



Climate Change at Acadia National Park

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 Acadia National Park.



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 coast of Maine, warming oceans, increasing precipitation, and more frequent severe 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.

Acadia National Park is a crown jewel of the northeast, offering unparalleled visitor experiences, expansive vistas and unique coastal and terrestrial habitats where flora and fauna thrive. The park's rocky coastline offers protection from shoreline erosion and sediment loss, however climate change plagues park resources in other distinct ways, such as compromised infrastructure, altered landscapes and changing visitor trends.

TABLE 1: Flood Risk at Acadia National Park collected from Federal Emergency Management Agency (FEMA) and National Oceanic and Atmospheric Administration (NOAA). 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. **Below:** Bass Harbor Head Light Station in Tremont, ME, dating back to 1858, was transferred to the National Park Service by the United States Coast Guard in 2020. Today, the Bass Head Harbor Light Station remains a popular destination for park visitors. ©F11photo | Dreamstime



Flood Risk at Acadia National Park		Level of Flood Risk: ● High ● Moderate ● Low	
TABLE 1 Acadia National Park	Portion of Park in FEMA Flood Zones	NOAA Storm Surge Risk Under Category 1	NOAA Storm Surge Risk Under Category 4
Acadia National Park		Low - Moderate	Low - Severe





National Park Threat

Changing Landscapes Alter Important Ecosystems

Acadia National Park is located at the transition zone of two ecoregions—the eastern deciduous forest, which spans across the east coast of the United States, and the northern boreal forest, which stretches north to Canada. Acadia’s boreal forest support a vast array of wildlife and fragile plant species. Hiking through the Schoodic Peninsula, you smell the pungent balsam firs and weave between towering red and white spruce. Climbing the Precipice Trail, you take in expansive vistas while meandering through low laying juniper and wild Maine blueberries. These are some of the iconic species that make up Acadia’s boreal forest.

Unfortunately, the Arctic and boreal regions, globally, are warming at about two times the rate of the rest of the planet.³ The boreal forest biome only covers about 0.29 million square miles of the United States.⁴ Given that the U.S. has such a small portion of the world’s boreal forest, warming temperatures severely threaten the livelihood of this unique ecosystem in Acadia.

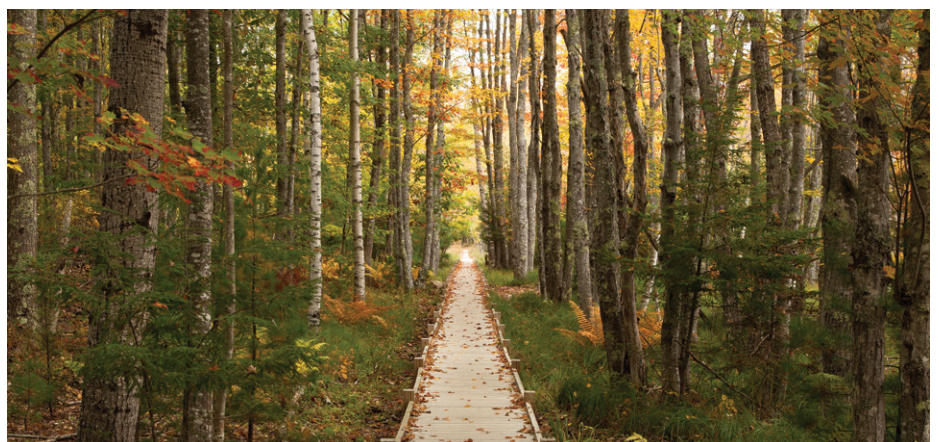
Temperatures in Acadia have risen 3° F since 1890 and projections show another 3° F of warming by 2050.⁵ The park is also experiencing extremely warm minimum temperatures compared to historical records.⁶ Due to the changing climate and shifting temperature ranges, many boreal tree species, like the spruce-fir,



will not be able to survive in Acadia in the future.⁷

Warming projections also threaten Acadia’s deciduous forest biome. According to the National Park Service, the Red Spruce, Acadia’s most common tree, would lose half of its habitat and four other native trees may be extinct by 2100.⁸ The loss of these trees in Acadia would affect the entire ecosystem, including the plants, animals, and insects that thrive in the park and depend on these trees for critical habitat. This is cause for alarm among park officials not only because the species could disappear, but also because of what will replace them. Park Service

staff and the Schoodic Institute are working to understand what Acadia’s ecosystem will look like in 50-100 years and how they might begin preparing for large-scale ecosystem change.⁹ NPS is partnering with local scientists to conduct tree species experiments to study their response to the projected shifting weather patters, such as harsher winters; hotter summers; earlier Spring seasons; and later Fall seasons. Their studies reveal that invasive nonnative shrubs common at the southern end of the park may outcompete Acadia’s sensitive tree species, choking out and preventing regeneration of the park’s once unique forested habitats.¹⁰



Top (clockwise): Wild Maine Blueberries flourish at high elevations throughout Acadia. ©gmcoop | IStock • Barred Owl perched on a tree at Acadia ©Harry Collins | Dreamstime • Red Spruce is an abundant tree that grows up to 80 feet tall at Acadia. ©Cynthia Mccrary | Dreamstime • Park Service staff work with conservation experts to protect critical milkweed habitat in the park for Monarch Butterflies ©Jennifer Lobo | Dreamstime **Above (left):** Acadia is on the edge of two distinct ecoregions, the northern boreal forest, dominated by spruce and firs, and the eastern deciduous forest with hardwoods that span across New England. ©Chee-onn Leong | Dreamstime **Above (right):** Jesup Path, Acadia National Park ©Eric Rach | Dreamstime



National Park Threat

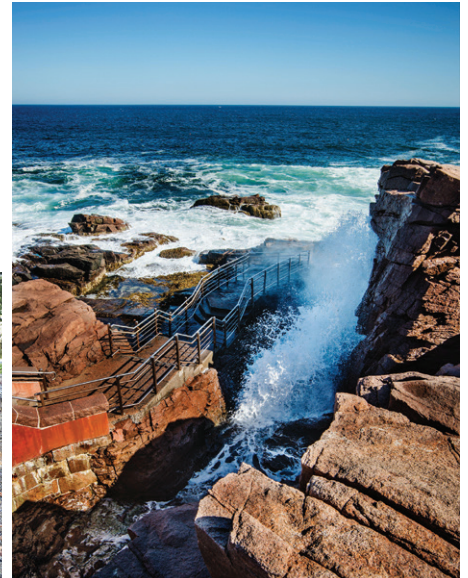
Extreme Weather Threatens Park Infrastructure

Extreme weather in the northeast refers to the rapid warming of air and ocean temperatures, increasing precipitation, stronger storm surge and more. One example of extreme weather at Acadia is known as ‘cloudburst’ rainfall—an increasing amount of precipitation over shorter periods of time. At Acadia, the current loading capacity of park infrastructure cannot handle the sudden, violent cloudburst rainstorms that have recently been recorded.

Many of Acadia’s roads and bridges are historic resources, dating back to the early 1910s. When the roads and bridges were built, climate change and high visitation were not considered. As a result of increasing frequency of high intensity precipitation events and winter icing, there are increased events that cause severe erosion of gravel roads and trails. Park managers have noted that violent storms are increasing cyclical maintenance of park infrastructure, such as repairs needed for storm drains, culverts, road systems, historic bridges, and other transportation infrastructure.

Acadia’s infrastructure is also compromised during fierce coastal storms, known as Nor’easters. Low-lying areas throughout the park, such as Thunder Hole, Schoodic Loop Road, and the Seawall (near Bass Harbor Head Lighthouse) experience massive over-wash from storm surges. At Seawall, the Park Service works with Maine Department of Transportation to maintain the state road. Whereas at Schoodic, the Park Service must occasionally clear the Loop Road using a snow plow to remove overwash debris. Big wave energy at Thunder Hole can damage the handrails and staircase, presenting public safety hazards and requiring time and money to repair.

Intense rain storms and winter freeze-thaw events are becoming more common, which compromise park infrastructure and erode the park’s 45 miles of carriage roads.¹¹ As climate projections predict more frequent cloudburst events and intense coastal storms in the future, visitors to Acadia are likely to encounter more road closures while NPS works

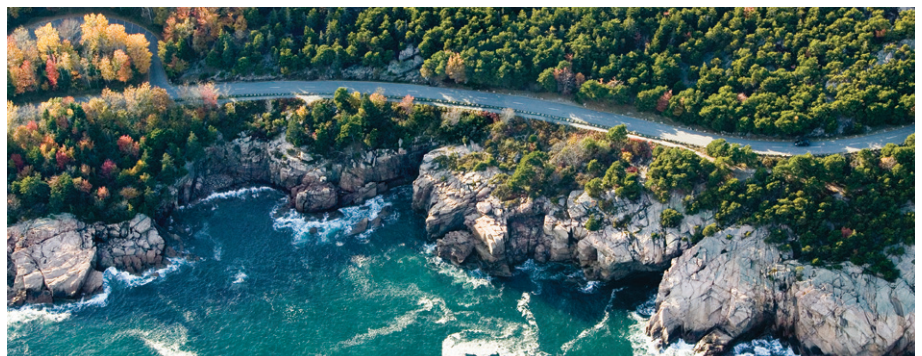


around the clock to keep up with repairs that are essential to retain emergency access to the park.

Funding levels have not kept up with these increasing maintenance costs at Acadia and Park Service staff are forced to make difficult decisions that lead to a growing maintenance backlog. Nor’easters are expected to increase in severity, which will cause more flooding across the island, further aggravating the park’s \$60 million in deferred maintenance.¹²

Luckily, Acadia is one of a few national parks to have completed a Vulnerability

Assessment which identify the park’s exposure and vulnerability to localized impacts of climate change. This study is a critical tool that park managers use to make smart decisions about future resource protection and investment. In addition to the Vulnerability Assessment, Acadia staff worked with the NPS Climate Change Response Program, NPS Region 1, and USGS Climate Adaptation Science Center on climate scenario planning to determine future impacts to park ecosystems and critical infrastructure. Then, park managers worked to address each scenario in subsequent resource management plans.



Top (clockwise): Otter Cove Causeway is an example of Acadia’s historic stone bridges handcrafted by masonry experts which require more frequent upkeep due to erosion from heavy rainfall. ©F11photo | Dreamstime • The Park Service must pay for, and repair, the staircase at Thunder Hole more frequently due to wave damage from storm surges and Nor’easters. ©Michael Marquand | Alamy • Acadia’s historic carriage roads sustained extensive damage following a severe rainstorm in June 2021 which closed 10 miles of the 45-mile carriage road network in the park. ©National Park Service **Above:** Park Loop Road, spanning alongside Acadia’s rocky shoreline, is vulnerable to increased storm events. ©Joe Sohm | Dreamstime



Climate Change Impact

Warmer Temperatures Extend Visitation Season in the Northeast

From the Statue of Liberty to Acadia, 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 among the most frequently visited within National Park System. Acadia, for example, continues to break visitation records year after year.

A report by Park Service scientists analyzed historical relationships between visitation and air temperature and predicted future trends based on least-change and major-change scenarios, using data 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.

Visitors are discovering shorter winters and longer summers at Acadia. This shift places extra strain on the Park Service as visitors are arriving before seasonal employees are hired.

Acadia is already one of the most visited parks in the country. In 2019, it was the nation’s 7th most visited National Park, welcoming over 3.4 million visitors. This year, Acadia is on track to break visitation records once again, with the

first four months of 2021 being 74% higher than January-April 2019. To tackle overcrowding and congestion at some of the most popular sites in the park, Acadia continues to evolve implementation of their recently approved Transportation Plan. Acadia Transportation Plan will be essential to help visitors make good decisions about how to access the park, by providing timed entry to manage congestion, improve visitor experience and help to reduce greenhouse gases.



Left: Traffic builds on Park Loop Road as more people are drawn to Acadia’s popular attractions on Mount Desert Island. ©Luckydoor | Dreamstime **Above:** Visitors enjoy one of Acadia’s most popular hikes, the Beehive Cliffs Trail. ©dbimages | Alamy **Below:** Thunder Hole in Acadia National Park, Maine. ©wbritten | iStock



Future warming is likely to bring more people to national parks and extend the length of the peak visitation season.¹³

At Acadia, an NPS study projects a 15% to 47% increase in annual visitation, and a 13- to 41-day expansion in the visitation season, depending on the warming scenario.¹⁴ The changes in peak visitor season are a result of shifting weather patterns along the coast of Maine.





NPS
Northeast
Region

Our Work to Advocate for Climate Resilient National Parks

NPCA works closely with local partners in Maine to protect Acadia National Park's natural and cultural resources in the face of climate change. We amplify community voices to rally public support to address the climate crisis and bring in federal funding to address the park's greatest needs. From communities to Congress to courtrooms, our national parks bring people together and we leverage this unique bipartisan appeal to advocate for stronger laws to hold polluters accountable. To do this, we work with communities, federal, state, and local partners to highlight parks as solutions for addressing climate change.

NPCA also works with area residents, small business owners and local coalitions to fight inadequate development that threatens Acadia's communities, air, lands, waters, and wildlife. And we advocate for science-based management practices that protect Maine's communities and national parks from more frequent and



severe coastal storms, extreme rainfall, and hotter temperatures.

Reducing greenhouse gas emissions and other pollutants from coal plants, vehicles and oil and gas operations is one of the most important things we can do to help our parks and communities battle climate

impacts. Right now, NPCA is working with federal and state agencies and elected officials to restore clear skies to places like Acadia National Park through the Clean Air Act.

We also advocate for clean, equitable access to Acadia by supporting their new transportation plan. This plan encourages people to get out of their cars and explore the park on the free, propane-powered Island Explorer shuttle bus while ensuring everyone has a chance to visit some of Acadia's most iconic places, like Cadillac Mountain, with a new reservation system.

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.



Top: Visitors can hitch a ride on the free Island Explorer shuttle bus from downtown Bar Harbor to explore some of Acadia's greatest attractions. ©Mira | Alamy **Above:** Crowds gather on top of Cadillac Mountain prior to the new timed entry vehicle reservation system. ©D. Trozzo | Alamy

References

- https://nca2018.globalchange.gov/downloads/NCA4_Ch18_Northeast_Full.pdf
- <https://nca2018.globalchange.gov/>
- https://e360.yale.edu/features/the_rapid_and_startling_decline_of_worlds_vast_boreal_forests
- <https://www.frontiersin.org/articles/10.3389/ffgc.2020.00090/full>
- <https://friendsofacadia.org/wp-content/uploads/2021/04/Science-to-Protect-Acadia.pdf>
- <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0101302>
- <https://irma.nps.gov/DataStore/Download-File/485072>
- <https://irma.nps.gov/DataStore/Download-File/485072>
- Ibid.
- <https://irma.nps.gov/DataStore/Download-File/517086>
- <https://www.mdislander.com/maine-news/carriage-roads-now-open-to-all-acadia-campgrounds-still-closed#:~:text=The%20carriage%20roads%20had%20been,10%20a.m.%20to%204%20p.m.>
- <https://bangordailynews.com/2017/09/16/weather/as-storms-get-worse-heres-what-maine-might-expect/>
- <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0128226>
- <https://irma.nps.gov/DataStore/Download-File/524325>
- <https://www.usgs.gov/center-news/northeast-warming-faster-rest-us>