Illinois Climate Impacts and Costs

Climate change poses many costly risks to Illinois residents, including an increase in precipitation and severe storms, hotter temperatures, and intensified drought.[1] Even if fossil fuel emissions and atmospheric concentrations of greenhouse gasses eventually stabilize through aggressive 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 Illinois 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.

Increased Precipitation, Severe Storms, and Flooding

Because a warmer atmosphere can hold more water vapor, climate change increases precipitation in many areas, including Illinois (Table 1).[2] Average annual precipitation in Illinois has increased by 12-15% and extreme precipitation events (days with more than 2 inches of precipitation) have increased by 40% since the beginning of the 20th century,[3] resulting in more frequent flooding. In August 2022, southeastern and central Illinois were hit with an extreme rain event that brought more rain in 36 hours than the average rainfall for the entire month of August.[4] The rain event caused flash flooding and damaged crops.[5] The City of Chicago has also been increasingly dealing with flooding due to increased lake levels and heavy precipitation events.[6] On July 2, 2023, over 9 inches of rain fell on parts of Chicago, where the average precipitation for the entire month of July is 3.7 inches. This rain event led to over 1,400 flooded homes.[7]

As storm events continue to intensify due to climate change — especially hourly rainfall accumulation[8] — stormwater infrastructure will be overwhelmed, causing even more extreme flooding. According to NOAA, billion-dollar flood events cost an average of $4.6 billion per event and billion-dollar storms cost an average of $2.4 billion per event.[9] Flood losses have cost around $260 million annually since the 1980's in Illinois, which is among the highest in the United States.[10] A recent analysis by Swiss Re, a reinsurance company, found that severe storms in the U.S. incurred $60 billion in insured losses during 2023 — a record

[1] EPA, "What Climate Change Means for Illinois," 2016, https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-il.pdf.
[2] Sillmann et al., "Climate Extremes Indices in the CMIP5 Multimodel Ensemble." https://onlinelibrary.wiley.com/doi/abs/10.1002/jgrd.50188
[3] Illinois State Climatologist, "Climate Change in Illinois," Illinois State Climatologist, accessed July 2, 2024, https://stateclimatologist.web.illinois.edu/climate-change-in-illinois/.
[4] Amanda Holpuch, "3 Downpours in 8 Days: How Extreme Rain Soaked the Midwest," *The New York Times*, August 5, 2022, sec. U.S., https://www.nytimes.com/2022/08/05/us/kentucky-missouri-illinois-rain-flooding.html.
[5] Ibid.
[6] Dan Egan, "A Battle Between a Great City and a Great Lake," *The New York Times*, July 8, 2021, sec. Climate, https://www.nytimes.com/interactive/2021/07/07/climate/chicago-river-lake-michigan.html.
[7] "Record July Rainfall Prompts Overflow Action - Blog - Friends of the Chicago River," Friends of the Chicago River, accessed July 3, 2024, https://www.chicagoriver.org/blog/2023/7/record-july-rainfall-prompts-overflow-action.
[8] Ham et al., "Anthropogenic Fingerprints in Daily Precipitation Revealed by Deep Learning." https://www.nature.com/articles/s41586-023-06474-x
[9] 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.
[10] "Climate of Illinois," Illinois State Climatologist, accessed July 2, 2024, https://stateclimatologist.web.illinois.edu/climate-of-illinois/.

high.[11] Another recent analysis found that homeowner insurance companies lost money in Illinois in 2023, due mostly to damage from severe storms. This has led the insurance companies, Pekin and Secura Insurance, to pause writing homeowners insurance policies and dropping customers in Illinois, respectively.[12]

Table 1: Increases in average precipitation (inches) from 1971-2021 in Illinois.[13]

Statistic	Annual	Winter	Spring	Summer	Fall
Precipitation	5.7	1.3	2.4	2.2	-0.1
Extreme Precipitation (days above 2 inches)	1.5 days	NA	NA	NA	NA

Flooding also increases the amount of polluted runoff and sewage overflowing into streams, rivers, and lakes. The City of Chicago has a combined sewer overflow (CSO) system, in which untreated, combined sewage flows into local waterways when the capacity of the system is overwhelmed by heavy precipitation.[14] According to the Metropolitan Water Reclamation District, sewer water overflows can happen in some locations in Chicago when just 0.3 inches of rain falls.[15]

Increased nutrient load to lakes across Illinois can cause harmful algal blooms (HABs) and pollute beaches, increasing public health risks. Warmer waters and changes to both regional precipitation patterns and timing can increase the risk of HABs. In 2021, over a dozen bodies of water across Illinois had toxic levels of algae.[16] HABs cause many health impacts to humans and their pets, such as: asthma-like symptoms, stomach pain, vomiting, rashes, and more.[17] Further, HABs deplete oxygen in the water, killing fish and creating economic impacts to fishing and other recreational industries.[18] The Environmental Working Group found that one city in Illinois spent $380,000 to prevent and treat HABs from 2010-2020.[19]

[11] "Insured Losses from Severe Thunderstorms Reach New All-Time High of USD 60 Billion in 2023, Swiss Re Institute Estimates," *Swiss Re*, December 7, 2023, https://www.swissre.com/press-release/Insured-losses-from-severe-thunderstorms-reach-new-all-time-high-of-USD-60-billion-in-2023-Swiss-Re-Institute-estimates/4a15acf7-64b4-4766-8662-1c35d268ab12.
[12] Christopher Flavelle and Mira Rojanasakul, "As Insurers Around the U.S. Bleed Cash From Climate Shocks, Homeowners Lose," *The New York Times*, May 14, 2024, sec. Climate, https://www.nytimes.com/interactive/2024/05/13/climate/insurance-homes-climate-change-weather.html.
[13] Kristen Giesting et al., "Climate Change Impacts on Illinois Agriculture" (United States Department of Agriculture Climate Hubs and Great Lakes Research Integrated Science Assessment, October 1, 2022), https://doi.org/10.32747/2022.7956964.ch.
[14] "CSO - Combined Sewer Overflows," City of Chicago, accessed July 3, 2024, https://www.chicago.gov/content/city/en/depts/water/provdrs/engineer/svcs/Combined_Sewer_Overflows.html.
[15] "Record July Rainfall Prompts Overflow Action - Blog - Friends of the Chicago River."
[16] Morgan Greene, "The Rise of Algae Blooms: This Year, More than a Dozen of the Water Bodies Sampled in Illinois Had Toxin Levels above Recreation Standard," *Chicago Tribune*, November 18, 2021, https://www.chicagotribune.com/2021/11/18/the-rise-of-algae-blooms-this-year-more-than-a-dozen-of-the-water-bodies-sampled-in-illinois-had-toxin-levels-above-recreation-standards/.
[17] "Algal Blooms." https://www.niehs.nih.gov/health/topics/agents/algal-blooms/index.cfm
[18] Ibid.
[19] "The High Cost of Algae Blooms in U.S. Waters," August 26, 2020, https://www.ewg.org/research/high-cost-of-algae-blooms.

In addition to flooding, severe storms often bring intense winds and sometimes tornadoes. Though more work is needed to understand the full impacts of climate change on tornadoes, recent research suggests an increased risk and occurrence of tornadoes throughout this century. This is due to the climate impacting hazardous convective weather, or the conditions that form tornadoes.[20] According to NOAA, Illinois experienced 118 tornadoes in 2023, more than any other state in the U.S.[21] While there has been an increase in the number of tornadoes in Illinois since the 1950s,[22] scientists cannot yet link the trend to a changing climate.[23] According to the National Weather Service and National Centers for Environmental Information, tornadoes cost $2.5 million per event.[24]

The Chicagoland area is situated on Lake Michigan, which plays a large role in regional precipitation patterns, especially lake effect snow.[25] Temperatures are rising the fastest in the winter months, which means winter precipitation is more likely to fall as rain or freezing rain, increasing winter flooding.[26] Even though winters are becoming increasingly warm, winter storms and freezes are simultaneously intensifying when they do occur, which some scientists attribute to a warming Arctic weakening the jet stream, though competing ideas still exist in the scientific community.[27] Warming temperatures also mean that the lakes have more open water in winter, potentially adding fuel in the form of water vapor to winter "lake effect" snow storms. In January 2024, a severe winter storm left over 70,000 Illinois residents without power, led to widespread transit delays, canceled flights, and school closures.[28] Severe winter storms often cost more than $1 million dollars per event and storm size and intensity have increased since the 1950's.[29]

Potential Costs Related to Increased Precipitation, Severe Storms, 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.

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[20] Tippett et al., "Climate and Hazardous Convective Weather"; Strader et al., "Projected 21st Century Changes in Tornado Exposure, Risk, and Disaster Potential." https://doi.org/10.1007/s40641-015-0006-6; https://doi.org/10.1007/s10584-017-1905-4
[21] Avani Kalra, "Warmer Winters and a Hotter Gulf of Mexico Could Be Contributing to More Tornadoes in Illinois, Experts Say," *Chicago Tribune*, April 13, 2024, https://www.chicagotribune.com/2024/04/13/illinois-tornadoes/.
[22] "Tornado Trends in Illinois," State Climatologist Office for Illinois, accessed July 8, 2024, https://www.isws.illinois.edu/statecli/climate-change/il-tornado.htm.
[23] Phyllis Cha, "Illinois Saw the Most Tornadoes in the U.S. in 2023, National Weather Service Says," *Chicago Sun-Times*, January 17, 2024, sec. News, https://chicago.suntimes.com/news/2024/1/16/24040771/illinois-most-tornadoes-of-any-state-in-2023-120.
[24] Hurst, "Tornadoes Caused $2.5 Million in Damage Per Storm Across U.S. in Past Decade." https://www.valuepenguin.com/damage-caused-by-tornadoes
[25] Scott and Huff, "Impacts of the Great Lakes on Regional Climate Conditions." https://www.sciencedirect.com/science/article/pii/S0380133096710067
[26] "Climate Change and Chicago Winters," Northwestern University, accessed July 3, 2024, https://www.northwestern.edu/sustainability/news/2022/climate-change-and-chicago-winters.html.
[27] Fountain, "A 'Once in a Generation' Storm. What's the Role of Climate Change?" https://www.nytimes.com/2022/12/28/climate/storm-buffalo-climate-change.html
[28] Patty Wetli, "Snow Blankets Chicago Area With Half a Foot in Some Places; Round Two Now Expected Overnight," *WTTW News*, January 12, 2024, https://news.wttw.com/2024/01/12/snow-blankets-chicago-friday-morning-and-just-round-one.
[29] Changnon, "Catastrophic Winter Storms." https://doi.org/10.1007/s10584-007-9289-5

- 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, etc.
- 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 base flood elevation (BFE)[30] 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).[31]
- 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.
- Implement severe storm strategies for the future like burying utility lines underground.

Natural Flood Mitigation

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

Public Health

- Protect public water supplies from harmful algal blooms.
- Increased hospitalizations related to water-borne illness.

Local Planning and Regulation

- Update flood risk maps and flood zones.
- Develop a floodplain management plan.
- Adopt a stormwater management or drainage plan.
- Adopt, apply, and enforce building codes to ensure buildings can withstand flooding.

[30] 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."
[31] Federal Emergency Management Agency, "Executive Order 11988: Floodplain Management," www.fema.gov/executive-order-11988-floodplain-management.

- Obtain easements to use privately-owned land for temporary water retention and drainage.
- Join or improve compliance with the National Flood Insurance Program (NFIP) if needed.[32]
- 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.
- Increase public outreach to provide awareness of harmful algal blooms and their health impacts.
- Locate new utilities and critical facilities outside of susceptible areas.

Summary of Costs from Increased Precipitation, Severe Storms, 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, increase public awareness of flooding and HABs.

Hotter Temperatures

By 2100, the average temperature in Illinois is predicted to increase by up to 9°F under a moderate climate scenario (RCP4.5). The average daily temperature has already increased by 1-2°F in most areas of the state and the average nighttime temperature has increased by more than 3°F over the last 120 years.[33] A recent report found that from May 2023-May 2024, Illinois experienced 7.6 more days of temperatures above the 90th percentile temperature for the period of 1991-2020.[34]

It is expected that Illinois will experience an average of 42 days per year with temperatures above 92°F by 2050,[35] which will increase the need for air conditioning in schools and public

[32] 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 May 31, 2024; Illinois has over $7 billion in total coverage and over 30,000 policies, but local governments should make sure they comply.
[33] Donald Wuebbles et al., "An Assessment of the Impacts of Climate Change in Illinois" (The Nature Conservancy, Illinois, 2021), https://www.nature.org/content/dam/tnc/nature/en/documents/IL_Climate_Assessment_2021.pdf.
[34] Julie Arrighi et al., "Climate Change and the Escalation of Global Extreme Heat: Assessing and Addressing the Risks" (Climate Central, May 28, 2024), https://assets.ctfassets.net/cxgxgstp8r5d/5sjPWtBWuPk56xVZKuuL3g/710d0a89e6eb859b1dc0417cb718dea8/Climate_Central_Climate_Change_and_the_Escalation_of_Global_Extreme_Heat.pdf.
[35] "Top Illinois Climate Change Risks: Precipitation, Heat, Drought," ClimateCheck, accessed July 2, 2024, https://climatecheck.com/illinois.

buildings.[36] In August 2023, after a record-breaking summer of heat, some schools in the Chicagoland area were forced to postpone the first day of classes due to inadequate air conditioning.[37] The Center for Climate Integrity estimates Illinois will need to spend $6.1 billion by 2025 to install air conditioning in schools where it was not needed in 1970. These hotter temperatures will impact about 1.8 million students.[38]

Warmer temperatures will also change the composition of forests and decrease agricultural yields of corn, soybeans, and other crops. For example, without winter freezes,[39] crops and other plants are more vulnerable to pests, less productive, and bloom too early.[40] Further, some varieties of fruits, nuts, and vegetables will no longer be able to thrive in Illinois, as plant zones shift northward.[41] Heat stress caused by climate change is likely to reduce corn yields by 23-34%[42] in Illinois by mid-century.[43] Illinois will also experience a longer growing season, which also has negative impacts to agriculture like an increase in the risk of a late season freeze and a greater risk of pests, diseases, and weeds.[44]

Warmer temperatures will also increase ground level ozone, increase heat-related illness, and increase vector-borne illness.[45] Lyme disease is the fastest-growing vector-borne disease in the United States and, according to the Centers for Disease Control and Prevention, cases are increasing in Illinois.[46]

Table 2: Increases in average temperature (°F) from 1990-2019 relative to 1895-1924 in Illinois.[47]

Temperature Statistic	Winter	Spring	Summer	Fall
Overnight Minimum Temperature	3.0	1.8	1.7	1.3
Average Daily Temperature	2.5	1.6	0.5	0.8
Daytime Maximum Temperature	2.2	1.4	-0.7	0.4

[36] Sverre LeRoy, Megan Matthews, and Richard Wiles, "Hotter Days, Higher Costs: The Cooling Crisis in America's Classrooms" (Center for Climate Integrity, 2021).
[37] Glenn Marshall and Julian Crews, "Extreme Heat Causing Some Chicago Area School Districts to Make Adjustments," *WGN-TV*, August 22, 2023, https://wgntv.com/news/chicago-news/excessive-heat-causing-some-chicago-area-school-districts-to-make-adjustments/.
[38] Sverre LeRoy, "Illinois - Hotter Days, Higher Costs: The Cooling Crisis in America's Classrooms" (The Center for Climate Integrity, 2021), https://coolingcrisis.org/uploads/media/CCI-StateReport-Illinois.pdf.
[39] Ocko, "5 Reasons Why Your Warmer Winter Is so Alarming." https://www.edf.org/blog/2020/02/12/5-reasons-why-your-warmer-winter-so-alarming
[40] "Leaves Emerging Earlier." https://www.climatecentral.org/climate-matters/leaves-emerging-earlier
[41] Giesting et al., "Climate Change Impacts on Illinois Agriculture."
[42] Ibid.
[43] Wuebbles et al., "An Assessment of the Impacts of Climate Change in Illinois."
[44] Giesting et al., "Climate Change Impacts on Illinois Agriculture."
[45] "Climate and Health Overview." https://www.michigan.gov/mdhhs/safety-injury-prev/environmental-health/topics/climate/overview
[46] Illinois Lyme Association, "Lyme Overview," Illinois Lyme Association, accessed July 1, 2024, https://www.illymeassociation.org/lyme-overview.
[47] Wuebbles et al., "An Assessment of the Impacts of Climate Change in Illinois."

Temperatures are increasing the most in the winter (Table 2), posing many challenges for Illinois. The Great Lakes are also expected to warm 3-7°F by mid-century.[48] According to the Environmental Protection Agency, winter ice coverage on the Great Lakes has decreased by 63% due to warmer air and water temperatures,[49] causing huge fluctuations in water level and subsequent erosion and flooding.[50] Declining ice coverage and warmer waters also pose both ecological and recreational threats. In February 2024, ice cover on Lake Michigan was at a record low.[51]

The water level in the Great Lakes has been increasing and lake level fluctuations up to 2 meters have occurred.[52] Until about 2016, the Great Lakes experienced decreased water levels due to increased evaporation of the warmer waters.[53] More recently, lake levels have been rising. Lake Michigan water level is the highest it has been since the 1980's.[54] By 2040, lake levels in the Great Lakes are projected to rise up to another 0.4 meters, as over-lake precipitation and basin run-off increase due to climate change.[55] Increased wind and wave action in the Great Lakes also causes coastal flooding.[56] Fluctuating lake levels impact shipping, ecosystem assemblages, coastal infrastructure, hydropower, and recreation.

Harmful algal blooms (HABs) are also caused by warmer temperatures, so the impacts related to HABs in the "Increased Precipitation, Severe Storms, and Flooding" section above apply here too. It is important to note that warmer temperatures or increased runoff can cause HABs (in other words, both conditions do not need to be present for a HAB to occur), but if both conditions are present HABs may become more likely.

Potential Costs Related to Hotter Temperatures

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.
- Plant and maintain trees to reduce the urban heat island effect.
- Increase high-albedo surfaces on buildings, roads, and other locations where feasible.
- Increased costs of dredging during times of lower lake levels.

[48] EPA, "What Climate Change Means for Illinois."
[49] "What Climate Change Means for Michigan."
[50] Justin Kaufmann and Andrew Freedman, "Lake Michigan Ice Cover at Record Low," *Axios Chicago*, February 16, 2024, https://www.axios.com/local/chicago/2024/02/16/lake-michigan-ice-cover-warm-weather.
[51] Ibid.
[52] "Future Rise of the Great Lakes Water Levels Under Climate Change | Great Lakes Research Center | Michigan Tech." https://www.mtu.edu/greatlakes/research-highlights/climate-change-great-lakes/
[53] US EPA, "Climate Change Indicators." https://www.epa.gov/climate-indicators/great-lakes
[54] "State Climate Summaries: Michigan."
[55] Kayastha et al., "Future Rise of the Great Lakes Water Levels under Climate Change." https://linkinghub.elsevier.com/retrieve/pii/S0022169422007788
[56] Changnon, "Changes in Climate and Levels of Lake Michigan"; Hartmann, "Climate Change Impacts on Laurentian Great Lakes Levels." https://doi.org/10.1007/BF01091616

- Update piers and other coastal infrastructure to accommodate fluctuating water levels.

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 using education and physical and chemical controls for ticks and mosquitoes.
- Treat victims of vector borne illness.
- Treat an 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 Hotter Temperatures:

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

Intensified Drought

Despite increases in average precipitation, summer droughts are predicted to intensify.[57] Increased summer droughts threaten crop yields. Summer droughts will also impact water availability and the flow of large rivers, like the Mississippi River.[58] A severe drought has impacted barge transportation on the Mississippi River since 2021.[59] The drought cost the U.S. around $20 billion in lost economic output due to delays in shipping.[60] Droughts will also likely increase wildfire occurrences in Illinois' forests.[61] Not only does drought pose local wildfire risk, increased temperatures and drought are exacerbating wildfires in Canada.[62] The smoke from these wildfires has made it to Chicago the past two years, posing health risk to residents.[63]

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[57] EPA, "What Climate Change Means for Illinois."
[58] Ibid.
[59] Ryan Hanrahan, "Drought Ends Along Mississippi River, For Now," *Farm Policy News* (blog), March 5, 2024, https://farmpolicynews.illinois.edu/2024/03/drought-ends-along-mississippi-river-for-now/.
[60] Michael Rudolph, "Mississippi River Shipping Faces Potential Crisis for Third Straight Year," *FreightWaves*, March 29, 2024, sec. American Shipper, https://www.freightwaves.com/news/mississippi-river-shipping-faces-potential-crisis-for-third-straight-year.
[61] "Forests," Illinois Department of Natural Resources, accessed July 3, 2024, https://dnr.illinois.gov/outreach/climate-action-plan/climate-change-impacts/forests.html.
[62] James MacCarthy et al., "Canada's Record-Breaking 2023 Wildfires Released Nearly 4 Times More Carbon than Global Aviation," June 27, 2024, https://www.wri.org/insights/canada-wildfire-emissions.
[63] Todd Richmond, "Chicago Air Quality: Canadian Wildfire Smoke Chokes Upper Midwest," *Associated Press*, May 13, 2024, https://www.fox32chicago.com/news/chicago-air-quality-canadian-wildfire-smoke-chokes-upper-midwest; John Lippert, "Canadian Wildfires Could Change How Midwest Handles Pollution," *Chicago Tribune*, November 12, 2023,

Potential Costs Related to Intensified Drought

Water Management

- Protect drinking water supplies from low lake levels.
- Individual purchase of water during water scarce times.[64]
- Treatment for victims of water-borne illnesses.[65]
- Replace old pipelines that have water leak issues.[66]
- Hire a climate scientist to recommend updates to water treatment, wastewater treatment, and other energy infrastructure using the best available science.[67]

Navigation

- Delays to shipping from low water levels on the Mississippi River.
- Increased barge rates for shipping.[68]

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.[69]
- Rehabilitate the landscape post-fire to reduce the risk of erosion and invasive species and mitigate future fire risk.
- 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.

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https://www.chicagotribune.com/2023/11/12/midwest-pollution-spiked-dramatically-this-summer-because-of-canadian-wildfires-now-officials-may-erase-those-days-from-the-books/.

[64] 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.

[65] Ibid.

[66] CISA, "Drought and Infrastructure - A Planning Guide" https://www.cisa.gov/sites/default/files/publications/Drought_and_Infrastructure_A_Planning_Guide_508c.pdf

[67] Ibid.

[68] Daniel Munch, "Low Mississippi River Levels Drive up Grain Transportation Costs," *American Farm Bureau Federation*, September 28, 2023, https://www.fb.org/market-intel/low-mississippi-river-levels-drive-up-grain-transportation-costs.

[69] Jennifer L, "Wildfires Cost Over $148B" https://carboncredits.com/wildfires-cost-emissions/

Summary of Costs from Intensified Drought:

Fire prevention and recovery, water security and water treatment, infrastructure damages, delays to shipping, increased barge rates, public health, and education and awareness.

Other Potential Costs

Other plausible impacts from climate change that would incur public health costs are increased allergen levels, food- and water-borne infections, and zoonotic diseases.[70] Since Illinois' climate is historically moderate, Illinois is also likely to see an influx of climate refugees, which will incur costs as they plan for and accommodate more residents.[71]

[70] Carmen Milanes et al., "Indicators of Climate Change"
[71] Freedman, "The Great Lakes Region Could Be a Haven for Climate Migrants. Some Are Already Here. https://www.crainsdetroit.com/crains-forum/climate-change-extreme-weather-spur-migration-great-lakes