Maryland Climate Impacts and Costs

The climate crisis is accelerating in Maryland, posing increased risks and burdening residents with the costs of adapting to a rapidly changing environment. Maryland will experience sea level rise, extreme precipitation, intensified drought, and hotter temperatures in the coming years.[1] Even if fossil fuel emissions and atmospheric concentrations of greenhouse gasses eventually stabilize through climate action, the severity of these events will continue to rise as we adjust to the new reality of the climate crisis. Below we outline the impacts of climate change that Maryland faces and some of the potential costs associated with these impacts. This list is not exhaustive and other costs may be incurred as a result of additional climate change impacts.

Rising Sea Levels – Coastal Flooding and Erosion

Globally, sea levels are rising due to climate change,[2] as glaciers melt and ocean waters expand.[3] With almost 3,200 miles of coastline, Maryland residents are already feeling the effects of sea level rise, as Maryland has lost more than 25,000 acres of forest and about 3,500 acres of farmland to tidal marsh since 1984.[4] The rate of sea level rise in Maryland has more than doubled over the past 30 years, increasing from 2.3 mm/yr from 1993-2002 to 4.7 mm/yr from 2013-2022,[5] consistent with the global rate.[6] By 2050, the sea level along Maryland's coast is projected to be between ~1 and 1.6 feet (~12 and 20 inches) higher than it was in 2000 and by 2100, sea level could be up to 3.6 feet (43 inches) higher.[7] In the Chesapeake Bay, water levels have already risen over 1 foot and will rise another 1 to 5 feet over the next 100 years. The Chesapeake Bay is especially vulnerable to sea level rise and climate change because its wetlands also experience compaction and subsidence (shrinking and downward motion of the land surface), which increases the relative rate of sea level rise.[8]

Sea level rise poses many threats to Maryland, and it is important to note that the associated impacts will occur even if rising temperatures and greenhouse gas emissions are mitigated. One impact that is already costing communities millions is the increase in the number of days coastal cities in Maryland experience high tide flooding. In 2019, Annapolis, Maryland, experienced 18 days of high tide flooding, or an average of a flood every three weeks, which was the most days the city had experienced in a single year to date.[9] "Sunny day" high tide

[1] EPA, "What Climate Change Means for Maryland." https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-md.pdf
[2] Ekwurzel et al., "The Rise in Global Atmospheric CO2, Surface Temperature, and Sea Level from Emissions Traced to Major Carbon Producers." https://doi.org/10.1007/s10584-017-1978-0
[3] Miller et al., "A Geological Perspective on Sea-Level Rise and Its Impacts along the U.S. Mid-Atlantic Coast." https://onlinelibrary.wiley.com/doi/abs/10.1002/2013EF000135
[4] Boesch et al., "Sea-Level Rise Projections for Maryland." https://www.umces.edu/sites/default/files/Maryland%20Sea-Level%20Rise%20Projections%202023%20report.pdf
[5] ibid
[6] World Meteorological Organization and United Nations, "Provisional State of the Global Climate 2023." https://wmo.int/sites/default/files/2023-11/WMO%20Provisional%20State%20of%20the%20Global%20Climate%202023.pdf
[7] ibid
[8] Chesapeake Bay Program, "Climate Change." https://www.chesapeakebay.net/issues/threats-to-the-bay/climate-change
[9] Flavelle, "New Data Shows an 'Extraordinary' Rise in U.S. Coastal Flooding." https://www.nytimes.com/2020/07/14/climate/coastal-flooding-noaa.html

flooding is now the norm for Annapolis, often flooding the old City Dock in downtown.[10] The same year, Baltimore, Maryland, experienced 11 days of high tide flooding. Researchers at the University of Maryland predict that Baltimore will experience between 50-155 days of high tide flooding by 2050.[11] The National Atmospheric and Oceanic Administration states that high tide flooding (or nuisance flooding) is already three to nine times more frequent than it was just 50 years ago.[12] According to the Center for Climate Integrity, Maryland will face $27.4 billion in costs to build seawalls by 2040.[13] The report also states that "roads, rails, and other public infrastructure will be hit with unavoidable rising tides, unless state officials invest in mitigating infrastructure, such as seawalls."

Not only does sea level rise increase high tide flooding, it also increases the height of storm surges, leading to more costly storm recovery and more damage from associated high tide flooding.[14] More intense hurricanes that tend to stall over land and drop extreme amounts of rainfall have been occurring in recent years, which has been attributed to climate change.[15] Not only does an increase in the probability of a strong hurricane threaten Maryland communities, but sea level rise compounds the disastrous impacts. One study estimated the impact of a hurricane similar in size to Hurricane Isabel (2003) if it were to occur in 2050 and 2100.[16] The authors estimate that the area flooded by the storm surge would be about 30% greater in 2050 and about 50-60% greater in 2100 than when it occurred in 2003.[17]

Sea level rise also causes saltwater intrusion into ground and surface water, which threatens drinking water supplies.[18] Saltwater intrusion continues to push inland as sea levels rise, but episodic events like storms periodically bring saltwater even further inland. As the threat of saltwater intrusion continues to increase in Maryland, the Maryland Department of Planning has been tasked with creating an adaptation plan for the state.[19] Saltwater intrusion also impacts coastal farmlands. One study estimated that the impact of saltwater intrusion to coastal farmlands in the mid-Atlantic was between $39.4 million and $107.5 million annually.[20]

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[10] Corum, "A Sharp Increase In 'Sunny Day' Flooding."
https://www.nytimes.com/interactive/2016/09/04/science/global-warming-increases-nuisance-flooding.html
[11] "Sea Level Rise."
https://extension.umd.edu/programs/environment-natural-resources/program-areas/coastal-climate-program/sea-level-rise/
[12] Lindsey, "Climate Change."
https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level
[13] "Climate Costs in 2040: Maryland" https://climatecosts2040.org/files/state/MD.pdf
[14] ibid
[15] Zhang et al., "Attributing Intensification of Precipitation Extremes to Human Influence"; Reed, Wehner, and Zarzycki, "Attribution of 2020 Hurricane Season Extreme Rainfall to Human-Induced Climate Change"; Welch, "How Climate Change Likely Strengthened Recent Hurricanes."
https://onlinelibrary.wiley.com/doi/abs/10.1002/grl.51010; https://www.nature.com/articles/s41467-022-29379-1; https://www.nationalgeographic.com/science/article/hurricane-harvey-climate-change-global-warming-weather
[16] Li et al., "Assessing Storm Surge Impacts on Coastal Inundation Due to Climate Change."
https://link.springer.com/article/10.1007/s11069-020-04096-4
[17] ibid
[18] Maryland Department of Natural Resources, "Climate Change Impact Areas: Planning for Climate Change."
https://dnr.maryland.gov/climateresilience/Documents/ClimateChangeImpactAreas2.pdf
[19] Maryland Department of Planning, "Maryland's Plan to Adapt to Saltwater Intrusion and Salinization."
https://planning.maryland.gov/Documents/OurWork/envr-planning/2019-1212-Marylands-plan-to-adapt-to-saltwater-intrusion-and-salinization.pdf
[20] Mondal et al., "The Spread and Cost of Saltwater Intrusion in the US Mid-Atlantic."
https://www.nature.com/articles/s41893-023-01186-6

Potential Costs Related to Rising Sea Level

Structure and infrastructure projects

- Stabilize susceptible coastal slopes and cliffs and shorelines using grading techniques, planting vegetation, riprap or geotextile fabric, or bioengineering.
- Remove, relocate, acquire, or demolish structures to minimize future flood losses.
- Install, reroute, increase capacity, or implement a routine cleaning plan of the storm drainage system.
- Add extra culverts, increase dimensions of existing culverts, or implement routine cleaning and repairing to divert high-tide flood water.
- Install detention or retention basins, relief drains, spillways, drain widening/dredging or rerouting, green infrastructure, etc.[21]
- Inspect and maintain drainage systems and flood control structures (dams, levees, etc.).
- Elevate structures above the base flood elevation (BFE),[22] or relocate utilities, water heaters, etc. above BFE.
- Floodproof inside of municipal buildings, for example by installing check valves, sump pumps, or backflow prevention devices.
- Floodproof wastewater treatment facilities located in coastal areas.
- Floodproof water treatment facilities located in coastal areas.
- Protect emergency operations by requiring or moving all emergency operations centers, police stations, and fire department facilities outside of coastal, flood-prone areas.
- Protect critical and emergency facilities from floods using any other technique, for example, raising components above BFE, installing pumping systems or back-up generators for pumping, building dikes, or stabilizing banks.

Coastal protection

- Protect critical infrastructure using techniques like beach nourishment, jetties, and seawalls.
- Restore natural wetland areas.

Local planning and regulation

- Identify, map, and track coastal erosion and flood hazards.
- Develop and enforce a coastal zone management plan.
- Develop site and building standards.

Education and awareness programs

- Increase awareness by disclosing location of high-risk areas to current and future property owners; offer mitigation technique information.
- Locate new utilities and critical facilities outside of susceptible areas.

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[21] Giese et al., "Assessing Watershed-Scale Stormwater Green Infrastructure Response to Climate Change in Clarksburg, Maryland." https://ascelibrary.org/doi/full/10.1061/%28ASCE%29WR.1943-5452.0001099?casa_token=XUXNexpXVioAAAAA%3AhGupZ8-_DSW_LpmJeH70D1zfz1RD_rMKFl9a_vwxzycN0fgN22inasD2c39yMqyiAbBA__RYYpM

[22] Base flood elevation (BFE), as defined by FEMA, is "the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year."

- Identify, map, or track erosion hazard areas.
- Other education and awareness programs.

Summary of Costs from Sea Level Rise:

Implement flood management infrastructure and structure projects in coastal areas, install coastal protection, restore natural flood protection, develop and implement a comprehensive coastal zone management plan, and increase public awareness of sea level rise risks.

Extreme Precipitation and Flooding

Average annual precipitation in Maryland has been above the long-term average (1950-2014) since 1995 and the number of extreme precipitation events has also increased during this time period.[23] By the end of this century, the 100-year storm event[24] is expected to occur every 20 to 50 years, becoming at least twice as common due to climate change. Flash flooding is becoming the norm in Maryland. In 2018, just two years after a storm caused major flooding and damage in Ellicott City, the city experienced another disastrous storm, which led to flood waters up to 6 feet deep.[25] The storm in 2016 delivered between 5 and 8 inches of rain, while the storm in 2018 delivered between 6 and 15 inches of rain, depending on location. Both storms, which happened within two years of each other, were deemed one in 1,000 year events based on historical records.[26] In August 2023, a severe storm hit the northeast United States causing power outages and flooding in Maryland. The flood was so severe that it ripped up sidewalks and gutted local shops in Ellicott City.[27] This severe storm also impacted air travel, grounding hundreds of flights in the eastern U.S.[28] After another storm hit Maryland in January 2024, Baltimore and Annapolis experienced severe flooding. In Annapolis, large parts of downtown flooded from the storm, which was then made worse by high tide.[29] In Baltimore, the floodwaters were so high that cars were submerged.[30]

According to NOAA, there have been 44 billion dollar flooding events and 230 severe storms since the 1980's (inflation adjusted). The number of billion dollar floods has risen since the 80's, which had an average of 0.6 events per year, to 2.3 events per year in the last three years. Similarly, the number of billion dollar storms has risen since the 80's, which had an average of 1.4 events per year, to 16.0 events per year over the last three years. These billion dollar flooding events cost an average of $4.6 billion per event and severe storms cost an

[23] Kunkel, "State Climate Summaries for the United States 2022. NOAA Technical Report NESDIS 150."
[24] A 100-year storm event is a storm of such a great magnitude that is expected to occur only once every 100 years.
[25] Mele and Baumgaertner, "One Missing After Flash Flooding Rages Through Community Near Baltimore." https://www.nytimes.com/2018/05/27/us/ellicott-city-flooding-maryland.html
[26] Halverson, "The Second 1,000-Year Rainstorm in Two Years Engulfed Ellicott City. Here's How It Happened." https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/05/28/the-second-1000-year-rainstorm-in-two-years-engulfed-ellicott-city-heres-how-it-happened/
[27] Mele and Baumgaertner, "One Missing After Flash Flooding Rages Through Community Near Baltimore." https://www.nytimes.com/2018/05/27/us/ellicott-city-flooding-maryland.html
[28] Jiménez and Carballo, "Cleanup Begins After Severe Storms Tear Through Eastern U.S." https://www.nytimes.com/2023/08/08/us/us-severe-storms-damage.html
[29] Yoon, "East Coast Faces Flooding After Day of Rain." https://www.nytimes.com/2024/01/09/us/storm-east-coast-flooding.html
[30] Gillespie, "Flooding Affects Baltimore Area, January 9-10." https://www.baltimoresun.com/2024/01/09/flooding-affects-baltimore-area-january-9-2024-photos/

average of $2.4 billion per event.[31] A recent analysis by Swiss Re, a reinsurance company, found that severe storms in the U.S. incurred $34 billion in insured losses during the first half of 2023.[32]

Potential Costs Related to Extreme Precipitation and Flooding

Structure and Infrastructure Projects

- Remove, relocate, acquire, or demolish structures to minimize future flood losses.
- Install, reroute, increase capacity, or implement a routine cleaning plan of the storm drainage system.
- Add extra culverts, increase dimensions of existing culverts, or implement routine cleaning and repairing.
- Install detention or retention basins, relief drains, spillways, drain widening/dredging or rerouting, green infrastructure, etc.[33]
- Inspect and maintain drainage systems and flood control structures (dams, levees, etc.).
- Inspect bridges in order to identify and/or implement repairs or retrofits or clean under low bridges.
- Resurface roads with more permeable pavement and concrete.
- Elevate roads and bridges above the BFE to maintain dry access.
- Elevate structures above the BFE, or relocate utilities, water heaters, etc. above BFE.
- Floodproof inside of municipal buildings, for example by installing check valves, sump pumps, or backflow prevention devices.
- Floodproof wastewater treatment facilities located in flood hazard areas.
- Floodproof water treatment facilities located in flood hazard areas.
- Protect emergency operations by requiring or moving all emergency operations centers, police stations, and fire department facilities outside of flood-prone areas.
- Protect critical and emergency facilities by requiring all critical facilities be built one foot above the 500-year flood elevation (to meet requirements of FEMA Executive Order 11988).[34]
- Protect critical and emergency facilities from floods using any other technique, for example, raising components above BFE, installing pumping systems or back-up generators for pumping, building dikes, or stabilizing banks.
- Construct floodwalls, small berms, revetments, bioengineered bank stabilization, or other small structural mitigants.

Natural Flood Mitigation

- Protect and enhance natural floodplain mitigation features (such as wetlands, dunes, and vegetative buffers) to help prevent flooding in other areas.

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[31] National Atmospheric and Oceanic Administration (NOAA), "NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters," 2023. https://doi.org/10.25921/stkw-7w73.
[32] The Associated Press, "Surge in U.S. Thunderstorms"
[33] Giese et al., "Assessing Watershed-Scale Stormwater Green Infrastructure Response to Climate Change in Clarksburg, Maryland." https://ascelibrary.org/doi/full/10.1061/%28ASCE%29WR.1943-5452.0001099?casa_token=XUXNexpXVioAAAAA%3AhGupZ8-_DSW_LpmJeH70D1zfz1RD_rMKFl9a_vwxzycN0fgN22inasD2c39yMqyiAbBA__RYYpM
[34] Federal Emergency Management Agency, "Executive Order 11988: Floodplain Management," www.fema.gov/executive-order-11988-floodplain-management.

Local Planning and Regulation

- Update flood risk maps and flood zones.[35]
- Develop a floodplain management plan.
- Adopt a stormwater management or drainage plan.
- Adopt, apply, and enforce building codes to ensure buildings can withstand flooding.
- Obtain easements to use privately-owned land for temporary water retention and drainage.
- Join or improve compliance with the National Flood Insurance Program (NFIP).[36]
- Preserve floodplains as open space using any of several land use planning tools: develop a plan that targets hazard areas for acquisition, reuse, and preservation, a land banking program, use of transfer of development rights to keep floodplains vacant, easements to prevent development, or acquiring properties in the floodplain and turning them into open space.

Education and awareness programs

- Increase public outreach to encourage flood insurance purchase; educate residents in flood safety, flood mitigation, technical assistance availability, funding sources, and best practices.
- Locate new utilities and critical facilities outside of susceptible areas.
- Identify, map, or track erosion hazard areas.

Summary of Costs from Extreme Precipitation and Flooding

Floodproof buildings, relocate infrastructure in especially flood prone areas, improve drainage systems and flood control structures, elevate infrastructure (buildings, roads, and bridges) where needed, restore natural flood protection, develop and implement comprehensive flood management plans, preserve floodplains, and increase public awareness of flooding.

Intensified Drought

Despite increases in precipitation statewide, more severe droughts will also be a part of the future climate in Maryland, likely occurring in the summer and fall.[37] Earlier snowmelt and increased temperatures will increase evaporation and dry out soils.[38] Drought will decrease streamflow and groundwater levels, posing a risk to drinking water supplies. Drought also poses a risk of increased wildfires. Smoke from wildfires can decrease air quality far away from the source. This was seen in the summer of 2023, where Canadian wildfire smoke engulfed the United States, traveling all the way to Maryland.[39] The Environmental Protection Agency estimates the cost nationwide to treat long-term health impacts from exposures to

[35] Brett Sanders et al., "Large and Inequitable Flood Risks in Los Angeles, California," *Nature Sustainability* 6, no. 1 (2023): 47–57. https://doi.org/10.1038/s41893-022-00977-7.
[36] U.S. Federal Emergency Management Agency (FEMA), The National Flood Insurance Program (NFIP), at www.fema.gov/national-flood-insurance-program Policy Information by State (https://nfipservices.floodsmart.gov//reports-flood-insurance-data), accessed December 12, 2023; Maryland has over 63,000 active NFIP policy in place, which covers over $16 billion.
[37] Kunkel, "State Climate Summaries for the United States 2022. NOAA Technical Report NESDIS 150."
[38] EPA, "What Climate Change Means for Maryland."
[39] Jewell, "Wildfires — We Have Them in Maryland, Too."
https://www.commonsenseeasternshore.org/wildfires-we-have-them-in-maryland-too

wildfire and wildfire-generated air pollution is $450 billion.[40] The same analysis estimated that short-term exposure (2008-2012) led to premature death and hospitalizations totaling $63 billion.[41] While small in size, Maryland has an average of 5,000 wildfires per year according to the Maryland Department of Natural Resources.[42] Wildfires are also costly to fight and control. Fire suppression — which includes expenditure on aviation, vehicles, and fire crew — cost the U.S. $3.7 billion in 2022.[43]

Potential Costs Related to Intensified Drought

Water Management

- Protect drinking water supplies from low lake levels.
- Individual purchase of water during water scarce times.[44]
- Implement water conservation plans.[45]
- Treatment for victims of water-borne illnesses.[46]
- Replace old pipelines that have water leak issues.[47]
- Hire a climate scientist to recommend updates to water treatment, wastewater treatment, and other energy infrastructure using the best available science.[48]

Wildfires

- Increase fire suppression, including staffing and aviation.
- Rebuild or relocate damaged properties and public infrastructure, such as homes and utility lines.
- Relocate public infrastructure where necessary.
- Update power lines to withstand wildfires.
- Implement fire mitigation strategies for the future like burying utility lines underground.
- Plan for and disburse community aid after wildfires.
- Implement fire detection strategies, like solar-powered sensors.[49]
- Rehabilitate the landscape post-fire to reduce the risk of erosion and invasive species and mitigate future fire risk.

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[40] Fann et al., "The Health Impacts and Economic Value of Wildland Fire Episodes in the U.S." https://www.sciencedirect.com/science/article/abs/pii/S0048969717320223?via%3Dihub
[41] Fann et al.
[42] Jewell, "Wildfires — We Have Them in Maryland, Too." https://www.commonsenseeasternshore.org/wildfires-we-have-them-in-maryland-too
[43] Jennifer L, "Wildfires Cost Over $148B and 30% of Emissions," Carbon Credits, January 30, 2023. https://carboncredits.com/wildfires-cost-emissions/; Western Fire Chiefs Association, "What Is the Financial Cost of a Wildfire?," December 7, 2022. https://wfca.com/articles/cost-of-wildfires/.
[44] Zoë Roller et al., "Closing the Water Access Gap in the United States: A National Action Plan," Dig Deep and US Water Alliance, 2022. https://static1.squarespace.com/static/5e80f1a64ed7dc3408525fb9/t/6092ddcc499e1b6a6a07ba3a/1620237782228/Dig-Deep_Closing-the-Water-Access-Gap-in-the-United-States_DIGITAL_compressed.pdf.
[45] Maryland Department of Natural Resources, "Climate Change Impact Areas: Planning for Climate Change." https://dnr.maryland.gov/climateresilience/Documents/ClimateChangeImpactAreas2.pdf
[46] ibid
[47] CISA, "Drought and Infrastructure - A Planning Guide" https://www.cisa.gov/sites/default/files/publications/Drought_and_Infrastructure_A_Planning_Guide_508c.pdf
[48] ibid
[49] Jennifer L, "Wildfires Cost Over $148B" https://carboncredits.com/wildfires-cost-emissions/

- Increased hospitalization costs for asthma attacks and other chronic health conditions (resulting from decreased air quality due to wildfire smoke).

Education and awareness programs

- Increase public outreach to encourage wildfire risk management; educate residents in wildfire safety, technical assistance availability, funding sources, and best practices.

Summary of Costs from Extreme Drought:

Fire prevention and recovery, water security and water treatment, infrastructure damages, public health, and education and awareness.

Temperature Extremes

Maryland has warmed about 2.5°F since the start of the 20th century.[50] By 2070, temperatures in Maryland are predicted to increase by about 6°F relative to the average temperature from 1961-1990.[51] Further, days with extreme temperatures have increased from about 0.1% of days in the mid 1900's (1951-1980) to over 22% of days in 2019.[52] The U.S. Global Change Research Program reports that Maryland will experience more than 60 additional days above 90°F by 2050, as compared to the end of the 20th century.[53] Extreme heat during the summer (2000-2012) increased the risk of hospitalizations for asthma and heart attacks in Maryland.[54] In late June and early July of 2012, temperatures in Maryland were on average 9.5°F warmer than normal and a series of thunderstorms left mass power outages in the state. This led to 12 heat-related deaths in the state of Maryland[55] — a foreboding reality that will only become more common as climate change intensifies. In July 2023, the hottest month in recorded history, Baltimore declared a "code red" extreme heat alert[56] and at least one death was recorded in the state.[57] According to the Center for Climate Integrity, Maryland will face around $800 million in school cooling costs by 2025, impacting almost 900,000 students.[58]

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[50] Kunkel, "State Climate Summaries for the United States 2022. NOAA Technical Report NESDIS 150." https://statesummaries.ncics.org/chapter/md/#:~:text=By%20the%20end%20of%20the,degrees%20under%20the%20higher%20pathway.

[51] Bradley, Karmalkar, and Woods, "Climate Change State Profiles: Maryland." https://www.geo.umass.edu/climate/stateClimateReports/MD_ClimateReport_CSRC.pdf

[52] University of Maryland, "The Effects of Climate Change in Maryland." https://extension.umd.edu/resource/effects-climate-change-maryland

[53] Melillo, Richmond, and Yohe, "Climate Change Impacts in the United States: The Third National Climate Assessment." https://www.nrc.gov/docs/ML1412/ML14129A233.pdf

[54] Sapkota et al., "Maryland Climate and Health Profile Report"; Soneja et al., "Exposure to Extreme Heat and Precipitation Events Associated with Increased Risk of Hospitalization for Asthma in Maryland, U.S.A." https://health.maryland.gov/phpa/OEHFP/EH/Climate%20Change%20Binder/a1-CHPR-Full.pdf; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4847234/

[55] Fowler et al., "Heat-Related Deaths After an Extreme Heat Event — Four States, 2012, and United States, 1999–2009." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4604981/

[56] Russell, Nolan, and Jones, "Spared the Worst of Summer Until Now, the Northeast Joins a Nation Scorched." https://www.nytimes.com/2023/07/27/us/heat-weather-northeast-philadelphia-nyc.html

[57] Brown, "MD Health Officials Issue Heat Safety Reminders; Report Year's First Heat-Related Death." https://www.marylandmatters.org/2023/07/13/md-health-officials-issue-heat-safety-reminders-report-years-first-heat-related-death/

[58] Center for Climate Integrity, "Hotter Days, Higher Costs: The Cooling Crisis in America's Classrooms." Center for Climate Integrity, 2021. https://coolingcrisis.org.

Potential Costs Related to Temperature Extremes

Structure and Infrastructure Projects

- Energy efficiency retrofits in public and private buildings and housing, including costs for the design and development of standards.
- Increased cooling costs for all public buildings, including green roofs or cool roofing systems on public buildings and new AC installation or upgrade costs for schools.
- Increased road damage due to more frequent extreme heat events.
- Plan for and increase capacity for increased energy demands due to both increased daytime and nighttime temperature.
- Increase high-albedo surfaces on buildings, roads and/or pavements, or where else feasible.

Public Health Projects

- Build and manage more cooling centers, including staffing and tracking of high-risk individuals.
- Increased demand for publicly financed air conditioning targeted to low income families and public housing.
- Control the increase of vector borne illness — education and physical and chemical controls for ticks and mosquitos.
- Treat victims of vector borne illness.
- Increase in asthma attacks requiring hospitalization (resulting from increased heat and ground level ozone, and the increase in airborne allergens).
- Reduce the urban heat island effect by planting trees.
- Protect drinking water supplies from hazardous algae blooms.

Summary of Costs from Increased Temperatures:

Public health costs (e.g., medicare/medicaid), AC installation and improvement where needed, establishing new cooling centers, planting trees to reduce urban heat islands, and protecting drinking water supplies.

Other Extreme Weather

Other extreme weather events include: tropical storms, severe thunderstorms, tornadoes, and extreme winter weather.[59]

Potential Costs Related to other Extreme Weather

Structure and infrastructure projects

- Increased costs of storm recovery and clean-up.
- Protect power lines through pruning trees.
- Bury overhead power lines or install systems that allow small sections of power lines to fail rather than the complete system.

[59] Kunkel, "State Climate Summaries for the United States 2022. NOAA Technical Report NESDIS 150."

Other Public Health Costs

Other plausible impacts from climate change that would incur public health costs are increased allergen levels, food- and waterborne infections, and zoonotic diseases.[60] Increased *Salmonellosis* risk during extreme temperature and precipitation events has been documented in Maryland and will incur public health costs as the climate crisis worsens. This risk disproportionately impacts coastal communities in Maryland.[61]

[60] Carmen Milanes et al., "Indicators of Climate Change"
[61] Jiang et al., "Climate Change, Extreme Events and Increased Risk of Salmonellosis in Maryland, USA." https://www.sciencedirect.com/science/article/pii/S0160412015001361