



New Jersey

Confronting Climate Change in the U.S. Northeast



From the Jersey Shore's sandy beaches to the Delaware Water Gap, the climate of New Jersey 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, New Jersey 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 New Jersey, 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 New Jersey 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 across 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.

NEW JERSEY'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 most of New Jersey are projected to rise 7°F to 12°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. Under the higher-emissions scenario New Jersey's cities can expect a dramatic increase in the number of days over 100°F.

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. Not a snowy place historically, New Jersey is expected to lose virtually all of its snow cover by the end of the century if higher emissions prevail.



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 the NYC Tri-State region (the greater New York City metropolitan region, encompassing parts of New Jersey and Connecticut). 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 this region could feel like under the lower-emissions scenario.

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

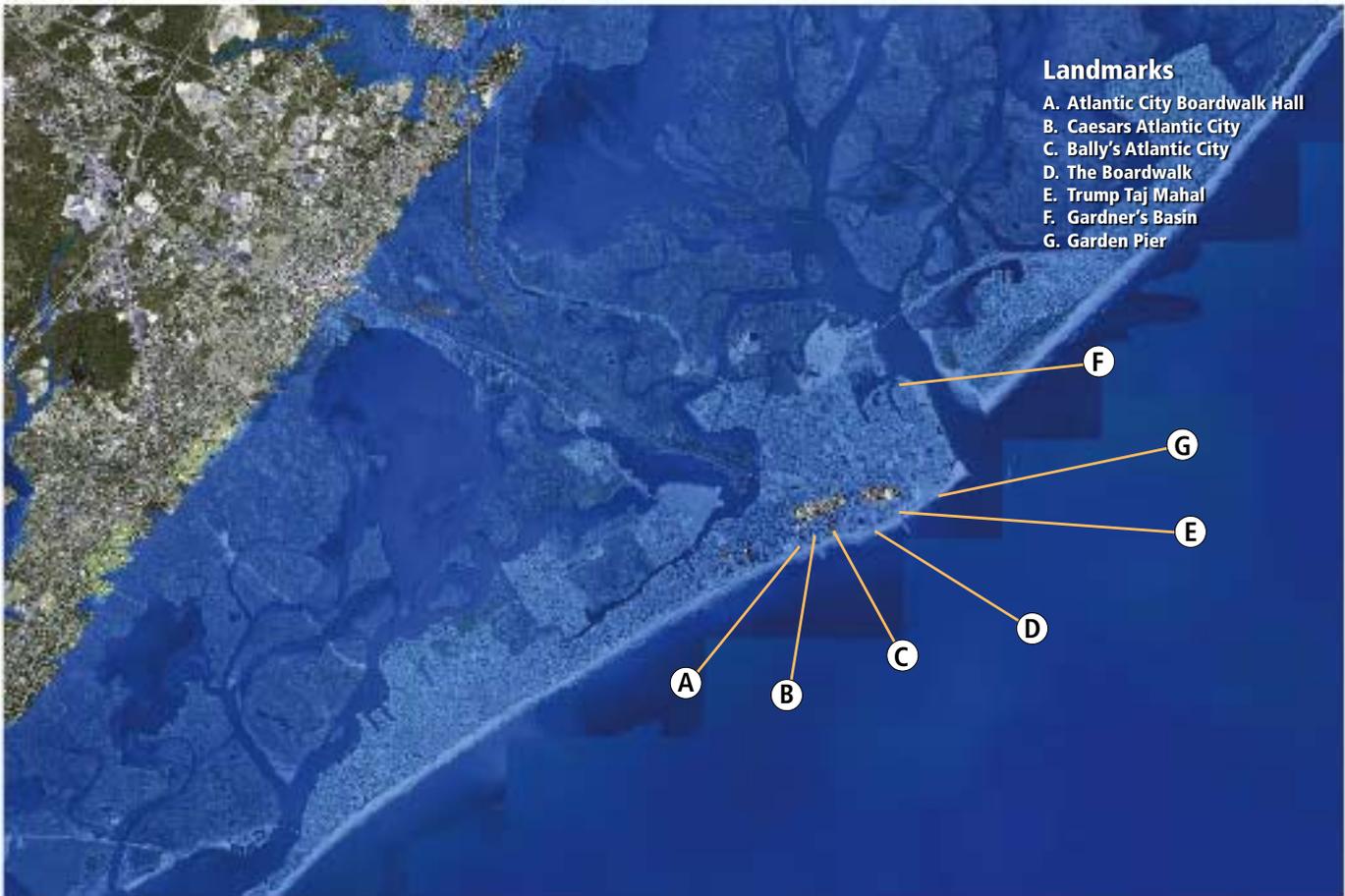
Drought. Rising summer temperatures coupled with little change in summer rainfall are projected to increase the frequency of short-term (one- to three-month) droughts, particularly under the higher-emissions scenario. These changes would increase stress on both natural and managed ecosystems across the state.

Sea-level rise. Global warming affects sea levels by causing ocean water to expand as it warms, and by melting land-based ice. With higher emissions, global sea level is projected to rise between 10 inches and two feet by the end of this 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, New Jersey’s densely populated coast faces substantial increases in the extent and frequency of coastal flooding, erosion, and property damage.

IMPACTS ON COASTAL COMMUNITIES

New Jersey has 127 miles of Atlantic coastline with virtually continuous beach from Sandy Hook to Cape May. The state is also the nation’s most densely populated, and 60 percent of its residents live in coastal counties.

In summer, the population of many Jersey Shore communities triples as tourists seek seaside fun and a respite from the heat. Atlantic City, best known today for its casinos, has long been a popular beach destination (featuring the world’s longest boardwalk and first oceanside amusement pier). Not surprisingly New Jersey’s coastal counties generate nearly 70 percent of the state’s \$30 billion in tourism revenues.



Credit: Applied Science Associates, Inc. Source: Google, Sanborn, State of New Jersey, TerraMetrics

Atlantic City Flooding

The light blue area depicts today’s 100-year flood zone (which extends beyond the area shown). Currently, this area has a 1 percent chance of being flooded in a given year. By 2100, this approximate area is projected to flood, on average, once every year or two under either emissions scenario, inundating high-tourist-value hotels and casinos. Under the higher-emissions scenario, the new 100-year flood height would be roughly four feet greater in 2100 than today, flooding a far greater area than the current flood zone.

Coastal flooding. Rising sea levels caused by global warming are projected to increase the frequency and severity of damaging storm surges and flooding, harming not only the state's coastal communities, infrastructure, transportation systems, and industry, but also its critical coastal wetlands. Communities situated on low-lying barrier islands, such as Atlantic City, are especially vulnerable. What is now considered a once-in-a-century coastal flood in Atlantic City is projected to occur, on average, as frequently as once every four years by mid-century and once every year or two by late-century—under either emissions scenario.

Shoreline change. Sea-level rise is expected to permanently inundate certain low-lying coastal areas and dramatically accelerate erosion—already a severe problem along New Jersey's heavily developed shore. Continued sea-level rise will further threaten coastal homes and businesses along the state's 83 miles of shoreline in protected bays. These ecologically important salt marshes and estuaries serve as critical feeding grounds for migrating waterfowl and other birds (making Cape May arguably the Northeast's top bird-watching area), and nursery habitat for important commercial fish such as menhaden and blue crab.

New Jersey's 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 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 could increase the risks of many health problems.

Extreme heat. While Garden State residents are accustomed to the occasional summer heat wave, the number of very hot days is expected to increase significantly, particularly under the higher-emissions scenario. This will be especially problematic in metropolitan counties such as Bergen, Essex, Hudson, and Passaic (near New York City) and Burlington, Camden, and Gloucester (near Philadelphia), where the urban heat-island effect can amplify temperatures. By late-century, for example, New York City could experience roughly 25 days over 100°F under the higher-emissions scenario, but only seven such days under the lower-emissions scenario. Emissions choices may have similar implications for New Jersey residents living across the river from Philadelphia in the urbanized Camden area, as Philadelphia is projected to experience nearly 30 days over 100°F under the higher-emissions scenario and fewer than 10 such days with lower emissions.

Very hot days are not only unpleasant but also dangerous. As extreme heat becomes more commonplace the risk of heat stress, heart attack, and death increases. Cities across the state will need to prepare for an increase in dangerously hot conditions by taking steps (e.g., installing better insulation, establishing 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 New Jersey. In 2006 the New York City-Newark-Bridgeport region was ranked the ninth most ozone-polluted metropolitan region in the country according to U.S. Environmental Protection Agency (EPA) standards; the Philadelphia-Camden-Vineland area ranked tenth.

Global warming is expected to wor-

Dr. Norbert P. Psuty



Beaches will become more vulnerable to erosion as sea level rises, and neighboring homes will become more vulnerable to damage from coastal flooding. Efforts to replenish beach sand, like that undertaken at Brant Beach on Long Beach Island, NJ (shown here), can help protect property and coastal tourism. As rising sea level drives greater erosion, however, these efforts may need to be repeated much more frequently and thus become more costly.

sen air quality in the region, putting more 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 is projected to quadruple in cities like Newark and Camden by late-century under the higher-emissions scenario. Under the lower-emissions scenario the number of such days could increase by half.

Higher temperatures and increasing levels of carbon dioxide (CO₂) in the air are also expected to accelerate seasonal pollen production in plants within 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 New Jersey.

Vector-borne disease. Mosquitoes and ticks carry West Nile virus (WNV) and Lyme disease-causing bacteria, respectively, and spread them to animals or people. Factors affecting the spread of such 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 WNV outbreaks.

IMPACTS ON AGRICULTURE

With the Jersey Fresh and Farmland Preservation programs, New Jerseyans are working to save their state's farmland. More than 9,000 farms cover 800,000 acres in fertile areas such as the Wallkill and Delaware Valleys, the Highlands region, and the Pinelands bogs. Global warming will present both opportunities and challenges to New Jersey's growers and producers.

Crops. The country's first cultivated blueberries were developed in the Pinelands region, and today New Jersey ranks among the top three states for both blueberry and cranberry production, which totaled over \$100 million in 2006. Nationally, the Garden State is also one of the top 10 producers of peaches, bell peppers, snap beans, spinach, tomatoes, and lettuce. An extended frost-free period may benefit peach, melon, and pepper farmers,

whose crop requires a long growing season. But increases in the frequency of short-term drought (see p.2) could necessitate increased irrigation and operational costs. Moreover, northern blueberries and cranberries require long periods of winter chill for optimum flowering and fruit development. Under either emissions scenario, the chilling requirements for these fruits would not be met in most winters by mid-century—an indicator of substantial risk to sustained crop production. Although blueberry growers may switch to varieties now grown in the South, there are currently no known low-chill cranberry varieties.

If higher emissions prevail, increasing summer temperatures and heat stress are expected to depress the yields of a number of other economically important crops adapted to cooler conditions (e.g., spinach, lettuce) by mid-century, while rising winter temperatures are expected to drive the continued northward expansion of agricultural pests and weeds (such as kudzu). This would further impede crop production and potentially pressure farmers to increase their herbicide and pesticide use.

IMPACTS ON FORESTS

Forests cover 37 percent of New Jersey, extending from the southern Pinelands to the hardwood forests in the north, which dazzle with colorful foliage each autumn. These maple/beech/birch forests face an uncertain future as conditions for their optimal habitat are projected to move north, and conditions become favorable for more southern species such as oak and hickory. The loss of habitat suitable to maple, beech, and birch trees is likely to occur under both emissions scenarios.

The southern part of New Jersey is dominated by the ecologically renowned Pinelands, which occupy 22 percent of the state's land area. Pitch pines and scrub oak thrive in the sandy, acidic, nutrient-poor soils, and blueberries and cranberries flourish in its bogs. These uncommon conditions have nourished a number of unique plant species and earned the Pinelands special status as the nation's first nature reserve. Under either emissions scenario, this area is likely to remain suitable habitat for pitch pines.



USDA/Keith Weller

New Jersey is among the top national producers of cranberries. This crop is particularly vulnerable under either scenario, but by mid-century under the higher-emissions scenario, it is unlikely that cranberries will meet the long winter-chill periods required for optimum flowering, fruit set, and seed development in New Jersey. Unlike other fruits, no known low-chill variety of cranberry exists.

WHAT WE CAN DO

Once the crossroads of the American Revolution, New Jersey is now at the center of another pivotal moment in our nation's history. 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 New Jersey's residents, ecosystems, and economies to those changes that are now unavoidable.

Here in New Jersey, and across 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 as a global leader in technology, policy, and innovation and a major source of heat-trapping emissions, New Jersey (and the rest of the Northeast) is well positioned to drive national and international action. In mid-2007, the state demonstrated it was determined to do so by enacting the most ambitious and far-reaching statewide emissions-reduction targets in the country. The Global Warming Solutions Act requires that emissions generated by every aspect of the state's economy, not just electric power plants, must be reduced to 1990 levels by 2020 and further reduced by 2050 to 80 percent below 2006 levels. Concerted, sustained reductions to achieve these targets can help pull global emissions below the lower-emissions scenario described here.

New Jersey and its municipal 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. As a participant in the Regional Greenhouse Gas Initiative (RGGI), New Jersey can reap substantial



New Jersey's Atlantic County Utilities Authority commissioned a five-turbine, 7.5 MW wind farm at its wastewater treatment plant in Atlantic City in 2005. Also featuring a 500 kW solar PV array, it became Atlantic City's most unlikely attraction during its first year of operation, when more than 4,000 visitors toured the site.

NJ Board of Public Utilities

energy-cost savings, promote economic development, and reduce emissions by auctioning 100 percent of the emissions credits created by the program and investing the proceeds in energy efficiency and renewable energy development. New Jersey leads the region with an important precedent contained in the Global Warming Solutions Act that requires the Board of Public Utilities to regulate emissions associated with all electricity sold in the state. This provision will help prevent an increase in heat-trapping emissions from electricity generators serving New Jersey but not included in RGGI.

Buildings. The federal Energy Star Buildings program and the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards are proven frameworks for substantially improving the energy efficiency of existing and new buildings.

These programs could be used to help achieve the substantial reductions in electricity and natural gas use that the Global Warming Solutions Act requires of the state's electric and gas utilities.

Transportation. Cars and trucks account for 50 percent of New Jersey's total carbon emissions. 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 transportation, incentives to purchase low-emissions vehicles, and incentives and regulations that promote "smart growth" strategies such as concentrating development in clusters. In addition, New



Jenn Kramer/PSE&G

New Jersey's largest electric and gas utility, PSE&G, will replace 1,300 vehicles with hybrids over the next decade. PSE&G estimates this will reduce CO₂ by more than 81,000 tons.

Jersey can adopt standards to reduce the carbon content of fuels.

Industries and large institutions can reduce emissions while lowering energy costs by improving the energy efficiency of their buildings and facilities, and by installing combined-heat-and-power systems and on-site renewable energy systems.

CONCLUSION

Global warming represents an enormous challenge, but the solutions are within reach if we act swiftly. The emissions choices we make today in New Jersey, the Northeast, and globally will shape the climate our children and grandchildren inherit. The time to act is now.

A Citizen's Guide to Reducing Emissions

1. **Become carbon-conscious.** The problem of global warming stems from a previous lack of awareness of our "carbon footprint" and its effect on climate. Individuals and families can start by using one of several publicly available carbon-footprint calculators that will help you understand which choices make the biggest difference.
2. **Drive change.** For most people, choosing a vehicle (and how much they should drive it) is the single biggest opportunity to slash personal carbon emissions. Each gallon of gas used is responsible for 25 pounds of heat-trapping emissions.
3. **Look for the Energy Star label.** When it comes time to replace household appliances, look for the Energy Star label on new models (refrigerators, freezers, furnaces, air conditioners, and water heaters use the most energy).
4. **Choose clean power.** Consumers in New Jersey can purchase electricity generated from renewable resources that produce no carbon emissions from your local utility. If your local utility does not offer a "green" option, consider purchasing renewable energy certificates.
5. **Unplug an underutilized freezer or refrigerator.** One of the quickest ways to reduce your global warming impact is to unplug a rarely used refrigerator or freezer. This can lower the typical family's CO₂ emissions nearly 10 percent.
6. **Get a home energy audit.** Take advantage of the free home energy audits offered by many utilities. Even simple measures (such as installing a programmable thermostat) can each reduce a typical family's CO₂ emissions about 5 percent.
7. **Lightbulbs matter.** If every U.S. household replaced one incandescent lightbulb with an energy-saving compact fluorescent lightbulb (CFL), we could reduce global warming pollution by more than 90 billion pounds over the life of the bulbs.
8. **Buy good wood.** When buying wood products, check for labels that indicate the source of the timber. Forests managed in a sustainable way are more likely to store carbon effectively—thus helping to slow global warming.
9. **Spread the word and help others.** A growing movement across the country seeks to reduce individual, family, business, and community emissions while inspiring and assisting others to do the same.
10. **Let policy makers know you are concerned about global warming.** Elected officials and candidates for public office at every level need to hear from citizens. Urge them to support policies and funding choices that will accelerate the shift to a low-emissions future.



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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.

