



U.S. Global Change
Research Program

Fourth National Climate Assessment, Vol II – Impacts, Risks, and Adaptation in the United States

Chapter 18 | Northeast

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Differences from NCA3

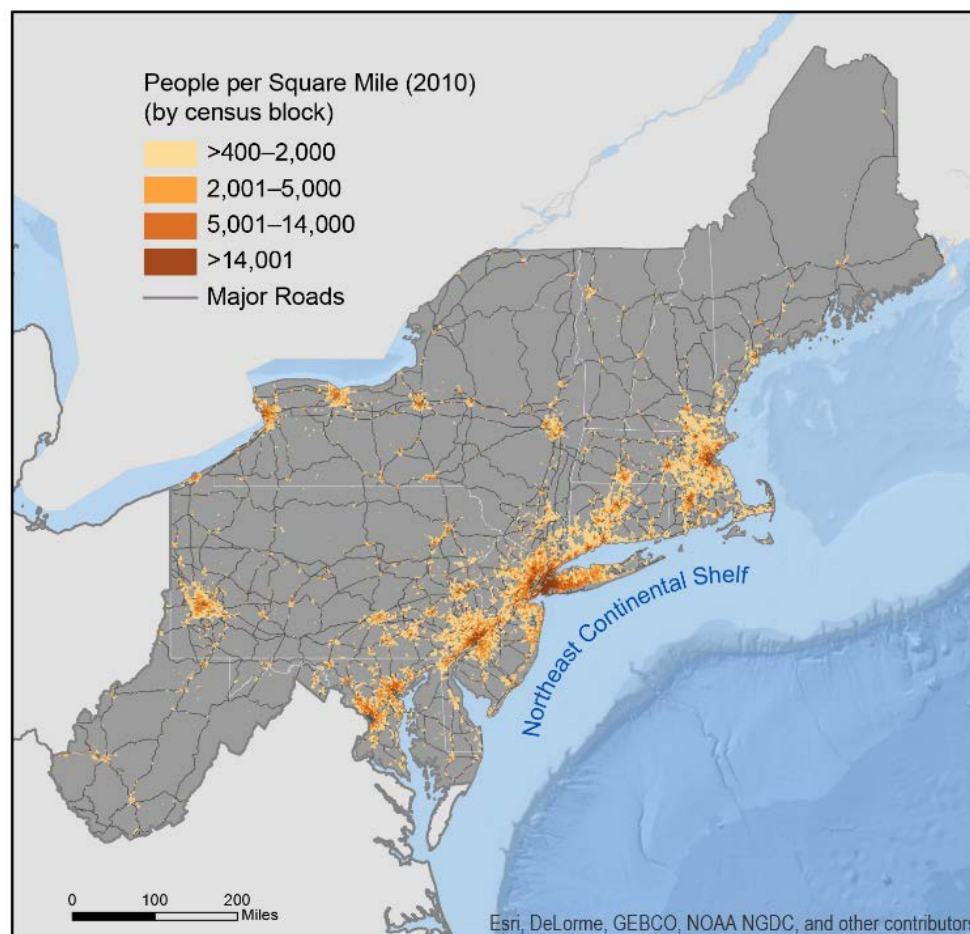
- **Expanded regional chapters**
- **Greater emphasis on rural impacts**
- **New key message on risks to human health**
- **Update on regional adaptation efforts since the last assessment**
- **Projections based on *representative concentration pathways* for a radiative forcing of 4.5 (low) and 8.5 (high)**



18 Chapter Background

Fig. 18.1: Population Density

A satellite mosaic overlaid with primary roads and population density highlights the diverse characteristics of the region in terms of settlement patterns, interconnections among population centers of varying sizes, and variability in relief across the ocean shelf. *Sources: U.S. Department of Transportation, U.S. Geological Survey, and ERT, Inc.*



18 Key Messages: Risk Framing



- **Rural industries & identity (Key Message 1)**
Climate-sensitive and are vulnerable to changes in seasonality
- **Marine & coastal environments (Key Message 2)**
Coastal communities are threaten by changes in ocean temperatures and sea level rise
- **Critical urban activities & infrastructure (Key Message 3)**
Disruptions from sea level rise and severe weather
- **Public health (Key Message 4)**
Increased exposure to reduced air and water quality, excessive heat, and disease
- **Adaptive capacity (Key Message 5)**
Opportunities to build on local to regional-scale adaptation activities

18 Key Message #1

Changing Seasons Affect Rural Ecosystems, Environments, and Economies

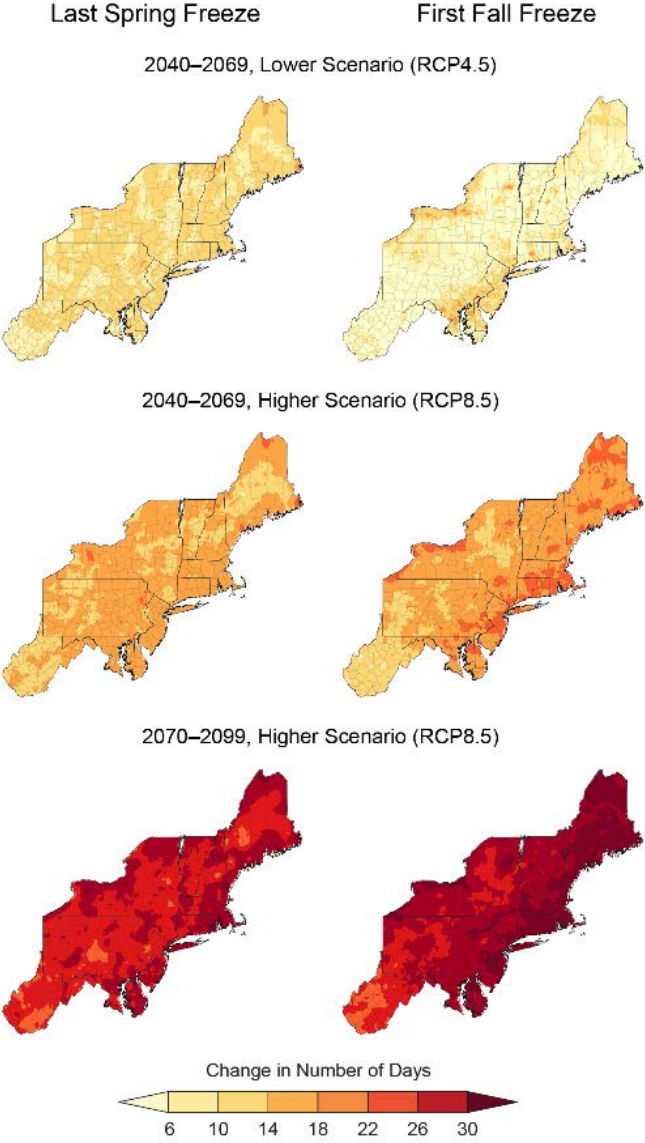


The seasonality of the Northeast is central to the region’s sense of place and is an important driver of rural economies. Less distinct seasons with milder winter and earlier spring conditions are already altering ecosystems and environments in ways that adversely impact tourism, farming, and forestry. The region’s rural industries and livelihoods are at risk from further changes to forests, wildlife, snowpack, and streamflow.

18 Key Message #1

Fig. 18.3: Lengthening of the Freeze-Free Period

These maps show projected shifts in the date of the last spring freeze (left column) and the date of the first fall freeze (right column) for the middle of the century (as compared to 1979–2008) under the lower scenario (RCP4.5; top row) and the higher scenario (RCP8.5; middle row). The bottom row shows the shift in these dates for the end of the century under the higher scenario. By the middle of the century, the freeze-free period across much of the Northeast is expected to lengthen by as much as two weeks under the lower scenario and by two to three weeks under the higher scenario. By the end of the century, the freeze-free period is expected to increase by at least three weeks over most of the region. *Source: adapted from Wolfe et al. 2018.*³⁵



18 Key Message #2



Changing Coastal and Ocean Habitats, Ecosystem Services, and Livelihoods

The Northeast's coast and ocean support commerce, tourism, and recreation that are important to the region's economy and way of life. Warmer ocean temperatures, sea level rise, and ocean acidification threaten these services. The adaptive capacity of marine ecosystems and coastal communities will influence ecological and socioeconomic outcomes as climate risks increase.

18 Key Message #2

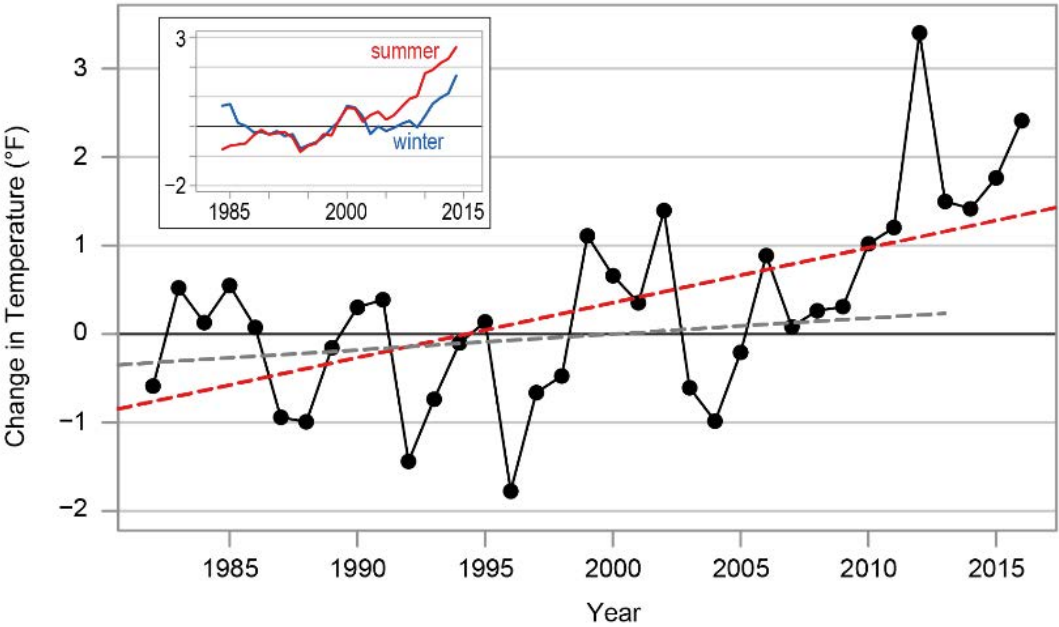


Fig. 18.4: Change in Sea Surface Temperature on the Northeast Continental Shelf

The figure shows annual average sea surface temperature (SST) differences from the 1982–2011 average (black dots and line). Over the period 1982–2016, sea surface temperature on the Northeast Continental Shelf has warmed at a rate of 0.06°F (0.033°C) per year (red dashed line). This rate is three times faster than the 1982–2013 global SST warming rate of 0.018°F (0.01°C) per year (gray dotted line).³⁹ The inset shows Northeast Continental Shelf seasonal SST differences from the 1982–2011 average as five-year rolling means for summer (July, August, September; red line) and winter (January, February, March; blue line). These seasons are centered on the warmest (summer) and coolest (winter) months for Northeast Shelf SSTs. Both seasons have warmed over the time period, but the summer warming rate has been stronger. *Source: Gulf of Maine Research Institute.*

18 Key Message #2



Fig 18.9: King Tide Flooding in Annapolis, Maryland

The photo shows King Tide flooding on Dock Street in Annapolis, Maryland, on December 21, 2012. *Photo credit: Amy McGovern ([CC BY 2.0](#)).*

18 Key Message #3

Maintaining Urban Areas and Communities and Their Interconnectedness



The Northeast's urban centers and their interconnections are regional and national hubs for cultural and economic activity. Major negative impacts on critical infrastructure, urban economies, and nationally significant historic sites are already occurring and will become more common with a changing climate.

18 Key Message #3

Fig 18.10: Subway Air Vent Flood Protection

The photo shows a subway air vent with a multiuse raised flood protection grate that was installed as part of the post-Superstorm Sandy coastal resilience efforts on West Broadway in lower Manhattan, New York City. *Photo credit: William Solecki.*



18 Key Message #4



Threats to Human Health

Changing climate threatens the health and well-being of people in the Northeast through more extreme weather, warmer temperatures, degradation of air and water quality, and sea level rise. These environmental changes are expected to lead to health-related impacts and costs, including additional deaths, emergency room visits and hospitalizations, and a lower quality of life. Health impacts are expected to vary by location, age, current health, and other characteristics of individuals and communities.

18 Key Message #4

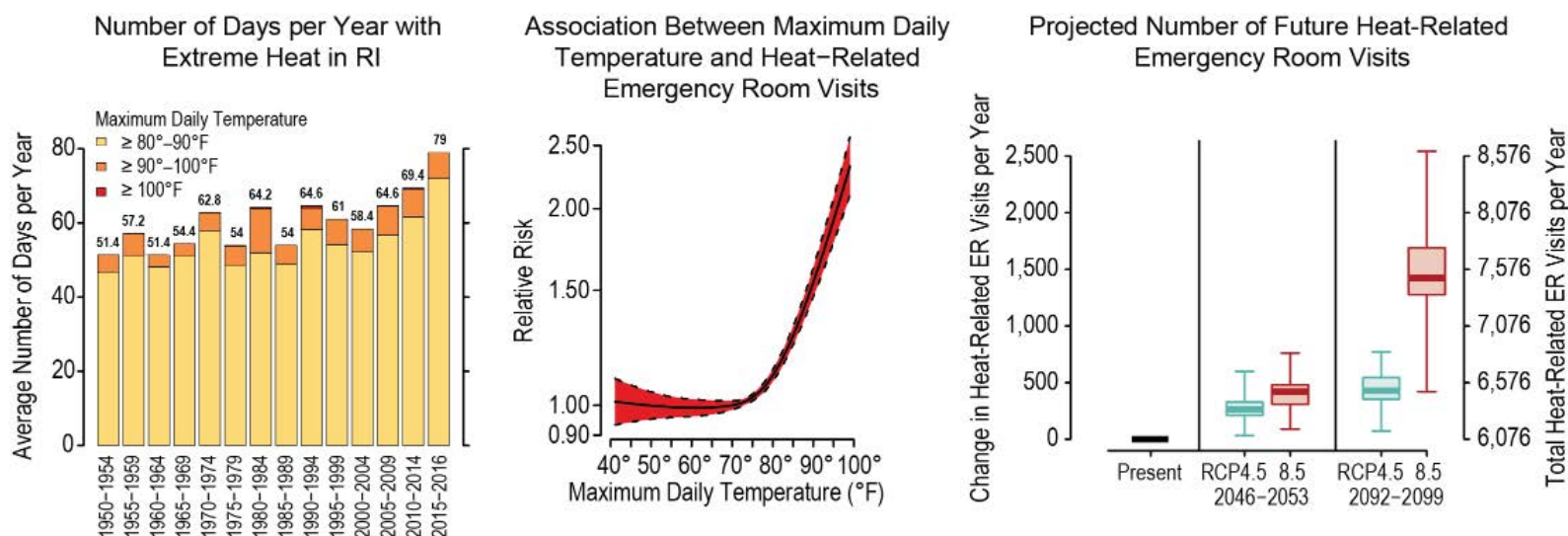


Fig. 18.11: Observed and Projected Impacts of Excess Heat on Emergency Room Visits in Rhode Island

This figure shows the observed and projected impacts of excess heat on emergency room visits in Rhode Island. (left) In Rhode Island, maximum daily temperatures in the summer have trended upwards over the last 60 years, such that residents experienced about three more weeks of health-threatening hot weather over 2015–2016 than in the 1950s. (middle) A recent study looking at visits to hospital emergency rooms (ERs) found that the incidence rate of heat-related ER visits rose sharply as maximum daily temperatures climbed above 80°F. (right) The study estimates that with continued climate change, Rhode Islanders could experience an additional 400 (6.8% more) heat-related ER visits each year by 2050 and up to an additional 1,500 (24.4% more) such visits each year by 2095 under the higher scenario (RCP8.5). About 1,000 fewer annual heat-related ER visits are projected for the end of the century under the lower scenario (RCP4.5) compared to the higher scenario (RCP8.5), reflecting the estimated health benefits of adhering to a lower greenhouse gas emissions scenario. *Sources: (left) Brown University; (middle, right) adapted from Kingsley et al. 2016.²⁶ Reproduced from Environmental Health Perspectives.*

18 Key Message #5



Adaptation to Climate Change Is Underway

Communities in the Northeast are proactively planning and implementing actions to reduce risks posed by climate change. Using decision support tools to develop and apply adaptation strategies informs both the value of adopting solutions and the remaining challenges. Experience since the last assessment provides a foundation to advance future adaptation efforts.

18 Key Message #5

Fig. 18.12: District of Columbia Water and Sewer Authority's Clean Rivers Project

The District of Columbia Water and Sewer Authority's Clean Rivers Project³⁴² aims to reduce combined sewer overflows into area waterways. The Clean Rivers Project is expected to reduce overflows annually by 96% throughout the system and by 98% for the Anacostia River. In addition, the project is expected to reduce the chance of flooding in the areas it serves from approximately 50% to 7% in any given year and reduce nitrogen discharged to the Chesapeake Bay by approximately 1 million pounds per year. *Photo credit: Daniel Lobo (CC BY 2.0).*



Key Takeaways



- **The Northeast economy and the quality of life of its residents are vulnerable to climate change**
- **Climate change is already impacting the region Northeast and these changes are likely to continue through the end of century**
- **Rural and urban communities face distinct challenges**
- **The region is engaged in a variety of adaptation efforts and has a high adaptive capacity for future efforts.**

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