

# Environmental challenges and climate change

## Introduction

Climate change presents a critical challenge that affects every country worldwide, but the situation is particularly severe in the United States due to its significant contributions and influence. Human activities, especially the burning of fossil fuels and large-scale agricultural practices, are the primary drivers of greenhouse gas emissions, which in turn exacerbate climate change. This issue often fuels political polarization, making it challenging to enact legislation that effectively addresses the underlying causes. In recent decades, the effects of climate change have intensified, leading to increased instances of wildfires and extreme weather patterns that disproportionately impact vulnerable populations, including ethnic minorities and low-income communities. Despite representing only 4% of the world's population, the U.S. has been responsible for a staggering 25% of global greenhouse gas emissions since 1850, underscoring the urgency of addressing this crisis both domestically and globally.<sup>1</sup>

The United States was impacted by 27 billion-dollar weather and climate disasters in 2024, exacting an extraordinary human and economic toll. These events included 17 severe storm events, five tropical cyclones, two winter storms, one wildfire event, one flood, and one drought. These disasters resulted in an estimated 568 deaths and \$182.7 billion in damages. The number of billion-dollar disasters in 2024 (27 events), 2023 (28 events), 2022 (18 events), and 2021 (20 events) was all far above the long-term average of around nine billion-dollar disasters per year since 1980.<sup>2</sup>

## Impacts of climate change in the United States

### Regional Effects

Climate change is bringing different types of challenges to each region of the country. According to NASA report<sup>3</sup>, some of the current and future impacts are summarized below. These findings are from the Third and Fourth National Climate Assessment Reports, released by the U.S. Global Change Research Program.

**Northeast:** Heat waves, heavy downpours, and sea level rise pose increasing challenges to many aspects of life in the Northeast. Infrastructure, agriculture, fisheries, and ecosystems will be increasingly compromised. Farmers can explore new crop options, but these adaptations are not cost- or risk-free. Moreover, adaptive capacity, which varies throughout the region, could be overwhelmed by a changing climate. Many states and cities are beginning to incorporate climate change into their planning.

**Northwest:** Changes in the timing of peak flows in rivers and streams are reducing water supplies and worsening competing demands for water. Sea level rise, erosion, flooding, risks to infrastructure, and increasing ocean acidity pose major threats. Increasing wildfire incidence and severity, heat waves, insect outbreaks, and tree diseases are causing widespread forest die-off.

**Southeast:** Sea level rise poses widespread and continuing threats to the region's economy and environment. Extreme heat will affect health, energy, agriculture, and more. Decreased water

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<sup>1</sup> Hannah Ritchie, "Who Has Contributed Most to Global CO<sub>2</sub> Emissions?" Our World in Data, October 1, 2019, <https://ourworldindata.org/contributed-most-global-co2>.

<sup>2</sup> <https://www.climatecentral.org/climate-matters/2024-global-and-us-review>

<sup>3</sup> <https://science.nasa.gov/climate-change/effects/>

availability will have economic and environmental impacts.

Midwest: Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also worsen a range of risks to the Great Lakes.

Southwest: Climate change has caused increased heat, drought, and insect outbreaks. In turn, these changes have made wildfires more numerous and severe. The warming climate has also caused a decline in water supplies, reduced agricultural yields, and triggered heat-related health impacts in cities. In coastal areas, flooding and erosion are additional concerns.

### **Social Consequence**

Climate change negatively affects all people in the United States in multiple ways. People all across the globe are negatively impacted by the climate crisis in some way.<sup>35</sup> However, geographically, climate change impacts developing countries and coastal regions the most. This is mostly because these countries have limited access to resources, and those living there are often unable to relocate in the case of disaster.

In the United States, people living near the coast are more impacted by climate change because sea-level rise forces them to relocate, and more intense hurricanes destroy people's homes.<sup>36</sup> In addition to the negative impacts experienced along the coast, people living in the western United States are more vulnerable to increased drought and fires due to climate change.<sup>37</sup> In the eastern half of the United States, flooding from heavy rains is a more serious problem.

In the United States, certain groups of people are more vulnerable to the impacts of climate change. People living in areas hit by natural disasters with family members nearby are more likely to evacuate than those who do not, while low-income, minority households and households with disabled or elderly people do not have the resources to evacuate. Poorer individuals are more likely to be negatively impacted by climate change for several reasons. They often have access to fewer resources to help them recuperate after climate disasters. Their livelihoods are more likely to be based on climate-dependent jobs, such as in the agricultural or fishing sectors, or they may not be protected from climate-related work disruption. In addition to those who are poor, children are also among the most vulnerable groups. They are especially prone to experience the mental consequences of climate change, such as fear, anxiety, depression, or even PTSD. One study found that around 82% of children in the United States experienced "strong feelings of fear, sadness, and anger" when discussing environmental problems.

### **Distributive Justice**

Social consequences such as distributive justice and mental health issues are a result of climate change because of historic prejudices and a lack of resources available for people impacted by climate change. No matter the consequence, the impacts of climate change have the tendency to disproportionately affect certain groups over others.<sup>4</sup> Those who are already most vulnerable include the poor, elderly, young, or otherwise marginalized.<sup>5</sup> The reason for this, as has been discussed throughout this brief, is that these socially vulnerable people often live in areas that don't

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<sup>4</sup> Alexander J. Hilert, "Counseling in the Anthropocene: Addressing Social Justice Amid Climate Change," *Journal of Multicultural Counseling and Development* 49, no. 3 (2021): 175–191, <https://doi.org/10.1002/jmcd.12223>.

<sup>5</sup> Alice Venn, "Ch. 24 - Social Justice and Climate Change," in *Managing Global Warming*, ed. Trevor M. Letcher (Academic Press, 2019), 711–728, <https://doi.org/10.1016/B978-0-12-814104-5.00024-7>

have the infrastructure to resist damage from natural disasters and climate change. Facilities that burn fossil fuels are more likely to be built in low-income African American or Latin neighborhoods because these people often did not have a voice in the local politics to say no.<sup>6,7</sup> For example, communities where the majority of residents were people of color tended to experience 40% greater exposure to industrial cancer-causing air pollution than predominantly white communities, according to one study. Furthermore, climate change could increase poverty levels to nearly 30% in the coming decades and facilitate a decline in estimated life spans.<sup>8</sup>

## **Mental Health**

There are also many mental health consequences associated with climate change. In the United States, nearly 60% of Americans are concerned or overwhelmed by the looming presence of climate change.<sup>9</sup> There is a growing sense of impending doom that is afflicting people across the country, especially among young adults. This is likely because the younger generation is the group that has been left with the responsibility of restoring the climate over the coming decades. The most common outcome of this is anxiety for the future. A study from the American Psychological Association found that 47% of young adults experience anxiety from climate change that impacts their daily lives. This anxiety can either be adaptive and lead people to positive action, or it can be maladaptive and lead to feelings of helplessness and even suicide.<sup>10</sup>

Warmer temperatures from climate change also contribute to adverse mental impacts. Studies have shown that increased heat has a strong positive correlation with increased aggressive behavior, such as crime or domestic violence. Increased heat can also lead to greater psychological stress and possibly suicidal behavior.<sup>11</sup>

## **Aquatic Consequences**

### **Flooding**

Aquatic consequences such as flooding, rising sea level, and tropical storms are consequences of climate change because warmer air can hold more moisture and therefore makes storms more intense. Climate change has caused an increase in flooding because of increased precipitation in parts of the United States. While there is less water in the western United States, since 1901, average precipitation across the country has increased by approximately 4%.<sup>12</sup> Partly because of this, there has been a 20% increase in extreme 100-year flooding events throughout the United States.<sup>13</sup>

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<sup>6</sup> Vernice Miller and Renee Skelton, "The Environmental Justice Movement," NRDC, accessed March 17, 2022, <https://www.nrdc.org/stories/environmental-justice-movement>. 215. Elisabeth Currit, "Disproportionate Exposure to Air Pollution for Low-Income Communities in the United States," Ballard Brief, May 2022, <https://ballardbrief.byu.edu/issue-briefs/disproportionate-exposure-to-air-pollution-for-low-income-communities-in-the-united-states>.

<sup>7</sup> Elisabeth Currit, "Disproportionate Exposure to Air Pollution for Low-Income Communities in the United States," Ballard Brief, May 2022, <https://ballardbrief.byu.edu/issue-briefs/disproportionate-exposure-to-air-pollution-for-low-income-communities-in-the-united-states>.

<sup>8</sup> Bruce Tonn et al., "A Futures Perspective of Health, Climate Change and Poverty in the United States," *Futures* 131 (August 1, 2021): 102759, <https://doi.org/10.1016/j.futures.2021.102759>.

<sup>9</sup> Matthew Goldberg et al., "For the First Time, the Alarmed Are Now the Largest of Global Warming's Six Americas," Yale Program on Climate Change Communication, accessed March 16, 2022, <https://climatecommunication.yale.edu/publications/for-the-first-time-the-alarmed-are-now-the-largest-of-global-warmings-six-americas/>.

<sup>10</sup> Susan Clayton, "Climate Anxiety: Psychological Responses to Climate Change," *Journal of Anxiety Disorders* 74 (August 1, 2020): 102263, <https://doi.org/10.1016/j.janxdis.2020.102263>.

<sup>11</sup> Susanta Kumar Padhy et al., "Mental Health Effects of Climate Change," *Indian Journal of Occupational and Environmental Medicine* 19, no. 1 (January 1, 2015): 3–7, <https://doi.org/10.4103/0019-5278.156997>.

<sup>12</sup> D.R. Easterling et al., "Ch. 7: Precipitation Change in the United States. Climate Science Special Report: Fourth National Climate Assessment," *CSSR* 1, no. 7 (2017), <https://doi.org/10.7930/J0H993CC>.

<sup>13</sup> D. L. Swain et al., "Increased Flood Exposure Due to Climate Change and Population Growth in the United States," *Earth's Future* 8, no. 11 (2020): e2020EF001778, <https://doi.org/10.1029/2020EF001778>.

It is estimated that there has been and will continue to be at least a 7% increase in extreme precipitation per degree C.<sup>14</sup> Over the next 80 years, this will result in flood damages going from \$3 billion to between \$4–7 billion.<sup>15</sup> Examples of extreme flooding occurred in the summer of 2022 in 5 regions within 5 weeks of each other throughout the United States. This is a new record.<sup>16</sup>

## Sea Level Rising

Sea levels are rising faster along the coast of the contiguous United States than the global sea level rise rates. Over the past 100 years, the global average rise is 17 cm; in the US, sea levels have risen closer to 28 cm.<sup>17</sup> It is estimated that by 2100, sea level rise could displace between 4.2–13.1 million people along the coasts of the continental United States. National GDP loss could be between \$70–289 billion per year by the year 2100.<sup>18</sup> The combination of human migration and GDP loss in cited States creates a major social and economic problem for the future. It is estimated that by 2050, the United States coastline could experience a foot of sea level rise.<sup>19</sup> Around 39% of the US population lives in coastal counties, meaning that flooding from higher sea levels would negatively impact the lives of hundreds of thousands of people.<sup>20</sup>

## Tropical Storms and Hurricanes

Climate change significantly contributes to the rising frequency and intensity of hurricanes, which pose a serious environmental threat. Estimates suggest that by the end of the century, tropical storms in the U.S. may increase in intensity by 2–11%, potentially leading to a 54% rise in annual damages. This increase in hurricane power is due to several factors: warmer air holds more moisture, resulting in heavier rainfall; warmer ocean temperatures cause higher wind speeds; and rising sea levels contribute to more destructive storm surges. The impact of hurricanes includes widespread destruction of homes and infrastructure, loss of food and water sources, and a tragic loss of life. Notably, the 2017 hurricane season saw twice the average number of major storms compared to previous years.<sup>21</sup>

## Desertification

Terrestrial consequences such as deforestation, food insecurity, and fires result from climate change in America because of increased heat and shifts in precipitation patterns. Climate change affects life both on land and in the water. On land, one of the primary changes is desertification.<sup>22</sup>

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<sup>14</sup> C. Wobus et al., “Projecting Changes in Expected Annual Damages From Riverine Flooding in the United States,” *Earth’s Future* 7, no. 5 (2019): 516–527, <https://doi.org/10.1029/2018EF001119>.

<sup>15</sup> Cameron Wobus et al., “Climate Change Impacts on Flood Risk and Asset Damages within Mapped 100-Year Floodplains of the Contiguous United States,” *Natural Hazards and Earth System Sciences* 17, no. 12 (December 8, 2017): 2199–2211, <https://doi.org/10.5194/nhess-17-2199-2017>.

<sup>16</sup> <https://ballardbrief.byu.edu/issue-briefs/impacts-of-climate-change-in-the-united-states>

<sup>17</sup> William V. Sweet et al., “2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along US Coastlines,” National Oceanic and Atmospheric Administration, accessed March 23, 2023, <https://aampublicoceanservice.blob.core.windows.net/oceanserviceprod/hazards/sealevelrise/noaa-nos-techrpt01-global-regional-SLR-scenarios-US.pdf>.

<sup>18</sup> Toon Haer et al., “Relative Sea-Level Rise and the Conterminous United States: Consequences of Potential Land Inundation in Terms of Population at Risk and GDP Loss,” *Global Environmental Change* 23, no. 6 (December 1, 2013): 1627–1636, <https://doi.org/10.1016/j.gloenvcha.2013.09.005>.

<sup>19</sup> William V. Sweet et al., “2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along US Coastlines” National Oceanic and Atmospheric Administration, accessed March 23, 2023, <https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nos-techrpt01-global-regional-SLR-scenarios-US.pdf>.

<sup>20</sup> “Fourth National Climate Assessment” US Global Change Research Program, accessed May 17, 2023, <https://nca2018.globalchange.gov/><https://nca2018.globalchange.gov/chapter/2>.

<sup>21</sup> <https://ballardbrief.byu.edu/issue-briefs/impacts-of-climate-change-in-the-united-states>

<sup>22</sup> S. Ostberg et al., “Critical Impacts of Global Warming on Land Ecosystems,” *Earth System Dynamics* 4, no. 2 (October 8, 2013): 347–357, <https://doi.org/10.5194/esd-4-347-2013>.

Desertification comes from both direct human interference and anthropogenic climate change. Earlier, this brief discussed desertification and deforestation as contributors to climate change. Here, desertification will be explained as a consequence of climate change. Desertification is manifested as land and vegetation degradation relating to drier conditions because of shifts in precipitation patterns from climate change. Around the world, over one-third of the land has been impacted by desertification, including much of the agricultural land in the United States. In the United States, most of this desertification happens in the West and is related to decreased precipitation. Nearly 40% of the US is arid or semi-arid (meaning it is highly susceptible to desertification).<sup>23</sup> Desertification drastically impacts Americans because it limits the land that can be effectively farmed and generates dust pollution.

### **Food Insecurity**

Climate change in the United States also harms food security. Because the climate is warming, the growing season is longer; this can limit the types of plants that can be grown and promote the growth of invasive species and weeds.<sup>24</sup> Even though an extended growing season could theoretically increase crop yield, it is expected that the actual productive growth period will be shortened because it is paired with a shift in precipitation patterns. In addition, increased levels of carbon in the atmosphere are limiting the nutritional value of crops grown, further contributing to food insecurity. Globally, it is estimated that protein and mineral concentrations will decrease between 5–15% while B vitamins will decrease by up to 30%. Crop yields globally for wheat and maize have already decreased by 4–6% and will continue to decrease as extreme heat and less water cause plants to experience increased stress.<sup>25</sup>

### **Fires**

In the western United States, climate change has doubled the number of large fires over the past 30 years.<sup>26</sup> It is estimated that the area burned each year has increased eightfold since 1985.<sup>27</sup> Fires are increasing in frequency and magnitude for a few primary reasons. First, there is less water later in the year. By 2050, there is expected to be a 25% decrease in precipitation in the western United States, especially snowfall.<sup>28</sup> In many parts of the western United States, there is less rain, meaning that forests and grasslands are drier and more prone to fires. Even though the western US is experiencing more intense drought, it is important to note that throughout most of the rest of the United States, there is an average increase in precipitation, so only certain regions are impacted by wildfires.<sup>29</sup>

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<sup>23</sup> Six - Land Use Change and Coastal Management," in *Climatic Hazards in Coastal Bangladesh*, ed. Bimal Kanti Paul and Harun Rashid (Boston, MA: Butterworth-Heinemann, 2017), 183–207, <https://doi.org/10.1016/B978-0-12-805276-1.00006-5>. 165. D.R. Easterling et al., "Ch. 7: Precipitation Change in the United States. Climate Science Special Report: Fourth National Climate Assessment," CSSR 1, no. 7 (2017), <https://doi.org/10.7930/J0H993CC>. 166. Ibid. 167. Kristie L. Ebi and Irakli Loladze, "Elevated Atmospheric CO<sub>2</sub> Concentrations and Climate Change Will Affect Our Food's Quality and Quantity," *The Lancet Planetary Health* 3, no. 7 (July 1, 2019), [https://doi.org/10.1016/S2468-2667\(19\)30011-1](https://doi.org/10.1016/S2468-2667(19)30011-1).

<sup>24</sup> D.R. Easterling et al., "Ch. 7: Precipitation Change in the United States. Climate Science Special Report: Fourth National Climate Assessment," CSSR 1, no. 7 (2017), <https://doi.org/10.7930/J0H993CC>.

<sup>25</sup> David B. Lobell and Sharon M. Gourdji, "The Influence of Climate Change on Global Crop Productivity," *Plant Physiology* 160, no. 4 (December 1, 2012): 1686–1697, <https://doi.org/10.1104/pp.112.208298>.

<sup>26</sup> "Chapter 8: Drought, Floods, and Wildfire" U.S. Global Change Research Program, accessed May 18, 2023, <https://science2017.globalchange.gov/chapter/8/>.

<sup>27</sup> S. A. Parks and J. T. Abatzoglou, "Warmer and Drier Fire Seasons Contribute to Increases in Area Burned at High Severity in Western US Forests From 1985 to 2017," *Geophysical Research Letters* 47, no. 22 (2020): e2020GL089858, <https://doi.org/10.1029/2020GL089858>.

<sup>28</sup> Erica R. Siirila-Woodburn et al., "A Low-to-No Snow Future and Its Impacts on Water Resources in the Western United States," *Nature Reviews Earth & Environment* 2, no. 11 (November 2021): 800–819, <https://doi.org/10.1038/s43017-021-00219-y>.

<sup>29</sup> D.R. Easterling et al., "Ch. 7: Precipitation Change in the United States. Climate Science Special Report: Fourth National Climate Assessment," CSSR 1, no. 7 (2017), <https://doi.org/10.7930/J0H993CC>.

## Conclusion

Addressing climate change in the United States is imperative, not only for environmental sustainability but also for social equity and economic stability. The multifaceted impacts of climate change—ranging from extreme weather events to regional disparities in vulnerability—underscore the urgent need for comprehensive and inclusive strategies that prioritize both mitigation and adaptation. As the frequency and severity of climate-related disasters increase, it is essential to recognize that marginalized communities often bear the brunt of these impacts. Thus, effective climate action must integrate social justice considerations, ensuring that those most affected receive the support and resources they need to adapt and thrive.

## Recommendations

1. **Transition to Renewable Energy:** The U.S. government should prioritize the shift towards renewable energy sources, such as solar, wind, and hydroelectric power, to decrease dependence on fossil fuels. Implementing tax incentives and subsidies for renewable energy projects could promote investment in these technologies.
2. **Enhancing Transportation Policies:** Given that the transportation sector is a major contributor to greenhouse gas emissions, accounting for a significant portion of the total emissions, it is crucial for the government to take comprehensive action. This includes substantial investments in the expansion and modernization of public transit systems, making them more efficient, accessible, and appealing to commuters. Initiatives could involve increasing the frequency of buses and trains, developing new routes that connect underserved areas, and integrating smart technology to offer real-time transit updates.
3. **Moreover, the government should actively promote the adoption of electric vehicles (EVs)** by providing incentives such as tax credits and rebates for consumers and businesses. Investment in a widespread network of charging stations is essential to alleviate range anxiety and encourage more drivers to transition to EVs. Additionally, strengthening fuel efficiency standards for cars and trucks will push manufacturers to innovate and produce cleaner vehicles, contributing to reduced emissions across the board. By implementing these measures, the government can significantly advance its climate goals while also improving air quality and public health.**Climate-Resilient Infrastructure:** We recommend that the US government reassess its infrastructure planning to incorporate climate-resilient measures. This ensures that roads, bridges, and public utilities can endure increased flooding and extreme weather conditions.
4. **Promoting Sustainable Development Initiatives:** We strongly encourage the U.S. government to embrace and implement the United Nations' Sustainable Development Goals (SDGs) framework. This comprehensive set of objectives is essential for tackling the pressing challenges posed by climate change and encompasses specific strategies aimed at significantly reducing greenhouse gas emissions. By aligning national policies with the SDGs, particularly those focused on affordable and clean energy, responsible consumption and production, and climate action, the government can foster a resilient economy while

ensuring a healthier planet for future generations. Active participation in these global goals will not only enhance environmental sustainability but also promote social equity and economic opportunity across all communities.