Extreme Events and Health in Connecticut

A Yale Center on Climate Change and Health Issue Brief

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Introduction

Climate change is making coastal storms more intense, heavy rainfall events more common, and flooding more frequent. Tropical Storm Isaias in August 2020, which caused massive power outages across Connecticut, and the remnants of Hurricane Ida in September 2021, which brought record-breaking rainfall and subsequent flooding, are two recent examples of the kind of supercharged extreme events expected under climate change. While floods, hurricanes, droughts, and other extreme events are not new to the state, the increased intensity and frequency pose magnified dangers to residents' health and wellbeing. Further, most of the state's infrastructure, regulations and other government policies, and operational systems were not designed to take climate change into account and thus lack the capacity to adequately respond to these threats.

The Connecticut General Assembly, state agencies, and municipalities have a responsibility to equitably protect human health from extreme events worsened by climate change. Building on recommendations made in the Governor's Council on Climate Change (GC3) *Taking Action on Climate Change and Building a More Resilient Connecticut for All: Phase 1 Report*, the Yale Center on Climate Change and Health puts forward the following recommendations:

- **Strengthen health care systems and prepare health care professionals to respond to extreme events and other climate impacts**
- **Support communities to build resilience to extreme events, including through the creation of "resilience hubs"**
- **Strengthen Connecticut's extreme event preparedness and recovery systems by integrating mental health services into disaster case management, as well as by integrating disaster preparedness, response, and recovery into ongoing mental health services (*Aligns with GC3 Recommendation 51i*)**
- **Adopt legislation requiring state and municipal agencies to engage diverse communities when updating disaster preparedness and response plans, and to integrate cultural competence into the plans to meet diverse needs**
- **Comprehensively plan and communicate emergency evacuation routes statewide, incorporating anticipated climate impacts and needs of vulnerable populations (*Aligns with GC3 Recommendation 54d*)**
- **Invest in equitable, climate-resilient, and affordable housing, and support community development while avoiding displacement**
- **Begin local discussions and planning for voluntary managed retreat, where necessary**
- **Improve the resilience of Connecticut's drinking water system to droughts, hurricanes, and other extreme events by establishing emergency interconnections between neighboring public water systems and developing water conservation measures and water restriction enforcement ordinances (*Aligns with GC3 Recommendation 53a and 53d*)**
- **Invest in short- and long-term strategies to avoid combined sewer overflow events (*Aligns with GC3 Recommendation 40h*)**

How has the environment changed?

In *Climate Change and Health in Connecticut: 2020 Report*, we tracked environmental and climate conditions over time, largely at the county level. Most of the extreme event indicators demonstrate a trend over time consistent with what is expected under climate change. For the indicators that do not yet show a trend, scientific studies project changes as the planet continues to warm.

The findings related to extreme events are summarized below. (Heat waves are also a form of extreme event that is increasing under climate change. That topic is covered separately in *Extreme Heat in Connecticut: A Yale Center on Climate Change and Health Issue Brief*.)

- **WEATHER DISASTERS**

From 2010 to 2019, the federal government issued nine disaster declarations for weather events in Connecticut, compared with only 13 in the previous 56 years.[1] Such events include hurricanes and tropical storms, winter storms, and flooding. Nationally, weather disaster events are rising, with significant economic and social cost: 2020 was the sixth consecutive year in which the country endured 10 or more billion-dollar weather disaster events.[2] In fact, in 2020, the U.S. experienced 22 billion-dollar disasters—the most since tracking began in 1980.[2] Over the past five years, the total cost of these disaster events was approximately $617 billion nationally, and $1-2 billion in Connecticut.[2]

- **HEAVY RAINFALL EVENTS**

From 1960 to 2019, the annual number of heavy rainfall events (defined as three consecutive days with total precipitation of three inches or more) increased in New Haven, Hartford, Litchfield, Tolland, and Windham counties.[3] For the state as a whole, total precipitation in 2018 was 37% higher than last century's average,[4] and summer precipitation increased by 10 to 20% across the state from 1950 to 2013.[5] However, year-to-year precipitation in Connecticut is variable, with average precipitation in six of the last 10 years lower than the 20th century average of 46.9 inches.[4]

- **DROUGHT**

Over the period from 2001 to 2019, we found no significant trend toward increased drought in any county. However, there were concerning events during this period, including a statewide drought that lasted 46 weeks, from June 21, 2016 to May 2, 2017.[6] The most intense period occurred the week of November 15, 2016, when extreme drought affected nearly 50% of Connecticut land.[6] Connecticut also experienced significant drought conditions during the second half of 2020, escalating to approximately 40% of land under extreme drought in early October.[6]

- **SEA LEVEL RISE**

Global mean sea level has risen eight to nine inches since 1880, with approximately three inches occurring since 1993.[7] In Connecticut and elsewhere, this has resulted in erosion and coastal flooding events at increased frequency during high tides and coastal storms. Sea level rise also makes saltwater intrusion into coastal aquifers more likely, which endangers the drinking water source of residents in coastal areas.[8]

- **COASTAL HIGH TIDE FLOODING**

High tide flooding occurs when seawater temporarily inundates low-lying areas until the tide recedes. The annual number of days with high tide flooding has ncreased at the New London and the Bridgeport tide gauges, a trend consistent with the sea level rise that has already occurred along the Connecticut coastline.[9]

What does this mean for our health?

WEATHER DISASTERS

Immediate dangers from severe storms and flooding include drowning or injuries due to high water or strong winds. Road flooding can also cut people off from safely evacuating. During and after storm events, there can be damage to electricity, sanitation, water treatment and water supplies, food refrigeration, communications, and transportation systems.[10] Loss of such critical infrastructure has wide ranging health effects, including interference with medical care and access to medication, which can be life threatening, particularly for those with chronic illness.[11, 12] Ambulances may be slowed due to roads blocked by flooding or downed trees. During a power outage, the improper placement of gas-powered generators or charcoal grills indoors can lead to carbon monoxide poisoning, which can be fatal.[13]

There are also important, though less visible, downstream impacts to health from severe storms. Individuals whose households experienced a flood or risk of flood report higher levels of depression and anxiety, and these impacts can persist several years after the event. Children have been found to experience high rates of post-traumatic stress disorder (PTSD) symptoms after certain natural disasters.[14] Recovery from this trauma can be prolonged if the children also experience, as a long-

term consequence of the disaster, displacement from their homes or community disruption.[15]

Storms can impact hazardous materials sites, including Superfund sites, resulting in potential release of contaminants into ground or surface water, the air, or the soil. An analysis by the U.S. Government Accountability Office found that seven of Connecticut's 16 Superfund sites are vulnerable to climate change impacts, including flooding and hurricane storm surge.[16]

The building stock in lower-income communities is often at increased risk for damage by natural disasters like floods and hurricanes. This is in part because of historic patterns of development in areas vulnerable to natural hazards, as well as underinvestment in public infrastructure in these neighborhoods.[17, 18]

Disaster planning experts recommend that households prepare to be self-sufficient (able to live without running water, electricity and/or gas, and telephones) for three to seven days following a disaster.[19] This includes having enough nonperishable food stored to last for that period. However, people experiencing food insecurity may not be able to maintain this amount of stored food. Additionally, in homes that use electricity for heating or cooling, indoor temperatures can be dangerously hot (in summertime) or cold (in wintertime) during a power outage, especially in homes that are not properly insulated.

Hurricanes may damage drinking water system infrastructure. During Hurricane Irene, for instance, some drinking water utilities across the Northeast region lost electricity, sustained damage to the well house or treatment plant, or personnel had difficulty reaching the water system infrastructure to service it due to road damage, among other issues.[28] In total, 14 public water systems in Connecticut were inundated during Hurricane Irene and/or Hurricane Sandy.[29]

HEAVY RAINFALL & FLOODING

Heavy rainfall can overwhelm the natural and human-made systems that normally process rainwater, leading to flooding. Flooding may cause injury and death due to drowning, and it also may lead to indirect health impacts from disruption of medical care and critical infrastructure. In addition, people can experience direct exposure to floodwaters that contain pathogens from raw sewage, which can cause infections, or to toxic chemicals released from industrial or brownfield sites during flooding.[10] Heavy precipitation can result in increased levels of pathogens or toxic chemicals in drinking water sources.[20]

Heavy rain and flooding can also adversely affect indoor air quality. This occurs when floodwaters enter basements or the ground floors of homes, damaging building walls and foundations. Such damage can lead to indoor mold, dust mites, chemical off-gassing from damaged building material, and other air contaminants.[10, 21] These contaminants can cause upper respiratory symptoms, allergic reactions, and exacerbation of asthma or chronic obstructive lung disease.[22]

Flooding occurs in river systems as well as in urban environments. Such "urban flooding" takes place when rainfall overwhelms storm sewers and other drainage infrastructure, particularly in heavily developed areas with little permeable surface. Further issues arise when these storm sewers are connected to sanitary sewers (i.e., "combined sewers"). During heavy rainstorms, these combined sewer systems can get overloaded in events called combined sewer overflows: the sewage-contaminated water overflows into streams, rivers, Long Island Sound, or the ocean without first getting treated to remove bacteria and other contaminants that harm human health. Six Connecticut municipalities still have combined sewer systems: Bridgeport, Hartford, New Haven, Norwalk, Norwich, and Waterbury.[23] Plans are underway to separate the remaining combined sewers in Connecticut, as required by the Clean Water Act, but the process is expected to cost $3 billion and take at least 20-40 more years.[23] Additionally, aging dams—often privately owned—are a safety hazard, because dam failure can cause severe downstream flooding and can occur with little warning. Among Connecticut's 3,646 state-regulated dams, over 1,000 are classified as moderate to high hazard, and over 800 have yet to be classified.[24]

DROUGHT

Typical impacts of moderate drought include increased risk of wildfires, stressed trees and landscaping, and lake and reservoir levels below normal capacity. As a drought worsens, impacts expand, with particular concerns about agriculture, wildlife, and wildfires. Impacts to agriculture include lower crop yields and higher crop losses, which can threaten availability of locally-produced food, as well as cause economic hardship for local farmers. Drought also strains drinking water systems by lowering surface water and groundwater reserves and contributing to saltwater intrusion into freshwater aquifers along the coast. Low reservoir levels can lead to mandatory conservation measures and can also reduce water pressures needed for sanitation and fire protection.[25] The prolonged 2016–2017 drought raised awareness in Connecticut that river basins can become depleted, even though water scarcity has not been a significant problem for the state in the past.[26]

HIGH TIDE FLOODING

Driven by sea level rise, minor high tide flooding is disruptive but not typically damaging. However, as flooding becomes more common or greater in magnitude, it may lead to direct and indirect health effects of concern. Saltwater flooding can transmit pathogens such as Vibrio bacteria, which can cause wound infections in people directly exposed to the water. Saltwater can contaminate drinking water sources near the coast, as well as coastal agricultural fields. With a highly developed coastline, Connecticut is also at risk for high tide flooding affecting a large number of roads, homes, businesses, and other infrastructure.[27]

Who is most at risk?

While climate change affects everyone, it does not affect everyone equally. Climate change is sometimes called a "risk amplifier," meaning that many existing risks to health—derived from environmental, economic, demographic, social, or genetic factors—are intensified by climate change impacts.[14, 31] Furthermore, factors affecting vulnerability are cumulative. Population groups most at risk to the health harms of extreme events include:

- **People with Chronic Illness:** People with chronic illness may have more difficulty evacuating prior to a storm, and storm-related power outages can be life threatening for someone requiring electricity-dependent medical equipment (e.g., supplemental oxygen). People with chronic illness are also more susceptible to temperature extremes to which they could be exposed if power is lost, along with home air conditioning or home heating. The stress and anxiety of experiencing an extreme event can exacerbate existing medical conditions and even lead to death.[32] People with pre-existing mental illness are at higher risk during and following an extreme event, both because of compounding stress and because their mental health services or support networks may be disrupted.[33] Health systems strained during an extreme weather event may not be able to provide the full care necessary, due to surges in demands and disruptions to services such as electricity, water, cooling, supply delivery, equipment reprocessing, and transportation of both health care workers and patients.

- **Low-income Communities:** Low-income communities have fewer material resources to support preparing for and recovering from extreme weather events. As one example, a prolonged storm-related power outage can cause refrigerated food to spoil, which has economic impacts and can worsen household food security. Infrastructure in low-income communities is often in poor condition.[34] Lack of vehicle ownership—more commonly the case for urban and suburban low-income households—makes storm evacuation more difficult.[35] Low-income households are disproportionately underinsured for protection against damage from storms and floods and often lack access to emergency credit to recuperate from property loss.[36] Renters, in particular, are vulnerable to displacement after a disaster, for reasons including that they lack control over whether or when the property will be repaired or rebuilt.[37]

- **People with Disabilities:** People with disabilities, including cognitive, hearing, vision, and mobility impairments, may have more difficulty evacuating safely, putting them at greater risk for injury or death from extreme events.[38] Those with hearing or communication impair-

ments may not receive emergency information and may have challenges communicating their needs.[39] Post-disaster shelters may not be sufficiently accessible.

- **Rural Communities:** Households in rural communities may be especially impacted by droughts, since they are more likely to rely on private drinking water wells or on small, less resilient water systems.[40] Additionally, agricultural workers and farm owners may be severely economically impacted by droughts and extreme weather events, leading to adverse mental health consequences including depression, anxiety, and suicide.[41] Rural emergency response managers may face particular challenges for reasons including low population density, limited financial resources and equipment, poor internet and cell service, and less redundancy in the rural road network.[42]

- **People without U.S. Legal Status:** Undocumented individuals are not eligible to receive federal disaster assistance from FEMA, though they may receive assistance from private charities, such as the American Red Cross.[43] People without legal status may also be fearful of legal repercussions from using emergency shelters or other relief services, or the services may fail to meet their needs due to language or cultural barriers.[35, 44]

- **Elderly:** The elderly are at greater risk to the health harms of extreme events, particularly when they also belong to another at-risk group identified here, and/or when they are socially isolated.[45] The elderly often have more difficulty evacuating due to mobility impairments. They can suffer more from the indirect health effects of extreme events, particularly due to exacerbated chronic conditions.[14] Older adults and people with disabilities have also been found to face particular challenges obtaining disaster assistance.[46]

- **Residents in Coastal Areas and Floodplains:** Residents in coastal areas and floodplains are more likely to need to evacuate during floods, hurricanes, and other storms. Their homes are more likely to be damaged or destroyed by flooding, which can cause mental stress as well as indoor air quality problems, including mold. In the longer term, some residents may need to consider relocating if recurring flooding makes areas unsafe or if the infrastructure cannot be economically maintained.[47]

What can we expect in the future?

Scientists have high confidence in projected changes in Connecticut through mid-century (or about 2050).[48] The projected changes after 2050, however, are critically dependent on how quickly we stop emitting greenhouse gases.

HEAVY RAINFALL & FLOODING

In Connecticut, increases in precipitation are expected primarily during the winter and spring.[5] Total annual precipitation is projected to increase across the state by 8.5% by mid-century. In addition to an increased total precipitation, heavy rainfall events are projected to continue to increase as climate change progresses. By mid-century key indicators of flood risk are expected to increase substantially: the number of days with more than one-inch precipitation, the number of heavy precipitation days (days with precipitation greater than the 1970–1999 99th percentile), and maximum one-day and five-day precipitation amounts.[5] More events of these sort will increase the risk of flooding.

SEA LEVEL RISE

Twenty inches (0.5 meters) of sea level rise is expected to occur in Long Island Sound by 2050,[49] compared to the base period of 1983–2001. Sea level rise will continue after 2050, possibly reaching 80 inches (6.7 feet) by 2100 if global greenhouse gas emissions are not curbed rapidly.[7, 48]

HIGH TIDE FLOODING

High tide flooding is projected to occur more frequently and for longer durations of time. That is, "today's flood will become tomorrow's high tide."[9] Researchers have projected the number of high tide flooding days annually under different climate change scenarios. Under an "intermediate" scenario (1 meter global sea level rise by 2100), the number of high tide flood days along coastal Connecticut is significant: approximately 167 days in New London and 129 days in Bridgeport by 2050; by 2100, high

tide flooding would occur nearly every day of the year in both locations.[9] By comparison, from 2000–2016 there were on average three high tide flood days in New London and four in Bridgeport.

DROUGHT

Summer droughts are projected to be more frequent and severe by late century. Extreme summer droughts—which historically have occurred every 20 years—are projected to occur about every six years by 2050.[5] If greenhouse gas emissions are not curbed rapidly, the frequency could increase to every three to four years by 2100.[5] This would occur due to the increase in evapotranspiration from warming temperatures, which would be especially pronounced in the summer.

HURRICANES & COASTAL STORMS

Atlantic hurricanes are already becoming more intense with higher sustained wind speeds and greater amounts of precipitation, and this is expected to amplify as climate change progresses.[50] Additionally, higher sea levels lead to more severe storm surges associated with coastal storms.

Recommendations

The Yale Center on Climate Change and Health evaluated policy measures found in the *GC3 Phase 1 Report* and in national best practices. We identified the following nine recommendations, which elevate measures that protect human health from worsening extreme events and that prioritize equity and environmental justice. Other climate adaptation measures, which focus on physical infrastructure improvements and the financing necessary to install and maintain it, are also necessary; however, these are not prioritized here in order to focus particularly on measures that support building human (rather than infrastructure) resilience.

1. Strengthen health care systems and prepare health care professionals to respond to extreme events and other climate impacts

Health care systems in Connecticut should prepare climate adaptation plans in partnership with the municipalities in which they are located. The plans should include climate change health needs assessments of communities served, evaluation of potential future climate impacts (including flooding, hurricanes, and drought) to the health care facilities, and how these climate impacts might affect staffing and continuity of operations.[51, 52]

Most health professionals—including physicians, physician assistants, nurses, psychologists, community health workers, and public health professionals—did not learn about climate change and its health effects in their formal training. Currently, climate change is covered in only a small proportion of health professional schools in the United States.[53, 54] Connecticut Department of Public Health, local health departments, professional associations, and local universities should work together to provide training and resources, including continuing education courses, to the existing medical and public health workforce to better prepare them for making informed decisions under a changing climate.

2. Support communities to build resilience to climate impacts, including through the creation of "resilience hubs"

Resilience hubs are "physical spaces that provide resources and capacity to promote social cohesion and everyday resilience (e.g., economic, health, environmental), as well as disaster preparedness, response, and recovery."[55] Existing community spaces—such as libraries, community centers, or schools—can serve as resilience hubs if outfitted with additional features, including emergency back-up power (ideally using renewable energy and battery storage), cooling capacity, and emergency supplies, such as first aid kits, flashlights, wheelchairs, food, and water. The resilience hubs should be integrated with local government emergency response processes and communication channels, and staff or community leaders should be trained to provide aid during and after the emergency event. In addition, the resilience hub should

offer programming and build community connections that strengthen everyday resilience. For instance, resilience hubs can offer youth or senior programming, host community events, and implement public awareness campaigns about disaster preparedness.[56]

The major barrier to developing resilience hubs is funding.[55] California has shown leadership by passing legislation in 2021 that will fund a grant program to support the creation and operation of resilience hubs throughout the state.[57] Connecticut should follow suit by securing funds, including from federal and philanthropic sources, and deploying these funds to trusted community organizations to develop and operate the hubs. Communities at greatest risk to the impacts of climate change (e.g., identified through a climate vulnerability index map or a community-level climate change health needs assessment process) should be prioritized if funding is limited.[55]

3. **Strengthen Connecticut's extreme event preparedness and recovery systems by integrating mental health services into disaster case management, as well as by integrating disaster preparedness, response, and recovery into ongoing mental health services** (***Aligns with GC3 Recommendation 51i***)

Mental health conditions are known to increase after extreme events.[33] However, the need to specifically address mental health as part of climate change adaptation is only beginning to be fully recognized and acted upon. Addressing this gap requires mental health professionals and the disaster management community to work together and integrate best practices across the two fields. Specifically, as recommended by the GC3 Public Health and Safety Working Group, this should be done by training Disaster Case Managers to address the needs of mental health populations using evidence-based best practices; integrating those best practices into Disaster Case Manager protocols and practices; establishing an evaluation program to assess program success and areas for improvement; and allocating sufficient funding toward the provision of mental health services during a post-disaster recovery period, as well as extending that funding to be available for a longer period of time to fully address needs.[25] In addition, mental health professionals, including those working in school settings, should be trained to address the specific circumstances of disaster recovery,[58] and their role should be incorporated into local and state disaster preparedness and recovery planning.

4. **Adopt legislation requiring state and municipal agencies to engage diverse communities when updating disaster preparedness and response plans, and to integrate cultural competence into the plans to meet diverse needs**

It is a best practice in building climate resilience and supporting environmental justice to engage those who will be most affected when developing plans and policies, and based on that public engagement, to tailor plans to the local needs and priorities.[55, 59] In the disaster resilience context, California has put forward an innovative example by passing SB 160, legislation that requires decision-making units (in California's case, counties) to engage communities when updating disaster preparedness and response plans.[55, 60] The legislation prioritizes reaching culturally diverse communities and people with disabilities, and it requires that emergency plans be updated to integrate cultural competence, which is defined to include, but not be limited to, "being respectful and responsive to the cultural and linguistic needs of diverse population groups."[60] The legislation also authorizes a county to establish a community advisory board to co-host, coordinate, and conduct the required outreach. The Connecticut General Assembly should develop and adopt legislation that similarly sets out standards for equitable community engagement when developing and updating local and state disaster preparedness and response plans, as well as broader climate resilience plans, and to require inclusion of cultural competence measures identified through the public engagement process.

5. **Comprehensively plan and communicate emergency evacuation routes statewide, incorporating anticipated climate impacts and needs of vulnerable populations (*Aligns with GC3 Recommendation 54d*)**

To prepare for both coastal storms and inland flooding

events, emergency evacuation routes statewide need to be comprehensively identified, updated if necessary, and communicated effectively to both residents and visitors. This action is overdue: the state's coastal storm preparedness and response plan (including evacuation routes) has not been updated since the original plan was written in 1994, and no evacuation route maps are available to the public on the Connecticut Division of Emergency Management and Homeland Security's website.[25, 61] Not all communities, even those along the coast, have evacuation route maps locally available. Additionally, climate change is worsening the storm events that the state needs to plan for; for instance, roads previously used to evacuate may now more frequently be flooded, and severe flooding can overwhelm undersized culverts and blow out roadbeds, leaving dangerous trenches in roadways. Public Act 13-179 acknowledges this and requires that sea level rise scenarios (as identified in the National Oceanic and Atmospheric Administration Technical Report OAR CPO-1) be considered when developing relevant municipal planning documents, including evacuation plans.[62] Other climate impacts, including increased hurricane intensity and heavier rainfall, should also be taken into account. Similarly, evacuation zone maps should be updated on regular intervals to reflect the best scientific information on coastal storm surge and inundation extent.

Evacuation plans also must include strategies to safely evacuate vulnerable populations, including people with disabilities, people without access to vehicles, and people with medical needs. As evidence for this need, after Hurricane Sandy, a study was conducted about Connecticut coastal residents' perceived barriers to evacuating prior to a hurricane.[63] The researchers found that, in communities that overall had lower household incomes, were younger, were more likely non-white, and had lower educational attainment levels, the residents identified lack of money, poor health or disability, lack of knowledge about how to evacuate, and no transportation as the major barriers to evacuation.[63] Finally, state agencies and municipalities need to clearly delineate roles and responsibilities to successfully develop and communicate these plans.

6. Invest in equitable, climate-resilient, and affordable housing, and support community development while avoiding displacement

Addressing the compounding crises of climate change and housing affordability will require committed action from a full range of state agencies, as well as federal and local governments, non-profit and philanthropic partners, and for-profit businesses, including housing developers. Importantly, the Connecticut Department of Housing is already engaged on preparing for climate change through the Resilient Connecticut process.[64] However, more needs to be done; below is a selection of recommended actions.

Connecticut Housing Finance Authority (CHFA) should incorporate climate adaptation and resilience principles into its policy goals and programs, including the Qualified Assistance Program (QAP). The QAP sets out the state's eligibility priorities and criteria for awarding federal tax credits to housing properties, and therefore has a determinative influence over the characteristics of new affordable housing developments. Specifically, CHFA should incorporate climate resilience into the QAP basic threshold requirements, with possible elements including: siting outside of the 500-year flood zone, wet and/or dry floodproofing, maintaining backup power to critical systems and for residents' lifesaving medical devices, elevating critical equipment off the ground level, and surface stormwater management.[65, 66]

Municipalities should investigate regulatory tools to make affordable housing in their jurisdictions more available and better prepared for climate change. One such tool is inclusionary zoning, which requires or encourages developers to include in a new housing project a specific percentage of below-market rate units and make them available to income-eligible renters or buyers.[67] Municipalities can also prepare for a just recovery from future extreme events by adopting anti-displacement measures, such as "right to return" policies, renter protections, and just cause eviction policies.[67, 68] Finally, municipalities can incorporate climate resilience into current zoning ordinances and building codes, such as by limiting new buildings in certain flood-prone areas, requiring

stronger building standards designed for withstanding storm impacts, or specifying low-impact development designs, such as permeable pavement or rain gardens, to reduce flood risks.[67]

7. Begin local discussions and planning for voluntary managed retreat, where necessary

Connecticut and other northeastern states have substantially developed coastlines, which means that a large number of roads, homes, businesses, and other infrastructure are at risk from high tide flooding, storm surges, and sea level rise.[27] Inland areas in floodplains are also at risk for more frequent and significant flooding, as heavy rainfall events become more common. More frequent flooding and storm events can lead to significant and costly damage to homes and infrastructure. Such damage produces negative economic impacts and strains municipal budgets, which can drain resources away from health. Furthermore, homeowners and small business owners who endure repeated storm or flooding impacts or are displaced are likely to endure considerable mental stress.

"Managed retreat" is the voluntary transition of people and ecosystems from vulnerable coastal areas and floodplains.[69] Although painful and politically difficult, in situations where retreat is inevitable, voluntary and planned retreat is highly preferable to unplanned displacement. Where necessary, municipal leaders should work together with residents to discuss options and develop plans that are proactive, voluntary, and equitable, and that minimize the social, psychological, and economic costs of relocation.[69, 70] Discussions also should include planning for the area's future use, which should include natural approaches to reduce storm and flood damage (e.g., dune or wetland restoration) and consider provisions for public access. State and local governments also should work to understand their legal authority and potential policy tools, with the goal of balancing community safety, financial constraints, environmental benefit, social equity, and private property rights.[69]

8. Improve the resilience of Connecticut's drinking water system to droughts, hurricanes, and other extreme events by establishing emergency interconnections between neighboring public water systems and developing water conservation measures and water restriction enforcement ordinances (*Aligns with GC3 Recommendation 53a and 53d*)

With state support and coordination, public water systems should establish emergency interconnections with neighboring systems. Emergency interconnections allow neighboring public water systems to share water during times of emergency, including droughts and other extreme events.[29] While funding is available through the Drinking Water State Revolving Fund, additional funding is likely to also be necessary. Additionally, Connecticut municipalities and community water systems should plan for the increased frequency of drought by instituting water conservation measures for homes, businesses, industry, and agriculture. The state should develop—and municipalities pursue adopting—model water restriction enforcement ordinances to assure compliance with necessary water conservation measures during periods of water shortage. Municipalities also should work with water utilities and heavy water users to implement drought mitigation strategies.[71]

9. Invest in short- and long-term strategies to avoid combined sewer overflow events (*Aligns with GC3 Recommendation 40h*)

Connecticut's remaining combined sewer outfalls need to be eliminated. Recognizing that this is an expensive and long-term goal, in the near-term, municipalities and water pollution control authorities should facilitate and fund low-impact design projects (e.g., permeable pavement, bioswales, strategic tree planting, and other green infrastructure) to reduce the stormwater runoff that triggers combined sewer overflow events. To fund these projects, municipalities should seriously explore creating stormwater utilities, which were enabled in 2021 under Public Act No. 21-115. Creating a stormwater utility allows a municipality to levy a fee on properties in the district, in order to pay for stormwater management infrastructure and its upkeep. Municipalities also should pursue requiring low-impact design for new and existing developments and should incorporate low-impact design concepts into both their plans of conservation and development and

capital improvement plans. Connecticut Department of Energy and Environmental Protection's planned update to its Stormwater and Erosion Control Guidelines also could encourage greater use of low-impact design by including higher initial stormwater infiltration rate requirements.

ABOUT THIS SERIES

YCCCH released *Climate Change and Health in Connecticut: 2020 Report* in September 2020. The comprehensive report tracks 19 indicators on climate change and health in Connecticut across four domains: temperature, extreme events, infectious diseases, and air quality. The issue brief series mirrors the four domains, summarizing key findings from the Report and extending it to include policy recommendations. To read the full report, visit:

https://publichealth.yale.edu/climate/policy_practice/connecticut/

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