

# Rhode Island

Confronting Climate Change in the U.S. Northeast



From the bluffs of Block Island to the streets of Providence, the climate of Rhode Island is changing. Records show that spring is arriving earlier, summers are growing hotter, and winters are becoming warmer and less snowy. These changes are consistent with global warming, an increasingly urgent phenomenon driven by heat-trapping emissions from human activities.

New state-of-the-art research shows that if global warming emissions continue to grow unabated, Rhode Island can expect dramatic changes in climate over the course of this century, with substantial impacts on vital aspects of the state's economy and character. If the rate of emissions is lowered, however, projections show that many of the changes will be far less dramatic. Emissions choices we make today—in Rhode Island, the Northeast, and worldwide—will help determine the climate our children and grandchildren inherit, and shape the consequences for their economy, environment, and quality of life.

The research summarized here describes how climate change may affect Rhode Island and other Northeast states under two different emissions scenarios. The higher-emissions scenario assumes continued heavy reliance on fossil fuels, causing heat-trapping emissions to rise rapidly over the course of the century. The lower-emissions scenario assumes a shift away from fossil fuels in favor of clean energy technologies, causing emissions to decline by mid-century.

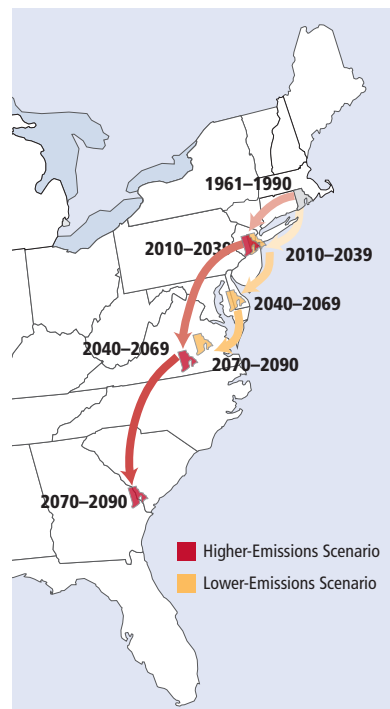
The research also explores actions that individual households, businesses, and governments in the Northeast can take today to reduce emissions to levels consistent with staying *below* the lower-emissions scenario and adapt to the unavoidable changes that past emissions have already set in motion.

## RHODE ISLAND'S CHANGING CLIMATE

**Temperature.** Average temperatures across the Northeast have risen more than 1.5 degrees Fahrenheit (°F) since 1970, with winters warming most rapidly—4°F between 1970 and 2000. If higher emissions prevail, seasonal average temperatures across Rhode Island are projected to rise 7°F to 13°F above historic levels in winter and 6°F to 14°F in summer by late-century, while lower emissions would cause roughly half this warming. As in other Northeast states, Rhode Island can expect a large increase in the frequency of days with temperatures above 90°F over the course of this century, with steep increases under the higher-emissions scenario.

**Precipitation and winter snow.** The Northeast region is projected to see an increase in winter precipitation on the order of 20 to 30 percent. Slightly greater increases are projected under the higher-emissions scenario, which would also feature less winter precipitation falling as snow and more as rain.

Snow is an iconic aspect of Northeast winters and an integral part of many favorite winter



## Migrating State Climate

Changes in average summer heat index—a measure of how hot it actually feels, given temperature and humidity—could strongly affect quality of life in the future for residents of Rhode Island. Red arrows track what summers could feel like over the course of the century under the higher-emissions scenario. Yellow arrows track what summers in the state could feel like under the lower-emissions scenario.

activities, but rising temperatures over the past few decades have caused snow to become wetter, or more “slushy,” and decreased the average number of snow-covered days. Rhode Island could see its snow season reduced to just a handful of days per winter month by mid-century, and virtually eliminated by late-century. Under the lower-emissions scenario the state would retain roughly one week per winter month of snow cover through this century.

Heavy, damaging rainfall events have already increased measurably across the Northeast in recent decades. Intense spring rains struck the region in both 2006 and 2007, for example, causing widespread flooding. The frequency of these events is expected to rise further under either emissions scenario.

**Drought.** Rising summer temperatures coupled with little change in summer rainfall are projected to increase the frequency of short-term (one- to three-month) droughts, particularly if higher emissions prevail. By late-century, for example, short-term droughts are projected to occur annually under the higher-emissions scenario (compared with once every two years, on average, historically), increasing stress on both natural and managed ecosystems. In contrast, little change in drought is expected under the lower-emissions scenario.

**Sea-level rise.** Global warming affects sea levels by causing ocean water to expand as it warms, and by melting land-based ice. Under the higher-emissions scenario, global sea level is projected to rise between 10 inches and two feet by the end of the century (7 to 14 inches under the lower-emissions scenario). These projections do not account for the recent observed melting of the world’s major ice sheets—nor the potential for accelerated melting—and may therefore be conservative. However, even under these projections, the Ocean State faces a substantial increase

in the extent and frequency of coastal flooding, erosion, and property damage.

## IMPACTS ON HUMAN HEALTH

Heat was the United States’ leading weather-related killer in 6 of 10 recent years (between 1993 and 2003). More intense summer heat waves and deteriorating air quality caused by global warming will increase the risks of many health problems.

**Extreme heat.** While Rhode Islanders are accustomed to the occasional summer heat wave, the number of very hot days in large cities (where the urban heat-island effect can amplify temperatures) is expected to increase significantly, particularly under the higher-emissions scenario. By late-century, for example, neighboring cities like Boston and Hartford could experience roughly 25 days over 100°F every summer under the higher-emissions scenario, compared with roughly seven such days under the lower-emissions scenario.

Very hot days are not only unpleasant but also dangerous. As the number of these days increases, so does the risk of heat stress, heart attack, and even death. The state’s larger cities such as Providence, Cranston, Warwick, and Pawtucket will need to prepare for an increase in dangerously hot conditions by taking steps (e.g., installing better insulation, establishing heat warning systems and cooling centers) that will lessen the impact of extreme heat on vulnerable populations.

**Air quality.** Air pollution from ground-level ozone and other components of smog is a serious concern across much of Rhode Island. From 2001 to 2005, the average summer in Rhode Island included nearly 11 days that did not meet U.S. Environmental Protection Agency (EPA) air-quality standards for ground-level ozone, putting additional stress on people with cardiovascular and respiratory diseases. In the absence of more stringent controls on ozone-

forming pollutants, the number of days with poor air quality in cities like Providence could quadruple under the higher-emissions scenario. Under the lower-emissions scenario such days could increase by half.

Higher temperatures and increasing levels of plant-stimulating carbon dioxide (CO<sub>2</sub>) in the air are also expected to accelerate seasonal pollen production in plants over the next several decades under the higher-emissions scenario. This could extend the allergy season, increase asthma risks, and exacerbate symptoms for both urban and rural residents of Rhode Island.

**Vector-borne disease.** Mosquitoes and ticks carry West Nile virus and Lyme disease-causing bacteria, respectively, and spread them to animals and humans. Factors affecting vector-borne diseases are complex; however, projections for the Northeast of warmer winters, hotter summers, and more frequent summer dry periods punctuated by heavy rainstorms are the same conditions that can set the stage for more frequent West Nile virus outbreaks.

## IMPACTS ON COASTAL COMMUNITIES

Rhode Island’s coastline spans estuaries, salt marshes, and wildlife preserves, and its many coastal parks are prized for family beach outings and recreational boating. From ecologically vital wetlands to critical infrastructure to waterfront homes, much of this coastline is exceptionally vulnerable to sea-level rise. Indeed, some major insurers have withdrawn coverage from thousands of homeowners in coastal areas across the Northeast in recent years.

**Coastal flooding.** Rising sea levels caused by global warming are projected to increase the frequency and severity of damaging storm surges and coastal flooding along the Northeast coast. Just across Buzzards Bay, what is now considered a once-in-a-century



Beaches, such as these on Block Island, will become increasingly vulnerable to erosion as sea level rises, and neighboring homes will become more vulnerable to coastal flooding.

coastal flood in Woods Hole, MA (one of five sites analyzed in this study) is expected to occur as frequently as once every 21 years, on average, by late-century if the lower-emissions scenario prevails and once every nine years, on average, under the higher-emissions scenario. Rhode Island has a lengthy history of protecting itself against the sea, but the extra stresses created by sea-level rise and more frequent and extensive flooding can be expected to severely tax both new and aging infrastructure and threaten vulnerable coastal communities across the state.

**Shoreline change.** Sea-level rise is expected to permanently inundate certain low-lying coastal areas and dramatical-

ly accelerate erosion, particularly on important barrier beaches such as East Beach and Misquamicut State Beach. Continued sea-level rise will also threaten the state's ecologically important salt marshes and estuaries, which serve as critical feeding grounds for migrating waterfowl and other birds, and nursery habitat for important commercial fish.

Rhode Island policy makers will need to take steps to protect the state's vulnerable populations and infrastructure, as well as wildlife and critical coastal wetlands. This includes public education, updating and enforcing building codes and land-use regulations, and working with the insurance industry to effectively protect property and people.

### IMPACTS ON FISHERIES

Clambakes and lobster feasts are synonymous with summer in Rhode Island. The state's lobster catch totaled more than 1,900 metric tons in 2005, bringing in \$23 million to the state economy. Global warming is expected to take a serious toll on this already declining shellfish population: lobster stocks in Rhode Island's nearshore waters are expected to collapse entirely as the maximum heat-stress threshold for lobster is consistently exceeded by mid-century under either emissions scenario.

### IMPACTS ON AGRICULTURE

From the Blackstone Valley to the fertile soils of the coastal lowlands, Rhode Island growers harvest some of the region's finest potatoes, fruits, and vegetables. More than 800 Ocean State farms produced \$51 million in agricultural sales in 2005. Global warming will present both opportunities and challenges to Rhode Island's growers and producers; for example, increases in the frequency

of short-term drought (see p.2) could necessitate increased irrigation and operational costs, while a longer growing season could benefit those farmers invested in warmer-weather crops.

Rhode Island fruit growers produce an abundance of high-value fruit crops, many of which require a certain number of hours each winter of adequately cold temperatures for optimal flowering and fruit development. By mid-century under the higher-emissions scenario, the winter chilling requirements of blueberries, raspberries, cranberries, and certain varieties of apples (e.g., McIntosh, Empire) would not be met across most of the state. Under the lower-emissions scenario the southern half of the state would, by late-century, become too warm to support these crops.

### WHAT WE CAN DO

From the historic status of the Blackstone River Valley as the birthplace of America's Industrial Revolution to Newport's modern-day role as an international sailing mecca, Rhode Island has a legacy of outsized contributions to our nation's fortune. Today, the Ocean State is poised to continue this legacy by leading the effort to reduce heat-trapping emissions and combat the dangerous effects of global warming. By reducing emissions today, we have an opportunity to help protect our children and grandchildren from the most severe consequences of global warming. At the same time, effective adaptation strategies are needed to help reduce the vulnerability of Rhode Island's residents, ecosystems, and economies to those changes that are now unavoidable.

Here in Rhode Island, the Northeast, and around the world, there is growing momentum to meet the climate challenge. Of course our actions alone will not be sufficient to avoid dangerous climate change, but Rhode Island (and the rest of the Northeast) is well positioned to help drive national and international progress. Concerted, sustained

efforts to reduce emissions in the region—on the order of 80 percent below 2000 levels by mid-century and just over 3 percent per year on average over the next several decades—can help pull global emissions below the lower-emissions scenario described here.

State and local governments have a rich array of strategies and policies at their disposal to meet the climate challenge in partnership with other states, businesses, civic institutions, and the public. These strategies and policies can reduce emissions in the following sectors:

**Electric power.** Legislation enacted with broad support in 2007 positions Rhode Island to make great strides in implementing its state Climate Change Action Plan and achieving substantial emissions reductions. Key provisions include requirements that utilities prioritize cost-effective energy-efficiency gains over new electricity supply and that the state auction 100 percent of the emissions permits created under the Regional Greenhouse Gas Initiative (RGGI), a multi-state effort to reduce heat-trapping emissions from power plants. These proceeds should provide substantial resources to invest in energy efficiency and renewable energy development. Governor Carcieri's call to raise the state's renewable electricity standard to a target of 20 percent by 2011 could help create jobs and enhance the diversity and security of Rhode Island's energy supply.

**Buildings.** Rhode Island's relatively old stock of residential, commercial, and



The Save the Bay headquarters in Providence won an EPA prize for brownfield development and includes solar panels and a “green” roof.

industrial buildings offers substantial opportunities to reduce emissions associated with water and space heating. The state can support stronger enforcement of building energy codes, while local governments can amend zoning laws to encourage and/or require new construction and substantial renovation projects to achieve the U.S. Green Building Council's LEED certification and/or energy-efficiency levels that qualify for the EPA's Energy Star Building designation.

**Transportation.** Cars and trucks are the largest and fastest-growing source of Rhode Island's heat-trapping emissions, accounting for nearly 40 percent of the state total. The state has adopted California's tailpipe emissions standards, which require reductions of approximately 30 percent below 2002 levels by 2016, beginning with the 2009 model year (implementation is contingent

upon a ruling expected from the EPA). State and local governments can further reduce vehicle emissions through sustained investment in public transit (with a focus on achieving new ridership targets), incentives to purchase low-emissions vehicles, and incentives and regulations that promote “smart growth” strategies such as concentrating development near existing downtowns and public transportation routes. In addition, Rhode Island can adopt standards to reduce the carbon content of fuels.

## CONCLUSION

Global warming represents an enormous challenge, but we can meet this challenge if we act swiftly. The emissions choices we make today in Rhode Island, the Northeast, and globally will shape the climate our children and grand-children inherit. The time to act is now.



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This summary was prepared by the Union of Concerned Scientists based on *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions*, a report of the Northeast Climate Impacts Assessment (NECIA, 2007). NECIA is a collaborative effort between the Union of Concerned Scientists and a team of independent scientific experts to assess how global warming may further affect the climate of the U.S. Northeast and to explore options for meeting the climate challenge.

For more information on our changing Northeast climate and what you can do, or to download a copy of the full report and additional state summaries, visit [www.climatechoices.org](http://www.climatechoices.org).

