring and accommodation strategies. It concluded that "retreat has much higher recreational and

ecological value than armoring since it preserves the beach and the coast." It suggested the development of a phased, long-term managed retreat plan.[126]

Charleston, South Carolina, a coastal city with 110,000 residents, issued a climate-resilience strategy in early 2019 that included retreat as a strategy for protecting citizens and neighborhoods. The city should "direct growth to where it makes the most sense over the long term, to high, dry and connected areas . . . and to seek innovative opportunities to adapt and retreat in higher risk areas." It must evaluate land uses in three categories: land to resist flood events, land to be retrofitted to adapt to living with flooding, and "land to be returned back to nature or remain natural."[127]

Increasingly, cities cannot hide the risks and the potential need for retreat, because more and more information about climate risks is out there. Some of a city's climate vulnerabilities may be obvious even if they are not yet part of a comprehensive analysis. For instance, houses and neighborhoods subject to recurring flooding and damage are a pretty strong indicator of a serious problem. A 2016 analysis by the Pew Charitable Trusts reported that more than 150,000 properties nationwide have flooded repeatedly—some in every state, but 21 states had more than 1,000 repeatedly flooded properties and five—Florida, Louisiana, New Jersey, New York, and Texas—had more than 10,000 each.[128] In Hawaii, a special commission on climate change issued a report with an online tool that lets the public see where coastal areas will be inundated by sea level rise during the seven decades.[129] A report on flood risks in Charleston County, South Carolina, projected that nearly 8,000 homes could flood in the county by 2050 if there is a 2-foot rise in sea levels.[130] Charleston is using a grant from Bloomberg Philanthropies to establish an online tool, the Flood Condition Awareness Program, that would use data from flood sensors around the city and climate-risk data from the National Weather Service and NOAA, to allow the public to see where flooding is predicted to occur.[131]

Projections of potential damage may not surprise many community members anymore. A national survey in December 2018 found that a majority of respondents worried at least a little that their local area might be harmed by extreme events—extreme heat, flooding, droughts, and water shortages.[132]

When cities ignore retreat, they miss an opportunity to educate the community through a deliberative engagement, to develop the community's understanding about climate change. Instead of setting the stage for a potentially necessary community deliberation, they put off what needs to be discussed and, perhaps, lay the ground for chaotic retreat. And they are assuming that retreat can only mean a negative future for the city.

3. *Cities should reframe retreat as not just a loss of what is, but as part of a positive and inspiring vision for what can be, for the city's long-term development and success.*

This is perhaps the most important lesson: a positive vision for the community's future, which reflects people's desires and dreams, can outweigh negative feelings of potential loss. "It's difficult to know where you are going if you don't have a clear vision of what that [future[should look like, in particular, a positive vision that you could get excited about and motivated to really make a transformational change," explained Timon McPhearson, director of the Urban Systems Lab at The New School.[133] Such a vision can become a part of the community's psyche, replacing the wish to keep everything the same.

In Norfolk, city leaders had bogged down when trying to decide what to do with limited resources that were not enough to armor all of its 144 miles of coastline against sea level rise. "How," recounted a 2016 report, "could the City determine which of its many stable, well-kept coastal neighborhoods were to be 'protected' and which the City would 'retreat' from? City leaders had begun to view the solution as only including those two options." It was a dilemma without good answers. The way out of the bind was to recognize that many areas of the city were not at risk from the sea due to their elevation and flood control infrastructure. These places offered opportunities for development where "the best elements of the City—the things that make Norfolk great—could be replicated on higher ground."[134] The planning process, it was decided, should reimagine *the entire city*, while also identifying shoreline protection measures for areas at risk. The vision developed with community residents was for Norfolk to become "a dynamic, water-based community into the next century," a "Coastal Community of the Future." Part of the visioning process identified the city's key assets—the downtown commercial area, the port, airport, light rail, and others—and their economic, cultural, and potential value. Although the vision acknowledged the possible use of retreat in areas where protection from sea level rise and flooding might not be available, it also designated "new urban centers" where new development could house as many as 60,000 people.[135]

In 2017-2018 in the San Francisco Bay Area, the Resilient by Design Challenge brought together local residents, public officials, and experts to design solutions that would strengthen resilience to sea level rise and severe storms, "The Challenge highlighted that design . . . can play an essential and aspirational role in complex, difficult conversations," reported an assessment of the process by the Consensus Building Institute. Focusing on design "helped shift the conversation toward what the region has to gain instead of focusing on what would be lost. [It] helped people understand that retreating doesn't have to look like failure. It can be done intentionally and in a way that has multiple benefits for people and the natural and built environments."[136]

Development of a positive vision was recommended by the Miami Foundation study. "Seeing this [sea level rise] as an opportunity is motivating. The idea of taking this as an opportunity to

embrace change and become a model 'City of the Future' was a popular and motivating theme." The city's residents, it reported, "need a real vision and plan of action. Where are we headed? The clearer the long-term vision for the city, the more courage and conviction we will see in personal and professional decisions about staying, investing, building a city of the future."[137]

People in a community need to have ways to cope with the sense of disruption that comes with considering retreat, as Charles Fletcher, vice chair of the City and County of Honolulu Climate Change Commission, explained: "When confronted with something that severely disrupts their standard practice, that's the first reaction of many people: 'How are we supposed to do this? Is this going to be expensive? I don't know what to do. So what if there's going to be high-tide flooding in the urban core of Honolulu? I don't know how to adapt to that.'"[138]

In Miami Beach, resilience planners urged the city to adopt a vision in which it would acquire developed land to use as open space for green infrastructure that would absorb groundwater—a form of retreat. To pay for the acquisition and infrastructure, the city could develop multifamily residential property that would border the attractive and usable green space.[139] In Cedar Rapids after the 2008 flood, city officials encouraged development of housing for relocating residents in the downtown area—a way of densifying the city. In Houston, after Harvey, a report of the Greater Houston Flood Mitigation Consortium urged the use of property buyouts as part of a larger strategy for flood control that would incorporate parks, open space, and housing stock.[140]

Pairing retreat approaches with development approaches—as in Norfolk and Miami Beach—provides a community with a positive approach that elected officials are more likely to favor. "A strong plan for the reuse of acquired properties can also encourage buy-in from municipal elected officials," noted the Lincoln Institute for Land Policy.

A retreat-including visioning process doesn't just allow positive feelings to emerge. It can create a "safe space" for retreat to be considered, since it's not an official, decision-making forum. When the Urban Resilience to Extremes (UREx) Sustainability Research Network helped city planners in San Juan, Puerto Rico, develop a long-term (2080) vision for coastal resilience, one scenario involved moving people off the coast, as well as building artificial reefs and mangroves, and using flood-control infrastructure. UREx member David Iwaniec, a professor of urban studies, asked one of the planners why she chose coastal retreat as a scenario. "She said, 'Because if I were to explore a scenario like this officially in my planning department, I'd be fired."[141]

Jeff Goddell in *The Water Will Come* described how a positive vision could include retreat but spark the dynamics a city (Miami, in this case) would want: "In a winning scenario, civic leaders address the risk of sea-level rise in a proactive way, lobbying hard for state and federal funds and demonstrating enough political courage to raise taxes so that the city will

have the money to elevate streets and causeways, invest in better sewer systems, and keep the low-lying airport functioning smoothly. Foreign investors don't panic, property values don't plummet. Population declines and some buildings are abandoned, but innovation flourishes and new ways of living with water emerge—houses float, canals replace streets, rooftops host gardens. The water keeps rising and people keep leaving, but it is a slow, stable retreat buffered by waves of innovation and civility."[142]

4. *A city can help to normalize retreat by relocating essential public infrastructure and revising city rules that steer new development.*

Even as a city develops the community's understanding of retreat as a potential approach, it may take steps that contain less controversial elements of a retreat. It can begin to plan for the relocation of public infrastructure that may be necessary; roads and streets, bus routes, bicycle pathways, train tracks, water treatment plants, electricity generating facilities, public recreational and storage facilities may be candidates for relocation. And the space that is vacated will have to be planned for as well. Undertaking this necessary planning for the community's well-being could help to underscore the seriousness of the climate risks and provide real-world examples of the sort of changes that may be needed.

A city can also start to incentive development in climate-safe areas of the city (e.g., higher ground, outside of floodplains), helping to steer future development away from high-risk zones. This, too, can signal the climate risks ahead and the sort of retreat-oriented actions that may make sense in the city.

Both of these actions are consistent with the retreat-based recommendation in the Urban Land Institute's 2018 report, "Ten Principles for Building Resilience" (principle #5). Cities should "redefine how and where to build" by incentivizing development in locations that are most likely to be secure for the longest period of time"[143]

5. *Consideration of retreat should include recognition of its potential impacts on economic and social disparities in the city.*

Sooner or later, a community's discussion of managed retreat will—or should—turn to a set of practical considerations about fair and equitable treatment. For instance:

- If homeowners are to be bought out, will they get enough money from the sale to afford another home? After the 1997 flood, Grand Forks partnered with a developer to build 180 homes in an underdeveloped part of the city—but the houses cost nearly twice as much as the cost of the demolished houses and were slow to sell.[144]

- If renters may have to move, will they be able to find alternatives they can afford? This is especially of concern for households with low-incomes, Elana Sulakshana noted:

they "have more limited options for relocation, because they have less flexibility in where they can move and are also competing with wealthier households for homes and land in less vulnerable areas."

- If entire neighborhoods may have to be relocated, will the city help to make it possible for neighbors to relocate to the same area so that social ties can be maintained? In other words, can entire neighborhoods be held together as they retreat?

The Lincoln Institute for Land Policy warned in 2016 that "without strategic planning for relocation and reconstruction, buyouts may actually deepen social and economic disparities."[145] And it's worth noting that a city's buyout approach could trigger concern that it's really a way to clear out poor neighborhoods to make room for development.

The Consensus Building Institute's assessment of San Francisco's Resilient by Design process noted that for the region's decision-making institutions to effectively build resilience, they must "acknowledge the inseparability of social equity and climate resilience."[146]

* * * * *

Considering managed retreat is not just a better choice for city leaders than waiting for disaster- or market-driven retreat. It's a feasible choice because a city's stakeholders and citizens can be engaged in the discussion in ways that acknowledge their fears and help them to shape a positive vision for the city in the climate-change era. A few cities are showing how this can be done. As climate changes arrive, more and more cities will need to follow the pathway to retreat that is emerging. But they will have to do more than engage in effective local planning processes. They will also have to figure out how to get the state and federal levels of government to provide much more of the support that cities will need when it comes to implementing a retreat approach.

Insight #3 -- Until more cities seriously consider using managed retreat, it is unlikely that crucial support from state and federal governments will occur on other than a sporadic, special-case basis.

It's a choice in the end. It's a human choice. We can think about that future as an opportunity or we can close our eyes and do nothing and let it happen to us, and see more death and despair, more assets and people lost.
--Henk Ovink[147]

Even when cities want to prepare for orderly retreat, they may face a number of uncertainties that they cannot resolve by themselves. Of course, considering the use of managed retreat—assessing the need and benefits, discussing the options and implications, adopting an approach—does not depend on knowing how a retreat will be implemented. Few cities know precisely how they would implement other strategies in their climate-resilience plans: technical, legal, and regulatory details remain to be addressed, financial resources still have to be obtained, project implementation has to be managed.

The implementation requirements for urban retreat can't be fully addressed without getting the attention of and action by state and federal governments. Without a state and federal government framework for supporting retreat, it will be difficult for individual cities to implement—and they will be competing with each other for scarce public resources. "Scaling up managed retreat will only be possible with the support of federal, state, and city governments who possess the resources at the necessary scale," noted an examination of the post-Sandy buyouts in New York City.[148]

In short, other levels of government will have to help to ease the already difficult path to managed retreat. This is becoming clear to some state governments, especially in states most vulnerable to sea level rise.

In early 2019, for instance, Hawaii's state legislature considered several bills that would support retreat, as reported in an article with a headline sure to find use in other places: "We Have to Move Our Homes and Businesses Away From the Shoreline. But How?" Lawmakers were wrestling with key policy issues: "Should Hawaii start setting money aside now to relocate coastal highways that are forecast to be underwater in the coming years? . . . Should homeowners have to disclose to prospective buyers that their property is expected to be inundated by water within the next couple decades? Should future developments have to plan for this new reality or be prohibited from building so close to the shore altogether?"[149]

As described earlier, California is taking steps to strongly encourage consideration of managed retreat by coastal cities undertaking adaptation planning. The policy that the state's Coastal Commission, which has regulatory power over coastal development, is developing sparked local concerns. "There's fear about the loss of property values," noted Jack Ainsworth, the commission's executive director. "We've got loss of a tax base, anxiety about managed retreat and what it means, concerns about taking of private property."[150]

Meanwhile, as climate-resilience consultant Coffee noted, some federal programs have started to have funding available for climate-risk prevention, not just post-disaster recovery. The Federal Emergency Management Agency can use 6 percent of its Disaster Relief Fund on pre-disaster efforts and the US Department of Housing and Urban Development has $16 billion earmarked for risk-mitigation grants in nine states, Puerto Rico, and the US Virgin Islands.[151]

Financial Implications of Retreat

For now, cities have to consider managed retreat without the assurance of obtaining sufficient money for implementation from federal and state governments, funding that can be critical for purchasing private properties and relocating public infrastructure. So far, state and federal governments mostly treat retreat as a unique episode, usually reacting only after a climate disaster and mostly for rebuilding. They have not institutionalized policies and resources that cities can rely on for managed retreat. In addition to the availability of funding, the design of funding programs—eligibility, uses, matching requirements, and other rules—is a key factor in whether and how retreat may be supported.

"To date, buyouts have been the only consistent method by which governments have facilitated private retreat of existing development," reported J. Peter Byrne and Jessica Grannis in an extensive scan of the legal landscape for retreat.[152] Buyout programs are voluntary, but they may be designed to encourage homeowners to sell. In New York, homeowners in areas targeted by the state due to the risk of repeated flooding were offered 10 percent above market value for their property if all owners in the area agreed to participate in the program. This is one way that program design can help avoid the creation of a "checkerboard" effect in which some properties are acquired and others in the same area are rebuilt, a pattern that minimizes future climate protection. The New York program also offered a 5 percent incentive to homeowners who sold and relocated within the same county. Some buyout programs offer relocation assistance to owners and dislocated renters. This includes an allowance that FEMA allocates to help participating owners who must pay more for a comparable house.[153]

Most buyout programs are designed for short-term post-disaster recovery, not long-term retreat. They concentrate on purchasing property and homeowners are on their own in the post-transaction phase. And they focus on individual homeowners, paying little attention to the potential for collective relocation of a neighborhood's residents to help preserve social structures. A study by the Lincoln Institute for Land Policy concluded that "The pervasive threats of flooding brought on by climate change necessitate a restructuring of buyout programs, including redefining long-term goals and strategies, and implementing viable time frames."[154]

Legal Implications of Retreat

Cities may also have concerns about the possible implications of laws determining their authority to take managed retreat actions and their obligation to compensate private property owners. These laws vary from state to state and some aspects of national law may not be firmly settled. In addition, noted Grannis, some legal barriers to retreat "are grounded in common law and constitutional law, so they are court-made rather than statutory. It's difficult for state legislatures to address or lead on these."[155]

Cities worry about whether certain retreat policies would trigger a "taking" of property and its economic value and require compensation for the owners. For instance, in Del Mar, California, owners of oceanfront properties worth millions of dollars contended that the city's consideration of managed retreat was devaluing their property. In Ellicott City, Maryland, after two floods damaged the 200-year-old downtown historic district, a county master plan considered the repurposing buildings on Main Street by turning their first floors into open pavilions through which flood waters could flow. Could this be defined as a government taking of property, as some building owners claimed?

The US Constitution prohibits taking of private property for public use without just compensation, and this has been applied to regulations on property uses with negative economic effects. But, noted Byrne and Grannis, "the U.S. Supreme Court has been unable to articulate a settled rule for determining when it will find a regulatory taking."[156] However, says Grannis, courts have been much more likely to uphold these regulations when the rules do not eliminate all economic use of a property, phase in restrictions, are based in a strong public policy rationale, and allow landowners to gradually write off their financial interest in the property.[157]

Cities also worry about whether or not they can reduce or eliminate infrastructure and services to residents and businesses of areas targeted for retreat. "Abandonment poses novel legal questions," reported Byrne and Grannis. Courts, they explained, have ruled that "municipalities have no obligation to provide services or commit to the expenditure of public funds in the future," but they have also ruled that there is a special right of access for landowners abutting public roads. In general, though, "it is unclear whether courts will second-guess government investment decisions and require governments to maintain infrastructure at great expense and in the face of mounting natural hazards."[158]

In some cases, it may be unclear who owns coastal land and buildings that become permanently submerged. This affects real estate assets and also offshore mineral and fishing rights. Because the inundation is due to natural causes, it is not considered a taking. In Alabama, however, some homeowners are continuing to pay property taxes on newly submerged lots in the hope that future dredging will put them above water and allow rebuilding.[159]

Relocation Implications of Retreat

Finally, cities considering managed retreat may face a question unlike any they've had before: whether and how to support the "receiving communities" to which some of their retreating people and business will relocate?

In the 20th century, the US experienced several mass migrations of population between regions. In the 1930s, an estimated 2.5 million Americans moved out of the Plains states, driven by Dust Bowl drought and failing farms.[160] Another exodus had begun more than a decade earlier and also lasted to about 1940: the first "Great Migration" of 1.6 million African-Americans out of the rural South to the urban North. This flow was followed, historians say, by a second Great Migration, from 1940-1970, in which 5 million more people moved out of the South to points across the nation.[161] These migrations had lasting effects on the regions and communities that were abandoned—and on the places that received the migrants. About 200,000 of the Dust Bowl refugees moved to California where many were met at the state border by policemen from Los Angeles, paid by the city to turn away "undesirables."[162] The black migrations rapidly expanded urban populations, were met with interracial strife, and fostered the growth of an urban African-American culture.[163]

Could climate change also trigger migrations within the US at a scale that could overwhelm and transform the places where people end up going? Very little research has been done about potential climate migration within the US and other developed nations. "Relatively fixed political borders and steady economic development regimes are not fully prepared for a reversion to climate-related migrations," noted a research report for the nonpartisan Center for Climate and Security, which draws on military and security experts.[164] Studies of America's security risks due to climate change have focused on what might happen in other nations. The center noted in 2018 that climate change impacts in other nations could create "mass displacements of people, which lead to unrest," and that this was a prominent security risk for the US.[165]

There already has been climate migration in the US. Hurricanes have produced disaster-driven retreat from New Orleans and Puerto Rico—hundreds of thousands of people moving permanently. There are anecdotal reports of migration out of the southwest due to drought and extreme heat. One of the direst predictions estimated that 13.1 million Americans would be at risk of losing their homes by 2100—with some 4 million people leaving Texas and Florida. Some researchers predict that many climate migrants will relocate to inland Arizona, but others point out that the state's ability to accommodate growth is constrained by rising temperatures and reducing water availability.[166]

How much climate-and-retreat induced migration will occur? Where will people go? How will receiving communities handle the inflow? Should "sending" cities take any responsibility for helping to prepare receiving communities? If so, what should they do?

* * * * *

The implementation of managed retreat presents cities with many challenges beyond those of gaining community acceptance and making a plan. Some city leaders may use this as an excuse for ignoring the possibility of retreat. But that's not likely to lead state and federal governments to create policy, legal, and financial frameworks that will help cities that will need to retreat. Instead, city leaders can chose to engage their communities in consideration of retreat and to join with other cities doing the same to generate collective demand for state and federal solutions.

Conclusion: The Courage to Change

Grant me the serenity to accept the things I cannot change,
the courage to change the things I can, and the wisdom
to know the difference.
--Reinhold Niebuhr[167]

Everywhere in America the growing and severe risks of climate change present cities with complex and long-term challenges that require innovative, adaptive approaches, especially toward a city's development and growth, its land uses and spatial footprint. Just as global warming has destabilized the climate we've known and counted on for centuries, climate changes are beginning to destabilize the familiar dynamics of urban development. In some cases, development-as-usual may increase risks rather than protect a city's people, property, and well-being.

Among the urban climate challenges just beginning to emerge is the use of managed retreat as a resilience-building approach, something cities instinctively want to avoid. But there are reasons for city leaders—elected officials, senior city management, civic advocates--to consider managed retreat as a viable strategy for building climate resilience. It seems safe to say, given the climate risks, that many cities will not be able to avoid retreat. What they can do is choose what kind of retreat to have: a stress-laden retreat after a climate disaster, a chaotic retreat dictated by market forces, or a forward-looking, community-embraced managed retreat. City leaders readily assume that managed retreat is a loser for the community and their own aspirations, but there is an emerging roadmap for generating community acceptance of managed retreat as part of building a city's climate resilience. The implementation of retreat presents cities with financial, legal, and relocation implications that they cannot fully handle by themselves. But if more and more cities explicitly consider managed retreat, they may be able to generate leverage for supportive policies and resources from other levels of government.

The most important driver of these changes is in the mindset of city leaders. If they insist on regarding managed retreat as a loss for the city, they may be inviting a chaotic, market-based retreat or a traumatic post-disaster retreat. Instead, they can see managed retreat for what it is: a potential way to protect the community and its people from new risks and to reshape the city's future in response to changing climatic conditions. Instead of waiting to see what happens (with fingers crossed), they can engage their communities in understanding and deliberating about managed retreat as a way of strengthening the city.

Appendix: Tools for Managed Retreat

Buyouts of homes may be the most visible tool that cities can use to implement managed retreat, but there are many others. Although legal frameworks and programs differ from state to state, the general set of tools that local governments can use for managed retreat are fairly clear. The compilation below combines tools from the Florida Adaptation Action Areas and from a comprehensive survey of legal techniques for retreat, "Coastal Retreat Measures," by J. Peter Byrne and Jessica Grannis.[168] Both focus on coastal communities dealing with sea level rise, but the tools apply to other types of climate drivers and in other places.

In 2011 Florida state government passed legislation that allowed local governments to designate "Adaptation Action Areas" to address coastal hazards and sea level rise and prioritizing infrastructure investments for the areas. The following year, the state, the federal National Oceanographic and Atmospheric Administration, South Florida Regional Planning Council, City of Fort Lauderdale, and Broward County collaborated to identify planning tools that coastal communities could use in adaptation areas. The tools they identified in "Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels" named managed retreat as a main adaptation strategy.[169] It described managed retreat as "the actual removal of existing development, their possible relocation to other areas, and/or the prevention of future development in high-risk areas. Retreat strategies usually involve the acquisition of vulnerable land for public ownership, but may include other strategies such as transfer of development rights, purchase of development rights, rolling and conservation easements."[170]

The tools, in alphabetical order, include:

Conditional development that establishes a condition for approval of a new development or development, such as removal of structures that are flood-prone, dedication of some land for public purpose or natural preservation, and rezoning. The conditions, known as "exactions," could allow for continued development while preserving the right to require future retreat.

Conservation easements that place permanent restrictions on the uses or allowable development of a property, while allowing the property owner to live on, retain, and develop the property with limitations. Easements are legally recorded and binding on all future property owners. Landowners receive tax deductions or other relief in return for the reduction in value associated with the donated easement. The boundaries of a "rolling" conservation easement automatically moves inland as the shoreline advances.

Floodplain regulations that impose additional restrictions on development in floodplains above the federal National Flood Insurance Program minimum standards, such as limiting types of use and imposing design requirements on sites and buildings. Other policies could limit or disallow public expenditures to build or maintain infrastructure in the 100-year and 500- year floodplains.

Market incentives that encourage property owners to develop property in certain ways or to provide desired amenities in exchange of economic benefits or services to the owner. "Some communities offer density bonuses or tax relief, abatement, or credits if a developer agrees to include a certain amount of … open space within a development. Incentives, such as Transfer of Development Right (TDR) programs, can be used to compensate an owner for giving up the right to develop portions or all of a property. Incentives are often viewed by property owners as a fair way to limit development since he or she receive something in return for any lost privileges."[171] Incentives could include payments for ecosystem services for land restoration and conservation.

Property acquisition that enables a local government to purchase lands and buildings, usually at market rates, for the purpose of removing development and returning the land to natural condition and preventing future development. Federal and state governments provide funding for buyout programs, mostly post-disaster.

Real estate disclosures that require sellers to reveal information such as foreseeable climate risks—e.g., coastal erosion rates, sea level rise projections, location in floodplain—to potential buyers, fully informing them of the conditions of a property before purchase.

Rebuilding restrictions that limit or prohibit what can be rebuilt on property damaged or destroyed by natural hazards. This could include a post-disaster building moratorium to evaluate and plan redevelopment in vulnerable areas. To determine when rebuilding restrictions are triggered, cities can use the "substantially damaged" rule which says that if repair costs would exceed 50 percent of the pre-damage market value, then rebuilt structures must comply with more stringent zoning.

Setbacks and buffers that require development to leave certain parts of sites to remain undeveloped to, for instance, provide protection from flooding or protect a shoreline. Setbacks can be based on the projected annual average rate of erosion over a specified number of years.

Transferable Development Rights that allows a landowner ("sender") to give up development rights in exchange for compensation from another landowner ("receiver") who wants to increase her development rights. This creates a market that directs development away from high-risk areas.

Zoning that protects environmental features such as wetlands, promotes special development, or discourages or encourage certain densities or intensities of development. The downzoning of permissible uses limits new development or expansion of more intense development in vulnerable areas.

Notes

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