



Climate Change at Northeast Harbor 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 in the New York, Boston and Salem Harbors.



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.

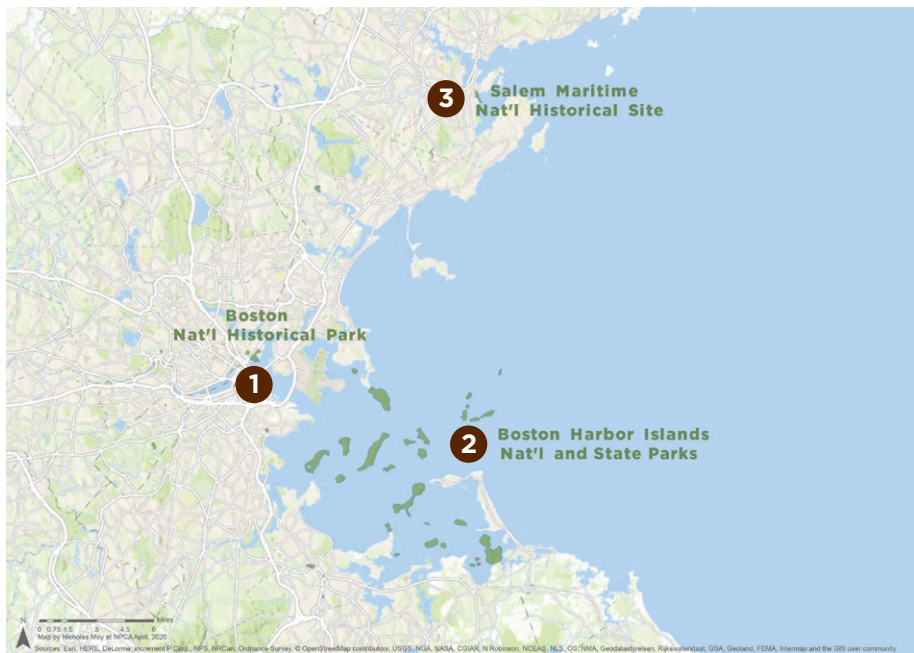
This document summarizes climate change impacts to six harbor national parks in the northeast:

- 1 **Boston National Historical Park (NHP)**
- 2 **Boston Harbor Islands National and State Parks**
- 3 **Salem Maritime National Historical Site (NHS)**
- 4 **Castle Clinton National Monument (NM)**
- 5 **Statue of Liberty and Ellis Island National Monument (NM)**
- 6 **Governors Island National Monument (NM)**

These six national park sites are located in working harbors at Salem, Massachusetts, Boston, Massachusetts and New York City, positioning them at the heart of thriving economies and on the front lines of climate change. Some of these parks and their resources are at greater risk than others. Table 1 below details the corresponding flood zones, storm surge zones, and high-risk hurricane evacuation zones for each of the six harbor national parks.

Top Right: Boston Harbor and Salem Harbor Parks ©Nik Moy | NPCA **Right:** New York Harbor Parks ©Nik Moy | NPCA **TABLE 1 Below:** Flood risk at the six northeast harbor national parks collected from 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 4 hurricanes are designated by NOAA. Hurricane evacuation zone data in the last column come from New York and Massachusetts state maps, demonstrating if areas of the park are within the first zone to evacuate during a hurricane.

The Harbor National Parks in the Northeast



Flood Risk at Northeast Harbor National Parks		Level of Flood Risk: ● High ● Moderate ● Low		
TABLE 1 Northeast Harbor 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
Boston Harbor Islands National and State Parks		Low - Moderate	Moderate - Severe	✓
Boston National Historical Park		Low - Moderate	Severe	✓
Castle Clinton National Monument		Low	Severe	✓
Governors Island National Monument		Low - Moderate	Severe	✓
Salem Maritime National Historic Site		Low	Severe	✓
Statue of Liberty Ellis Island National Monument		Low - Moderate	Severe	✓



National Park Threat

Extreme Weather Threatens Cultural and Historic Resources

The threat of extreme weather poses serious risks to northeast harbor national parks, which maintain some of our nation's most historically and culturally significant artifacts, archives, and resources. "Extreme weather" in the northeast refers to the projections for more intense weather patterns as a result of climate change.

In the northeast, the climate crisis is causing warmer ocean temperatures and higher sea levels, which intensify storms and make our northeast working harbors more vulnerable to damage. Higher waves and intense coastal weather patterns are battering the limited harbor ecosystems and historic structures and artifacts that remain.

The northeast Atlantic coast also experiences unique storms known as Nor'easters. Nor'easters are extratropical cyclones with low pressure systems that blow strong ocean winds over coastal areas and are most common in the fall and winter. Nor'easters threaten the northeast with unstable weather patterns producing heavy rain and snow, strong winds, coastal flooding and rough ocean conditions. Nor'easters form when polar air from Canada blows south and meets the warm, moist air from the Gulf Stream, effecting major cities like Boston, New York, Philadelphia and Washington, D.C.

In NPS' experience, Nor'easterers are responsible for significantly more erosion and storm surge damage than traditional hurricanes.

Superstorm Sandy at Northeast Harbor National Parks

Unfortunately, extreme weather was on full display when Superstorm Sandy ravaged through the northeast in 2012. Boston NHP lost heat and electricity across the entire park during Sandy's storm surge, despite being far north of the storm's primary impact zone. This can be attributed to Boston's overburdened water table and the park's heating and electrical systems in low-lying areas.

Less than 200 miles south and in the primary impact zone, the Statue of Liberty and Ellis Island NM also suffered severe damage from Superstorm Sandy. The climate control mechanisms on Ellis Island were damaged, and artifacts had to be evacuated—a process that took over six weeks. Three years after the hurricane, over one million artifacts were returned to Ellis Island, many of which were historic treasures of American immigrants. Since then, NPS elevated critical infrastructure such as boilers, transformers, and chillers out of the floodplain. Thanks to these necessary improvements, most of the critical infrastructure at



Ellis Island is no longer at severe risk and NPS will save thousands of dollars by preventing future flood damage.

Fort Warren at Boston Harbor Islands National and State Parks

Another prime example of extreme weather is visible on George's Island at Boston Harbor Islands National and State Parks. For thousands of years, Georges Island was occupied by Native Americans and artifacts reveal that they fished, farmed, hunted, and traded on many of the islands through the last glacial retreat. Today, Georges Island is home to Fort Warren, a historic fort and National Historic Landmark that protected Boston from 1861 through the end of World War II. The Fort is surrounded by a rock seawall that protects it from the rough tides twice a day. When intense storms hit Boston Harbor, the huge granite blocks from the seawall can loosen and drop out, leaving the Fort's outer earthworks directly vulnerable to erosion from future storms.

All of these national park sites preserve America's history and culture for generations to come and as climate change threatens our northeast harbor national parks, so too does it threaten our shared history.

Above: Incident Management Team members walk along the southern walkway of Liberty Island to assess the damage to the island. The paving bricks and underlying pavement were heavily damaged during the storm. ©NPS | Daley **Left:** Boston Lighthouse on Little Brewster Island at Boston Harbor Islands National and State Parks. ©Ewan O'Sullivan

The climate crisis makes our northeast working harbors more vulnerable to damage.





National Park Threat

Rising Seas Erode Park Infrastructure

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 due to local land subsidence.⁴ Low and intermediate climate scenarios would 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. Some estimates predict that even two feet of sea level rise in the northeast could triple the frequency of coastal flooding throughout the region, absent of any changes in storm frequency or intensity.⁵

It is important to consider the connection between sea level rise and extreme weather patterns, like stronger storm surge and more frequent and intense storms. Storm surge occurs when ocean winds push water levels above normal and onto land. This phenomenon is made worse by rising sea levels, as rising tides allow for more water to be pushed inland during storm surges. This dangerous combination can destroy park infrastructure if action is not taken immediately.

Derby Wharf at Salem Maritime NHS

These connected climate threats are glaring at Salem Maritime NHS. Rising sea levels are eroding park infrastructure, resulting in ongoing damage and maintenance costs for the Park Service. The longest wharf at Salem Maritime NHS, Derby Wharf, acts as a sea wall for the marina and properties behind it, shielding private development from the effects of rising tides and intense coastal storms. However, storm surge and increased wave energy are already affecting the structural integrity of Derby Wharf and NPS has dedicated thousands of dollars to restore the riprap and bulkhead supporting the critical and historic structure. NPS staff are planning to raise the bulkhead for the fourth, and final, time since 1940. In the fourth reconstruction of Derby Wharf, the bulkhead will reach its maximum height and weight carrying capacity, forcing the Park Service to consider alternative long-term solutions.



Above: A very High Tide at Derby Wharf, Salem Maritime National Historic Site. ©Jeff Folger (Ex-Ranger) **Below:** Damaged support dock on Liberty Island, Statue of Liberty National Monument, looking back towards Manhattan. ©NPS | Everitt



... the sea level rise in the northeast is almost four times the global average ...

— according to the U.S. Global Change Research Program's Fourth National Climate Assessment

Alternative management strategies to protect park resources are being considered by NPS in a phased approach. Phase 1 is to reconstruct Derby Wharf to bear the brunt of Salem's storm surge. Phase 2 could include saltwater tolerant revegetation and building retrofits, such as filling in basements and raising critical infrastructure. Phase 3 presents more challenging scenarios where strategic relocation and demolition of existing structures are up for debate. Unfortunately, with years of underfunding and dwindling resources for historic and cultural sites, the Park Service does not have the support needed to prepare for the worst-case climate scenarios projected 50+ years into the future.

Fort Jay at Governors Island NM

In the heart of the New York harbor, Governors Island is at severe risk from rising tides. Fort Jay, a U.S. Army post built in 1794 at Governors Island NM, is at great risk as rising seas continue to erode the bulkhead and pedestrian sidewalks shielding the fort from harbor waters and wave energy. The barrier rock wall that surrounds Fort Jay and Castle Williams continues to corrode as storms and wave energy persist. This ongoing battle has resulted in increasing maintenance costs for NPS. Occasionally the pedestrian walkway around Fort Jay is closed to the public as broken concrete and dispersed boulders create unsafe conditions and public hazards. As sea levels continue to rise, access for visitors could be limited if pedestrian walkway closures occur more frequently.

Warmer Temperatures Extend Visitation Season in the Northeast

From the Statue of Liberty and Ellis Island NM to Acadia NP, some of the nation’s most beloved stories and breathtaking landscapes are preserved in America’s national parks throughout the northeast. Northeast national parks are some of the most frequently visited sites in the National Park System, and trends point to increased visitation in the coming years.

A report commissioned for NPS analyzed historical relationships between visitation and air temperature and predicted future trends based on a least change and a major change scenario, utilizing the most up-to-date science from IPCC’s representative concentration pathways (RCP). Scientists found that 95% of parks showed a significant positive relationship between visitation and air temperature. The results predicted an average of 8%-23% increase in annual visits and a two- to four-week expansion in the visitation season by mid-century (2041-2060), depending on the warming scenario.

From 2000 to 2019, the National Park System saw a 94% increase in visitation. Given that northeast national parks are some of the most visited in the country, researchers believe that these sites will almost certainly experience sizable increases in visitation over the next several years extending the length of the peak visitation season.

Future warming is likely to bring more people to parks and extend the length of the peak visitation season.⁷

The National Park Service has conducted more specific research on growing visitation projections at individual parks. For example, at Boston National Historic Park, NPS projects an 8-23% increase in annual visitation depending on which warming scenario occurs. A 12- to 36-day expansion in the visitation season is predicted as well.⁸ Over three million people visit Boston National each year.

Similarly, an NPS report predicts annual visitation at Salem Maritime National Historic Site is projected to increase by 10-26% with a 25- to 50-day expansion in the typical visitor season.⁹

As the weather warms, urban heat island effect will exacerbate localized impacts of climate change in New York City. Nearby residents and park visitors will seek open space and waterfront respite to escape hot summer temperatures amidst the largest metropolitan city in the country.

Unfortunately, as warming and visitation are both projected to increase at these six northeast harbor national parks, so does NPS’s vulnerability to tidal flooding, sea level rise, storm surge and future hurricanes.



Top: Visitors enjoying Castle Clinton National Monument on a warm day. ©Shanshan533 | Dreamstime
Bottom: Visitors gathering at Boston National Historical Park. ©Enrico Della Pietra | Dreamstime



NPCA
Northeast
Region

Our Work to Advocate for Climate Resilient National Parks

NPCA works to protect national parks and nearby vulnerable communities from the causes and detrimental effects of climate change. From communities to Congress to courtrooms, our parks bring people together and we leverage this unique bipartisan appeal to advocate for stronger laws and to hold polluters accountable to those laws.

The effects of climate change are happening now, and our northeast harbor national park sites are at the forefront of the climate crisis. Just as we witnessed during Superstorm Sandy in 2012, extreme weather devastates our harbor national parks and surrounding communities, causing more than \$70 billion in damage. The destructive aftermath of hurricanes and coastal storms like Superstorm Sandy can be crippling for years.

This is why NPCA advocates on Capitol Hill—to deliver robust disaster relief funding for national parks and communities to recover and rebuild park facilities, roads, utilities, and other infrastructure to better withstand future storms. In 2013, we worked with congressional champions in the House and the Senate to secure disaster relief funds to provide shelter, power, and other basic necessities to struggling coastal communities, and to support the recovery of our beloved harbor national parks in the NY-NJ region.

And after leading the charge to pass the bipartisan Great American Outdoors Act—the largest investment in our parks and public lands in more than 50 years—NPCA is working to ensure this new funding will help the National Park Service build smarter, more resilient infrastructure and facilities that improve



Above: Castle Williams at Governors Island National Monument, with lower Manhattan in the background. ©Kropic | Dreamstime

water and energy use. Harbor national parks like the Statue of Liberty will receive funding from the Great American Outdoors Act to reconstruct a deteriorating seawall that surrounds the pedestal and fortifies the foundation of the island.

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 in protecting and building our parks stronger so they endure for generations to come. Learn more at www.npca.org/climate.

HOW YOU CAN HELP

To keep parks safe from the greatest threat they have ever faced we must do two things: reduce climate pollution and help parks and communities become more resilient. Each one of us has a role to play. Visit us at npca.org/climate to learn more about our work and to join us. You can email us at northeast@npca.org. Together with 1.4 million members across the nation, we are leading on action to protect our national parks.

References

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