Climate Change at Northeast Barrier National Parks

With sea levels rising and more frequent and severe storms, our treasured national parks are at the forefront of climate change and offer some of the best solutions to combatting it, starting at Cape Cod and Fire Island National Seashores and Gateway National Recreation Area.

Climate change is the greatest threat facing our planet, its inhabitants, and our national parks. We're seeing the effects of climate change take place on park visitors, wildlife, and the park's diverse landscapes faster than anywhere else in the country, and we must act to reverse this damage by making parks more resilient to climate threats. Through swift and comprehensive climate action that includes reducing greenhouse gas emissions, we can reverse course and protect our national parks, our communities, and the local economies that depend on them.

The Fourth National Climate Assessment projects severe changes to climatic systems in the northeast region over the next few decades.[1] Along the North Atlantic coast, warming oceans, increasing precipitation, and more frequent and intense storms threaten parks and their natural, cultural, and historical resources. These risks are heightened due to the rate of sea level rise in the northeast, which is almost **four times the global average.**[2]

As America's leading voice for our national parks, National Parks Conservation Association (NPCA) works to protect national parks and nearby vulnerable communities from the causes and detrimental effects of climate change. We work to enforce and develop new, stronger laws and policies to provide parks with the highest degree of protection. We utilize science to determine the best ways to protect natural and cultural resources, and we cultivate stakeholders to rally public support to address the climate crisis.

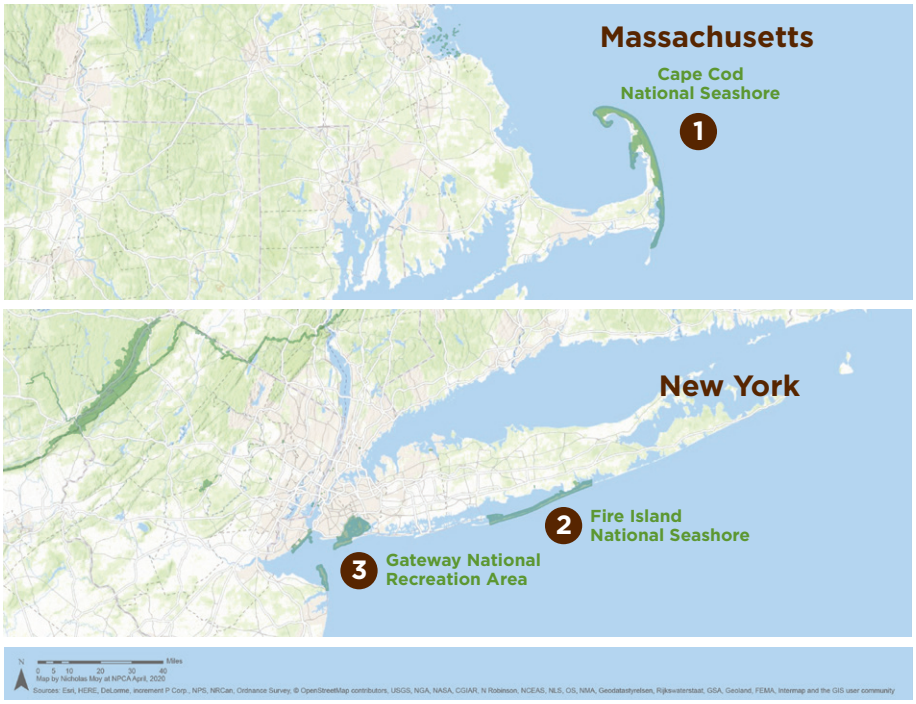
NPCA's Northeast region is systematically assessing, through research, analysis and peer-to-peer learning, the most serious climate impacts threatening our coastal national parks today.

Above: Cape Cod National Seashore ©James Kirkikis | Dreamstime

Cape Cod National Seashore (NS), **Fire Island National Seashore** (NS) and **Gateway National Recreation Area** (NRA) are coastal national parks on the edge of the Atlantic Ocean. Not only do they protect endangered wildlife, maritime history and unique cultural resources not found anywhere else in the world, but they also serve as front-line barrier systems protecting vulnerable communities from rising tides, storm surges and extreme weather. Due to the nature of these barrier parks, it is critical that the National Park Service have the staff and resources necessary to protect and adapt to the pressures of climate change now and in the future.

1. **Cape Cod National Seashore** (NS)
2. **Fire Island National Seashore** (NS)
3. **Gateway National Recreation Area** (NRA)

The Barrier National Parks in the Northeast



Above: Map of the northeast featuring Gateway National Recreation Area in Brooklyn, Queens, Staten Island and Monmouth County, New Jersey, Fire Island National Seashore in Long Island and Cape Cod National Seashore in Massachusetts ©Nicholas Moy | NPCA **Below:** Highland Lighthouse in Truro, Massachusetts at Cape Cod National Seashore ©Michael Sean OLeary | Shutterstock **TABLE 1 Below:** Flood risk at the three northeast barrier national parks identified by Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA) and other state agencies. The color gradient depicts the percentage of park land within FEMA flood zone areas. Storm surge risk during category 1 and category 4 hurricanes are designated by NOAA. Hurricane evacuation zone data collected from New York and Massachusetts state agencies, indicating if areas of the park are within the first zone to evacuate during a hurricane.

Flood Risk at Northeast Barrier National Parks

Level of Flood Risk: High Moderate Low

TABLE 1 Northeast Barrier National Parks	Portion of Park in FEMA Flood Zones	NOAA Storm Surge Risk Under Category 1	NOAA Storm Surge Risk Under Category 4	Areas in 1st Zone to Evacuate
Cape Cod National Seashore		Low - Moderate	**High - Severe**	✓
Fire Island National Seashore		Low - Moderate	**Severe**	✓
Gateway National Recreation Area		Low - **High**	**Severe**	✓

National Park Threat

Rising Sea Levels Erode Natural and Cultural Resources

Global sea levels are expected to rise one to four feet by 2100.[3] During that time, sea levels in the northeast are expected to exceed global projections. Low and intermediate climate scenarios result in a two to 4.5-foot rise, while worst-case scenarios project an eleven-foot rise in sea level throughout the north Atlantic coast. Either scenario would be detrimental to northeast coastal national parks, especially barrier parks like Cape Cod, Fire Island and Gateway.

Rising sea levels and extreme high tides are eroding park infrastructure at alarming rates, resulting in chronic damage and increasing maintenance that are already a challenge for the Park Service. Studies have found even a two-foot increase in sea levels in the northeast could **triple the frequency of coastal flooding throughout the region**. Our northeast barrier national parks are instrumental in the long-term protection of people, property, and unique coastal resources for centuries to come. NPCA tirelessly advocates for federal funding to restore wetlands, salt marshes and coastal dune ecosystems and repair critical infrastructure in parks that buffer climate pressures from vulnerable, neighboring communities.

Nauset Light Beach at Cape Cod

At Cape Cod, rising sea levels erode coastal sand dunes, NPS offices and visitor parking lots, bathrooms and other amenities. Already, the seashore experiences three to four feet of erosion per year. In response, NPS is pursuing "retreat and rebuild" strategies to ensure visitor safety and responsible long-term investment. At Nauset Light Beach, the Park Service dedicated funding to rebuild the bathhouse away from the sand dune cliffs with newly constructed trails rather than staircases to retain visitor beach access. Similarly, an interpretive shelter at the Marconi site had to be completely removed because the threat of collapse from erosion was eminent. As tides continue to rise, climate trends project increased rates of erosion at Cape Cod, prompting more retreat and rebuild strategies to protect park resources and retain public access.

Sunken Forest at Fire Island

As a low-lying coastal barrier system, Fire Island is threatened by the slow creep of sea level rise, saltwater intrusion and frequent tidal flooding. Fire Island was **one of five national seashores found to have more than half of its land less than a meter above sea level.**

The Sunken Forest, a critical forest ecosystem and marine estuary on Fire Island, supports rare plant and animal species adjacent to the Great South Bay. The Sunken Forest is classified as a globally rare forest ecosystem and is just one of two remaining Holly Maritime Forests left of earth. This unique forest ecosystem transformed from barren sand to a maritime forest in just 300 years and now supports diverse wildlife, such as the white-tailed deer, black racer snake, box turtle and over 300 species of birds.

Unfortunately, due to rising tides and accelerating rates of erosion, the Park Service is losing, on average, five meters of the Sunken Forest every year. This presents a tremendous challenge as conditions are expected to worsen over the next few decades.

The effects of saltwater intrusion are adversely impacting the root systems at the Sunken Forest. Not only are tree roots being impacted by a larger volume of water, but the water is now more saline. A 2014 study and recent USGS publication on tree mortality at the Sunken Forest found that sea level rise is contributing to the thinning of the unsaturated zone, which is the zone just above the water table and just below land surface, leading to tree mortality and preventing forest root establishment.[5]

Above: Erosion of stairs at Nauset Light Beach, Cape Cod National Seashore ©Cape Cod Times | Steve Heaslip **Below:** Sunken Forest at Fire Island National Seashore ©Demerzel21 | Dreamstime

Officers Row at Gateway

Gateway, a valued urban national recreation area on the heels of our nation's most populous city, has three units including Jamaica Bay in Brooklyn and Queens, Fort Wadsworth in Staten Island and Sandy Hook in New Jersey. Each unit is located along the Atlantic coast, providing the first line of defense for NY-NJ communities and business districts. Sea level rise is among the primary threats at Gateway, leading to secondary threats like coastal erosion that further compromise park resources. Gateway's three units are home to retired military forts that protected the NY-NJ Harbor during the War of 1812 and World War II. These one-of-a-kind historic resources provide visitors with unparalleled opportunities to discover and explore our nation's shared history and culture. At Sandy Hook, Fort Hancock features hundreds of Classical-Revival ornamentation buildings located on the northwest side of the peninsula facing Sandy Hook Bay, making them particularly vulnerable to sea level rise. Luckily, Gateway is dedicating millions of dollars from the Great American Outdoors Act to rehabilitate the existing seawall to better protect Fort Hancock from future storm surges and sea level rise.[6]

Above: Storm surge pounds the deteriorating seawall at Fort Hancock which serves as the only defense protecting historic buildings from high tides and coastal storms on Officers Row at Sandy Hook, Gateway National Recreation Area ©Geraldine Scull

EXTREME WEATHER DAMAGE

National Park Threat

Extreme Weather Endangers Wildlife and Park Resources

Extreme weather in the northeast refers to rapid warming of air and ocean temperatures, increasing precipitation, more intense hurricanes and nor'easters which bring storm surges and high winds. It is important to consider the connection between sea level rise and these extreme weather patterns. Storm surge occurs when water levels rise above normal and are pushed by inland wind. This phenomenon is made worse by rising tides, as higher sea levels push water further inland during storm surges.[7] The combination of these climate threats further exacerbates park infrastructure.

Herring Cove at Cape Cod

The connection between extreme weather and sea level rise is on full display along Cape Cod. At Marconi Beach, the largest stairwell for beach access on Cape Cod has been destroyed three times in the last five years from coastal erosion and storm surge. Each time, NPS had to pay $130,000 to repair the damage. Strong winter storms and rising sea level were cited as the biggest contributors to erosion at Marconi Beach. Similarly, storm surge at the northern terminus of the Cape has taken a toll on Herring Cove. In 2015, the Park Service had to replace and relocate the Herring Cove bathhouse complex out of harm's way and four years later, in 2019, the Park Service needed to relocate the northern parking lot at Herring Cove to prevent continued damage from extreme weather and rising tides.

As water levels increase year to year, storms hit national seashore infrastructure more frequently. This puts sites and structures near or on the shoreline's edge at risk of failure, creating unsafe environments for visitors.[8]

Extreme weather events at Cape Cod are getting worse. The Park Service conducted seven different precipitation scenarios on the National Seashore based on climate projections. Of these seven scenarios, four of them projected "extreme wet" conditions in the future.[9] The reality of these findings, consistent with the International Panel on Climate Change (IPCC), would likely bring more damage to Marconi Beach, Herring Cove, and other park resources at Cape Cod. If not thoroughly addressed, these projections could lead to dangerous inverse trends such as growing maintenance costs for the Park Service and limited public access for seashore visitors.

Above: Damage sustained to the Herring Cove Beach northern parking lot from winter storms bringing heavy shoreline erosion in 2018. Since then, the National Park Service has relocated the Herring Cove beach parking lot and bathhouse further inland to avoid future repairs. ©Merrily Cassidy | USA TODAY NETWORK

Endangered Sea Turtles at Risk

The world's most rare and endangered species of sea turtle are increasingly washing up on the shore of Cape Cod and Fire Island as a result of extreme weather.[10] Kemp's Ridley sea turtles have been traveling further north during summer migration as ocean temperatures in the northeast continue to increase. This rapid oceanic warming can be accredited to climate change. Unfortunately, the sea turtles are not accustomed the drastic drop in water temperature when seasons change. The sudden shock from cold water often leaves the sea turtles stunned and stranded on the barren coastline at Cape Cod and Fire Island. In 2014, there was a record 1,200 cold-stunned turtles found at Cape Cod NS.[11] Sea turtles like the endangered Kemp's Ridley are not migrating to warm waters fast enough.

The Fourth National Climate Assessment projected that approximately 50% of the commercial and protected fish and invertebrate species on the Northeast Continental Shelf will be "highly vulnerable" to climate change by 2050, under their highest emissions scenario.[12] The Kemp's Ridley sea turtle is just one example of how climate change in the northeast can impact wildlife. As ocean temperatures rise, the range of suitable habitat for many commercially important fish and shellfish species will shift north. As a result, Atlantic Cod and lobster fisheries south of Cape Cod are projected to significantly decline in the future.[13]

Riis Bathhouse at Gateway NRA

Iconic cultural sites at Gateway, like the Riis Bathhouse at Jacob Riis Park are extremely vulnerable to tropical storms, hurricanes and Nor'easters. The strong storm surge from Superstorm Sandy in 2012 compromised the Riis Bathhouse, destroying the courtyard wall and wiping out the door and window coverings.[14] The bathhouse was flooded with salt water, while propane tanks, sailboats and trees were tossed onto the shoreline. Superstorm Sandy brought over $180 million in damage to Gateway.[15] Tropical Storm Irene severely damaged the Riis Bathhouse just one year prior.

Having experienced severe flooding in the past and with dismal climate projections for the future, the Park Service knows that returning the Riis Bathhouse to its historic functions would be unsustainable.[16] Instead, Park Service staff are looking for ways to make this historic property "more resilient to future storm surges and expected sea level rise."[17]

After Superstorm Sandy, Gateway dedicated $4 million in federal disaster relief to rehabilitate the Riis bathhouse and surrounding courtyards. The Park Service redesigned the Riis Bathhouse to be more resilient during extreme weather. Today, the Riis Bathhouse provides shelter for concessions behind ocean-side garage doors that, in the event of extreme high tides, can be raised to let the sea water flood and recede after a storm. All critical infrastructure is raised or on wheels so that it can be removed when extreme weather is on the horizon. Of the three barrier national parks analyzed, Gateway is the only park at high risk under both category 1 and category 4 hurricanes.[18]

Top: Kemp's Ridley Sea Turtle released after being rehabilitated in a cold-stunned rehab center in North Eastham, Massachusetts on Cape Cod National Seashore ©National Park Service **Middle:** Trash and debris accumulate at Jacob Riis Park as city, state and federal agencies help communities dig their way out of the aftermath of Hurricane Sandy, 2012 ©ZUMA Press, Inc. | Alamy **Right:** Volunteers help the National Park Service clean up the Riis Bathhouse at Jacob Riis Park following Hurricane Sandy, 2012. ©ZUMA Press, Inc. | Alamy

Climate Change Impact

Changing Landscapes Threaten Park Communities

From Fire Island to Acadia, America's national parks protect the nation's most beloved stories and breathtaking landscapes. National parks in the northeast are some of the most frequently visited sites in the System, with trends pointing to increased visitation in the coming years. Beyond visitation, these three barrier national parks support neighboring communities with thousands of residents, small and large business owners, and critical infrastructure such as sewer treatment plants, public transportation systems, schools, hospitals and more. Many of these communities depend on barrier national parks for storm protection.

Superstorm Sandy revealed that northeast barrier national parks are highly exposed to a changing climate, making nearby communities vulnerable as weather becomes more unpredictable in the future. Climate change has the potential to render critical infrastructure obsolete and even permanently displace residents and whole communities.

Above: Breach in the Otis Pike Wilderness on Fire Island National Seashore formed during Hurricane Sandy, 2012 ©National Park Service
Below: Fire Island Wilderness Visitor Center at the Otis Pike High Dune Wilderness. ©National Park Service

Scared Homes and Wilderness at Fire Island NS

Climate change is impacting ecological and residential communities on Fire Island in dramatic ways. During Superstorm Sandy, wave damage destroyed oceanfront homes, trails and boardwalks. Local municipalities now require new homes or construction on existing homes, within the most severe flood zones, to elevate out of the floodplain. Residents quickly learned that oceanfront properties are highly vulnerable to intense storm surges, while homes on the bay side are more susceptible to erosion and flooding from the Great South Bay. Each area on Fire Island has unique impacts that need to be addressed with tailored solutions for adaptation.

Unpredictable weather patterns and intense storms are changing the wilderness on Fire Island. Superstorm Sandy's violent storm surges breached the island, cutting through the Otis Pike Wilderness Area and creating a new inlet from the Great South Bay to the Atlantic Ocean. Breaches, which are channels that form during storms and connect the ocean to the bay, are a natural process and they have occurred numerous times along the barrier island.

Following Superstorm Sandy, the Park Service developed and approved the *Fire Island Wilderness Breach Management Plan*, a public planning process that determined the best action for preserving the integrity of wilderness character while protecting human life and managing for economic and physical risks to surrounding areas. In the end, NPS selected an adaptive management framework that allows the breach to be controlled by natural processes. Since the breach occurred, local fisherman and Fire Island residents have reported more migratory fish returning to the Great South Bay with more frequent marine wildlife sightings including dolphins and seals.

Critical Infrastructure at Risk

Critical infrastructure that support barrier park residential communities are at increasing risk from climate change. On Fire Island, almost all residents rely on septic tanks. When a coastal storm occurs, septic tanks can overflow posing public health risks. Storms also lead to increased water runoff, sending fertilizer and herbicides into the watershed, harming park natural resources and producing brown tides and harmful algal blooms.

Similar to Fire Island, Cape Cod residents and Park Service staff are increasingly concerned with the use of septic tanks. Only two wastewater treatment plants exist on Cape Cod, leaving nearly 85% of homes to rely on septic systems.[19] Residents are already realizing that the lack of wastewater treatment on the Cape is a problem. When severe precipitation occurs, septic tanks fill up quickly and overflow into roads, green spaces and freshwater ponds, causing public health concerns. When this occurs, septic tanks cannot remove nitrogen (a major by-product of human waste) from the water causing harmful algal blooms and fish kills.[20]

At Gateway, compromised wastewater treatment plants are only the tip of the iceberg. Superstorm Sandy displayed the vulnerabilities at wastewater, electrical, and transportation systems throughout all three units, especially Jamaica Bay. **Of all the buildings in New York City identified as "unsafe or structurally damaged," 37% were located in the regions surrounding the Jamaica Bay unit of Gateway.**[21] Many nearby residents were flooded out of their homes and stranded for months. The closest New York City subway station was shut down for at least six months following the storm, stranding over 35,000 residents.[22]

Climate change has been a consideration in every project at Gateway since 2013. Gateway's General Management Plan, which was published in 2014, highlights three categories of maintenance for its natural, cultural, and historical resources. These categories–preserve, stabilize, or 'let go' –are determined by a numerical score which considers asset condition, uniqueness, and vulnerability. These scores help the Park Service determine the best management strategies for hundreds of park resources, while prioritizing staff and funding for the most critical needs in the park. Gateway's climate response framework was reviewed by the Park Service's Washington office and formalized as the 'resist, accept, direct' strategy to help park managers across the country tackle climate change.

Above: Coir logs are man-made fiber rolls used as biodegradable erosion control to build up an artificial dune and protect residents in Sandwich, MA just southwest of Cape Cod National Seashore. ©Ken Wiedemann | Istock **Below:** Homes left vulnerable from shoreline erosion following Hurricane Sandy along the Jersey shore south of Sandy Hook, Gateway National Recreation Area. ©Spiritartist | Istock **Bottom:** Birdwatchers observing wildlife at the Jamaica Bay Wildlife Refuge, Gateway National Recreation Area. ©Merganser

Visitation and Economic Impacts

Cape Cod, Fire Island and Gateway not only provide unique experiences for visitors from afar, but they also drive important economic revenues for neighboring communities.

Dangerous weather events and rising tides could force the Park Service to close their gates and jeopardize small business owners. Cape Cod, for example, is one of the northeast's most popular vacation areas, attracting four million visitors each year. Gateway, on the other hand, was the fourth most visited national park site in 2019, drawing more than 10 million urban dwellers and tourists alike.[23]

While NPS reports show that future warming is likely to bring more people to national parks and extend the length of the peak visitation season,[24] access to major attractions could be restricted following coastal storms and extreme flooding. Should the northeast climate trends persist, seasonal park closures could severely cripple local economies.

NPCA Northeast Region

Our Work to Advocate for Climate Resilient National Parks

NPCA works to protect northeast barrier national parks and nearby vulnerable communities from the causes and detrimental effects of climate change.

National parks, public lands, and waterways are our country's best defenses against the ongoing climate crisis. These protected areas also help store and capture climate causing pollution. This is why NPCA advocates for science-based management practices and adaptive management strategies that protect communities and park resources.

We have long-advocated for federal funding to rebuild natural buffers and make nature-based improvements that will protect our shoreline from flooding and improve water quality. These restoration efforts in barrier parks will help coastal communities better withstand future storms and greatly benefit Gateway, Fire Island and Cape Cod ecosystems, public resources, and critical infrastructure.

NPCA was a national leader in rallying support to pass the Great American Outdoors Act in 2020 to bring critical federal funding to restore seawalls, roads, bathhouses, and other park infrastructure. This bill promises five years of funding to tackle the most pressing needs in places like Gateway, Fire Island and Cape Cod. NPCA commits to advocating for the next round of federal funding to ensure our barrier national parks withstand a changing climate.

With the northeast being the fastest warming region in the country,—the decisions we make today matter and will have implications for our grandchildren's children. Additionally, vulnerable waterfront communities are hit hard by climate change impacts—with many located just outside our barrier national parks. Our laws and policies must be inclusive from the start, to ensure equitable climate solutions that reduce flood risk and address the unjust pollution and health and safety burdens these communities face.

HOW YOU CAN HELP

Through swift and comprehensive climate action, we can reverse course and protect our national parks, our communities, and the local economies that depend on them. Join us—learn more at **www.npca.org/climate.**

Above: Park Service staff and local partners visit the newly restored West Pond trail at the Jamaica Bay Wildlife Refuge following a breach in the trail network during Hurricane Sandy. ©National Park Service

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