



Texas Climate 2040:

How Climate Change Impacts
the Health of Texans



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Executive Summary

Climate change is an imminent health concern. Considered by many physicians and scientists to be the greatest threat to public health of the 21st century, it is likely to impact every person on the planet.¹ Health effects include increased heat-related illness, increased range of mosquito and other vector-borne diseases, more intense and destructive natural disasters, and significant impacts on our food systems. Air pollution, largely from burning of fossil fuels, contributes to increased heart attacks, lung disease, and even deteriorating mental health. Water pollution, from chemicals released from fracking, industrial waste, agricultural run-off, landfill leachate, and other sources can cause cancer, typhoid, cholera, dysentery, and amoebiasis. This is a public health emergency. Prevention and response in Texas and around the world are urgent and essential.

Many policymakers, and even a small body of physicians and other healthcare providers, are in denial or unaware of the major role that climate change plays in health outcomes and how to address the resulting public health crisis. The COVID-19 pandemic has understandably shifted attention away from conversations about climate and health. However, connections between COVID-19 and climate change are apparent. For example, patients with respiratory issues related to air pollution are at increased risk of complications from COVID-19.² We also saw notable improvements in air quality in many communities when car traffic declined during the pandemic indicating we have the ability to reduce pollution through our collective actions.³

Climate change increases vulnerability for other health issues as well, some established and others unknown. The potential health consequences of climate change are under-researched. We will need further exploration and research on the health impacts of climate change.

Racial and ethnic minorities and low-income communities are particularly at risk through the intersection of environmental factors and health inequities. Coastal communities, too, face hurricanes, flooding and other predictable climate events as well as many unknowns. These are our four key observations:

1. **The time is now.** Emerging evidence and newer climate models show we are rapidly running out of time to address the climate crisis. Further damage from climate change is inevitable, but its impact can be mitigated by immediate investments in clean energy and green jobs and by incentivizing governments, businesses, and individuals to shift to renewable energy and

1. "Call for Emergency Action to Limit Global Temperature Increases, Restore Biodiversity, and Protect Health | NEJM," accessed October 13, 2021, <https://www.nejm.org/doi/full/10.1056/NEJMe2113200>.

2. Thomas Bourdrel et al., "The Impact of Outdoor Air Pollution on COVID-19: A Review of Evidence from in Vitro, Animal, and Human Studies," *European Respiratory Review* 30, no. 159 (March 31, 2021), <https://doi.org/10.1183/16000617.0242-2020>.

3. "The First COVID-19 Lockdowns Improved Air Quality. Where Are We a Year Later?," UCLA, accessed August 20, 2021, <https://newsroom.ucla.edu/releases/air-quality-a-year-after-covid-lockdowns>.

prioritize health and equity. Inaction will lead to decades more of pollution and rising carbon levels, causing irreversible damage to our planet.

2. **Our actions make a difference.** Every action needs to have a climate consideration. Individually and in our public and private governing institutions, we need to consider climate justice in everything we do.
3. **Change requires political action at every level of government.** On the community, state-wide, federal, and global scale, change needs to happen now.
4. **Climate change and environmental vulnerabilities are social determinants of health.** Those with the greatest wealth and influence have benefitted the most from fossil fuels, while lower-income communities of color have borne the greatest price. Current and future solutions must strive to eliminate disparities and be careful not to exacerbate or create new inequities and injustices to the most disenfranchised populations.

The proposed recommendations can help stem this climate crisis and spur investment in solutions going forward. Climate action planning should involve partnerships between diverse stakeholders that cross municipal boundaries in public transport, food systems, and waste management. This collaboration can help involved parties share costs, pool resources, and build communities to manage complex climate action projects. An equitable, regenerative, diversified food and agriculture system; transition from fossil-fuel dependence and extraction to renewable, non-combustion energy; and decarbonization should all coalesce into climate action.

Summary of Recommendations

FEDERAL RECOMMENDATIONS

- Make investments that do no harm by eliminating subsidies and support for fossil fuel industries.
- Invest in clean, non-combustion renewable energy, achieving 100 percent renewable electricity by 2035.
- Make investments that advance health equity and environmental justice.
- Establish long-term, clean energy tax incentives.
- Make investments to substantially increase active and public transportation and other non-polluting forms of transportation.
- Make investments that strengthen health care and public health infrastructure, capacity, and climate resilience.
- Make investments in parks and greenspace, trees and urban forestry, and green infrastructure.
- Make investments that build community resilience to climate change and ensure that homes, schools, hospitals, and community buildings are carbon-neutral and able to sustain the impact of severe weather events and other consequences of a rapidly changing climate.
- Make investments that assure access to clean and affordable drinking water for all and ensure that our wastewater and stormwater infrastructure are adequate to meet the rising threats of climate change.
- Build healthy and sustainable food and

agricultural systems.

- Support programs that assure that workers and communities do not suffer from legacy health impacts of fossil fuels.

TEXAS AND LOCAL RECOMMENDATIONS

- Make evidence-based climate action plans at the state and local level.
- Shift to non-combustion renewable energy by 2035 for powering homes, businesses, industry, and vehicles.
- Hold companies accountable for violating the law.
- Increase the state's public health climate change preparedness.
- Promote sustainable and resilient food systems and farms.
- Ensure access to safe and affordable drinking water and a sustainable water supply.
- Prioritize environmental equity and justice.
- Promote widespread public education efforts.

INDIVIDUAL RECOMMENDATIONS

- Bike, walk, reduce air travel, and use public transportation to lessen the effect of travel on climate change.
- Choose a plant-based diet to improve health and mitigate the effects of the meat and agriculture industry on carbon levels.

- Take action at the household and community level to increase use of electric vehicles, weatherize homes, and install solar.
- Take a deep dive into personal emissions using the U.S. Environmental Protection Agency's (EPA) carbon footprint calculator and find ways to reduce one's carbon footprint.⁴

RECOMMENDATIONS FOR THE TEXAS HEALTH CARE COMMUNITY

- Focus on climate health preparedness.
- Recognize climate change as a public health emergency.⁵
- Acknowledge, address, and treat the mental health impacts of climate change.
- Advocate for investments in health care infrastructure in preparation for the health effects of climate change.
- Take an active role in achieving the state, federal, and individual recommendations in this report.

4. Office of Air and Radiation US EPA, "Carbon Footprint Calculator | Climate Change | US EPA," Data & Tools, accessed July 30, 2021, <https://www3.epa.gov/carbon-footprint-calculator>.

5. Caroline Wellbery, "Climate Change Health Impacts: A Role for the Family Physician," *American Family Physician* 100, no. 10 (November 15, 2019): 602–3, <https://www.aafp.org/afp/2019/1115/p602.html>.

Background

Climate change is happening now. Texas is one of the eight states most vulnerable to and least prepared for climate change, according to a collaborative report between Trust for America's Health and John Hopkins Bloomberg School of Public Health.⁶ Ironically, the most vulnerable states are often the least prepared.

The Working Group I contribution to the Sixth Assessment Report from the United Nations Intergovernmental Panel on Climate Change (IPCC) was released on August 9, 2021. Its conclusions are dire and emphasize the need to curb global warming to prevent ecological

and sociopolitical catastrophe.⁷ According to the Report, any increase in global temperature will affect human health and we will not be able to limit global warming unless there are immediate reductions in greenhouse gas emissions.

The Environmental Protection Agency reports that we can expect coastal storms of great intensity such as Hurricanes Harvey, Ike and Laura; increasing wildfires; increasing droughts; and worsening air pollution, all of which lead to premature death.⁸

Other consequences of global warming include intensified urban heat islands, heat-related illness, and diseases transmitted from

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6. Trust for America's Health, "States at Greatest Risk for Health Impacts of Climate Change Are Often Least Prepared to Protect Residents During Climate Related Events, New Report Finds," accessed August 2, 2021, <https://www.prnewswire.com/news-releases/states-at-greatest-risk-for-health-impacts-of-climate-change-are-often-least-prepared-to-protect-residents-during-climate-related-events-new-report-finds-301189276.html>; "Report: States Most Vulnerable to Climate Change Are Among the Least Prepared," Route Fifty, accessed August 2, 2021, <https://www.route-fifty.com/health-human-services/2020/12/report-states-most-vulnerable-climate-change-are-among-least-prepared/170628/>; "What U.S. Cities Facing Climate Disaster Risks Are Least Prepared?," Bloomberg.Com, August 19, 2019, <https://www.bloomberg.com/news/articles/2019-08-19/mapping-climate-change-readiness-and-resiliency>.
 7. "The IPCC Report Was Dreadful — Now, Let's Get to Work | Greenbiz," accessed August 20, 2021, <https://www.greenbiz.com/article/ipcc-report-was-dreadful-now-lets-get-to-work>; "Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments — IPCC," accessed August 2, 2021, <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/>.
 8. OAR US EPA, "Climate Change Indicators in the United States," Reports and Assessments, November 6, 2015, <https://www.epa.gov/climate-indicators>; Qian Di et al., "Air Pollution and Mortality in the Medicare Population," *New England Journal of Medicine* 376, no. 26 (June 29, 2017): 2513–22, <https://doi.org/10.1056/NEJMoa1702747>; 677 Huntington Avenue Boston and Ma 02115 +1495-1000, "Nationwide Study of U.S. Seniors Strengthens Link between Air Pollution and Premature Death," News, June 28, 2017, <https://www.hsph.harvard.edu/news/press-releases/u-s-seniors-air-pollution-premature-death/>; 677 Huntington Avenue Boston and Ma 02115 +1495-1000, "Environmental Regulation Rollbacks Could Lead to Premature Deaths," News, October 5, 2018, <https://www.hsph.harvard.edu/news/hsph-in-the-news/environmental-regulation-rollbacks-premature-deaths/>; "Wildfires Cause More Than 33,000 Deaths Globally Each Year | Health News | US News," accessed October 15, 2021, <https://www.usnews.com/news/health-news/articles/2021-09-09/wildfires-cause-more-than-33-000-deaths-globally-each-year>; "UN: Droughts Killed Most People in the World's Worst Disasters," accessed October 15, 2021, <https://www.businessinsider.com/un-droughts-killed-most-people-in-worlds-worst-disasters-2021-9/>; "88% of U.S. Deaths From Hurricanes, Tropical Storms Are From Water, Not Wind | The Weather Channel - Articles from The Weather Channel | Weather.Com," The Weather Channel, accessed October 15, 2021, <https://weather.com/safety/hurricane/news/hurricanes-tropical-storms-us-deaths-surge-flooding>.

mosquitoes and other insects.⁹

The U.S. Global Change Research Program has taken an in-depth look at climate change impacts on human health in the U.S. Among other findings, their research notes that the impacts of climate change on human health interact with underlying health, demographic, and socioeconomic factors. It notes that some populations are disproportionately vulnerable including, “some communities of color, low-income groups, people with limited English proficiency (LEP), and certain immigrant groups (especially those who are undocumented) live with many of the factors that contribute to their vulnerability to the health impacts of climate change.”¹⁰

Rising temperatures have significant meaning for Texas. Texas is likely to have nearly twice as many days per year above 100°F by 2036 as it has today.¹¹ High air temperatures cause heat stroke, worsen dehydration, and can damage people’s cardiovascular and nervous systems.¹² Warmer air can also increase the formation of ground-level ozone, which has a variety of

adverse effects on health, such as exacerbated lung diseases (including asthma and chronic obstructive pulmonary disease) and increased risk of premature death from heart and lung disease.¹³

Extreme weather events and their aftermath can have lasting consequences in affected communities, particularly when they result in diminished livelihoods or community relocation. The USGCRP’s Fourth National Climate Assessment finds that climate change may result in some counties in Texas and Florida experiencing more than six percent losses in annual labor hours by the end of the century due to extreme temperature.¹⁴ The combined health impacts from heat, vector-borne disease, and flooding contribute to chronic stress and impact mental health.

The risks are clear to Texas and Texans. This report maps climate-related health impacts in Texas and provides recommendations for mitigating injury, illness, and death. Unfortunately, the ill effects of climate change are already being felt and will worsen for the

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9. Diseases Carried by Vectors | CDC,” December 21, 2020, <https://www.cdc.gov/climateandhealth/effects/vectors.htm>; Walter Leal Filho et al., “Climate Change, Health and Mosquito-Borne Diseases: Trends and Implications to the Pacific Region,” *International Journal of Environmental Research and Public Health* 16, no. 24 (December 2019): 5114, <https://doi.org/10.3390/ijerph16245114>; “Climate Change and Health,” accessed August 2, 2021, <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>; Antonio Ligsay, Olivier Telle, and Richard Paul, “Challenges to Mitigating the Urban Health Burden of Mosquito-Borne Diseases in the Face of Climate Change,” *International Journal of Environmental Research and Public Health* 18, no. 9 (May 10, 2021): 5035, <https://doi.org/10.3390/ijerph18095035>; OAR US EPA, “Climate Change and Heat Islands,” Overviews and Factsheets, June 17, 2014, <https://www.epa.gov/heatislands/climate-change-and-heat-islands>.
 10. “GlobalChange.Gov,” GlobalChange.gov, accessed July 28, 2021, <https://www.globalchange.gov/>.
 11. Kiah Collier, “A&M Study: The Future of Texas Depends on Climate Preparedness,” *The Texas Tribune*, March 5, 2020, <https://www.texastribune.org/2020/03/05/study-future-texas-depends-climate-preparedness/>; “Texas Extreme Weather Assessment and Projections Report,” accessed July 28, 2021, <https://climatexas.tamu.edu/products/texas-extreme-weather-report/index.html>; Travis Bubenik, “Report Says Texas Could See More Frequent ‘Extreme Heat’ In Decades Ahead,” *Houston Public Media*, July 17, 2019, <https://www.houstonpublicmedia.org/articles/news/energy-environment/2019/07/17/339796/report-says-texas-could-see-more-frequent-extreme-heat-in-decades-ahead/>.
 12. “Heat Exposure and Reactions,” *Seattle Children’s Hospital*, accessed July 28, 2021, <https://www.seattlechildrens.org/conditions/a-z/heat-exposure-and-reactions/>; Katherine Harmon, “How Does a Heat Wave Affect the Human Body?,” *Scientific American*, accessed October 16, 2021, <https://www.scientificamerican.com/article/heat-wave-health/>.
 13. “Ozone,” accessed October 16, 2021, <https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/ozone>.
 14. USGCRP, “Fourth National Climate Assessment” (U.S. Global Change Research Program, Washington, DC, 2018), <https://nca2018.globalchange.gov>.

next decade. This is in part because warming temperatures, ice melt, and extreme weather create a positive feedback loop, accelerating climate change and increasing temperatures and carbon levels.¹⁵ However, multi-tiered, definitive actions now, as described below, can start to shift the tide for 2050 and beyond.

METHODOLOGY

Data-gathering for this report involved a review of published academic, peer-reviewed literature on climate change on a global and national scale, targeted to Texas. In addition, interviews were conducted with subject matter experts and leaders in climate change research in Texas.¹⁶ The report focuses on the physical and mental health impacts of climate change. First, climate change and its effects—extreme weather, hurricanes, drought, animal and plant endangerment, and fires—are examined. Then, the implications of these changes, along with the impact on human health, are reviewed. Examples are specific to Texas and the report systematically describes the characteristics of the health effects of climate change in Texas. The report includes both qualitative data and quantitative data (historical, current, and projected).

FINDINGS

Predictive climate modeling suggests that the risk for climate-related events, including the severity

of hurricanes and the frequency of wildfires, is increasing for Texas.¹⁷ But even more insidious is the general increase in heat waves, flooding, climate-related diseases, and worsening air quality.¹⁸ All these threats take a toll on human health and escalate with climate change. Climate-related effects are not equal opportunity.

Vulnerable populations are hit hardest, both physically and mentally, by climate change.¹⁹ The findings identify several categories of risk.

EXTREME WEATHER

Climate change brings with it an increase in extreme weather. In Texas, warmer weather, wildfires, flooding, drought, and hurricanes already have major impacts and will intensify. Extreme weather disrupts infrastructure such as electricity generation, transportation, and clean water supply, while limiting access to healthcare, food, and emergency services.

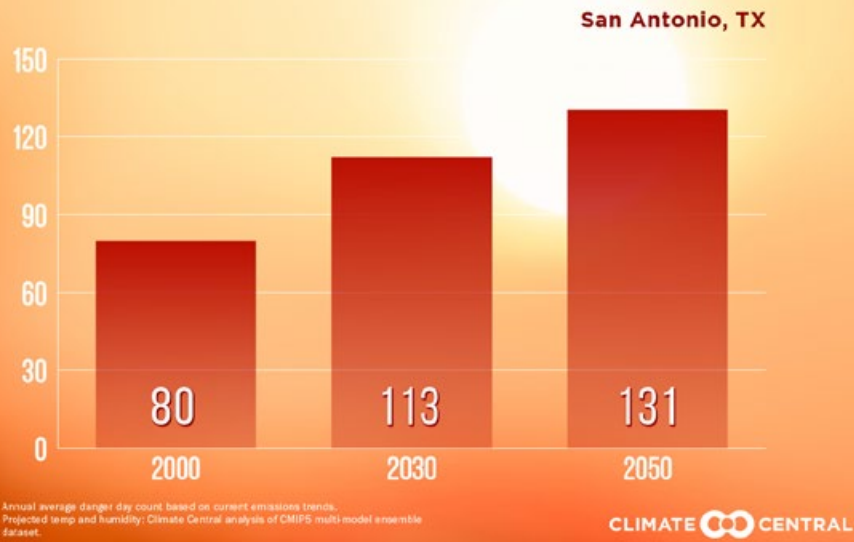
HEAT

The number of days over 100 degrees has doubled in the past 40 years and is expected to almost double again by 2036.²⁰ High temperatures can lead to heat cramps, exhaustion, heatstroke, hyperthermia, and death. Hot weather can also negatively impact air quality, leading to respiratory problems, especially for people with underlying conditions.

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15. "How Feedback Loops Are Making the Climate Crisis Worse | Climate Reality," accessed July 28, 2021, <https://www.climaterealityproject.org/blog/how-feedback-loops-are-making-climate-crisis-worse>.
 16. Robert W. Haley, n.d.; Danae King, Dr., n.d.; Elena Craft, Dr., n.d.; Natasha K. DeJarnett, Dr., n.d.
 17. Collier, "A&M Study"; "What Are Climate Models and How Accurate Are They?," *State of the Planet* (blog), May 18, 2018, <https://news.climate.columbia.edu/2018/05/18/climate-models-accuracy/>; "Texas Extreme Weather Assessment and Projections Report."
 18. "Climate Change & Health: Assessing State Preparedness," Trust for America's Health, 6, accessed July 28, 2021, https://www.tfah.org/wp-content/uploads/2020/12/ClimateChange_HealthRpt_FINAL.pdf.
 19. "Climate Change & Health," 18, 21, 53; "Climate Change Threatens Mental Health of Vulnerable Communities | The Nation's Health," accessed October 16, 2021, <https://www.thenationshealth.org/content/50/2/S7.2>.
 20. Collier, "A&M Study."

MORE DANGER DAYS

HEAT INDEX ABOVE 105°



Texas' Heat Threat. Source: Climate Central.

Furthermore, current research suggests that exposure to high heat can undermine mental health and heighten aggression. People with pre-existing mental health issues face a more acute threat from heat.²¹ People who work outside, as in the construction and landscaping industries, are particularly susceptible to extreme heat and urban heat islands. Minorities and low-income people will bear the brunt of heat-related illness.

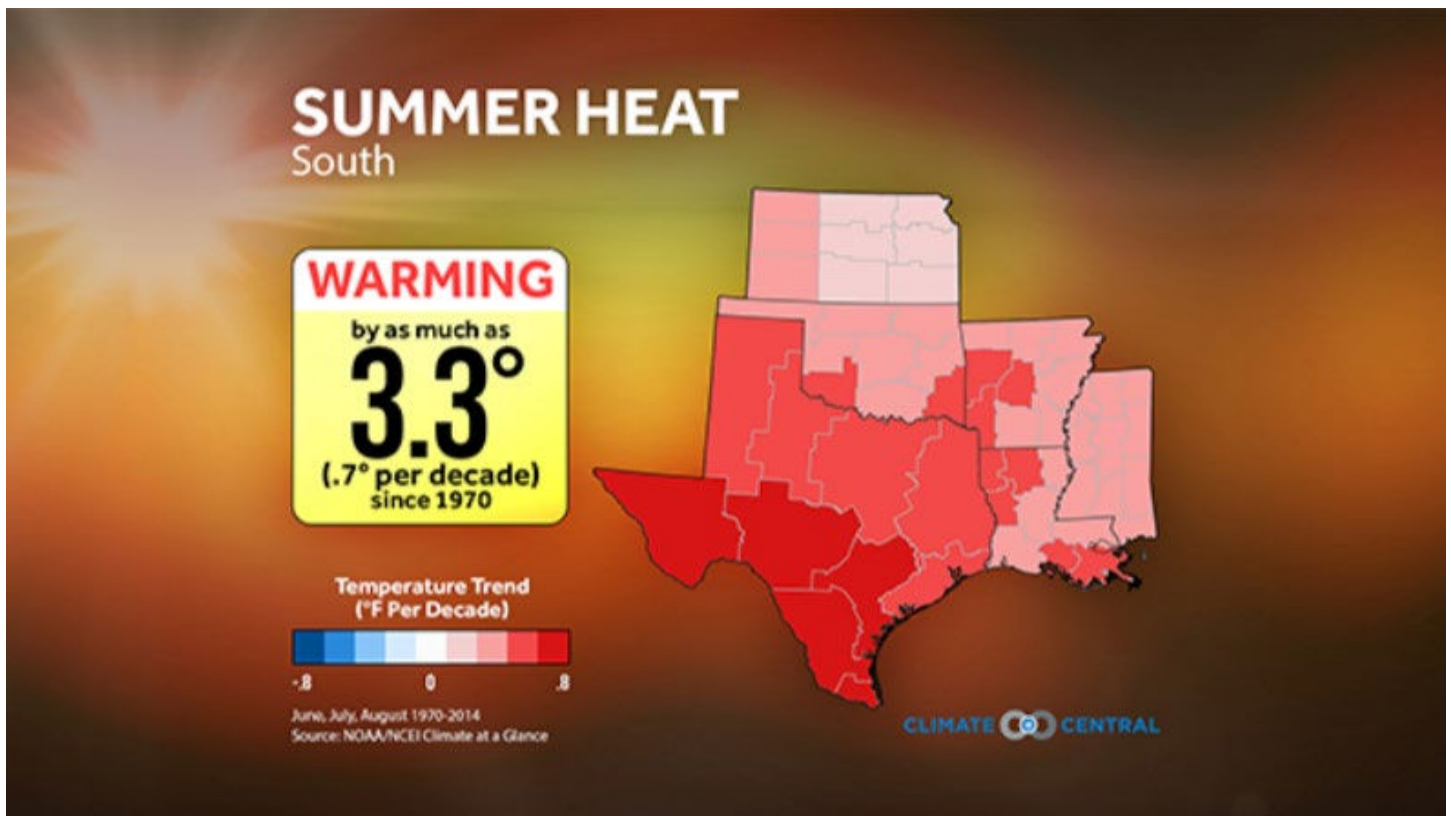
*Image Texas Heat Threat.*²²

*Image Texas Climate Threats.*²³

HURRICANES, STORMS, AND FLOODING

While heat-related events are increasing in Texas and elsewhere, other less intuitive weather changes are also happening. Dr. Katharine Hayhoe describes the phenomenon of weather “weirding,” coined by American environmentalist, Hunter Lovins.²⁴ It refers to climate change causing harsher, longer, and more extreme weather events in general, which will continue to intensify, causing more impacts to health and the economy.²⁵ The snowstorm in Texas in February

21. Climate Change & Health,” 16; Susan Clayton et al., “MENTAL HEALTH AND OUR CHANGING CLIMATE: IMPACTS, IMPLICATIONS, AND GUIDANCE,” n.d., 24, 38, <https://www.apa.org/news/press/releases/2017/03/mental-health-climate.pdf>.
22. “Texas’ Heat Threat,” accessed July 30, 2021, <http://statesatrisk.org/texas/extreme-heat>.
23. “Texas’ Climate Threats,” accessed August 9, 2021, <http://statesatrisk.org/texas/all>.
24. Thomas L. Friedman, “Opinion | The People We Have Been Waiting For,” *The New York Times*, December 2, 2007, sec. Opinion, <https://www.nytimes.com/2007/12/02/opinion/02friedman.html>.
25. “Why We Need to Talk about ‘Global Weirding,’” accessed August 2, 2021, <https://www.newstatesman.com/politics/environment/2021/04/why-we-need-talk-about-global-weirding>; “Global Weirding with Katharine Hayhoe,” NPR.org, accessed August 2, 2021, <https://www.npr.org/podcasts/961315153/global-weirding-with-katharine-hayhoe>.



Texas' Climate Threats. Source: Climate Central.

2021 resulted in more than 12 million Texans needing to boil water for safe consumption, despite some not having electricity or having no access to running water at all. The impacts are still being assessed, but at least 151 people died, mostly from hypothermia and carbon monoxide poisoning. The storm may have cost as much as \$295 billion in losses from damages, lost income,

and reduced output from businesses.²⁶

Hurricane intensity is increasing. The risk of storm surge may double in the next 30 years, compared to risk levels around the turn of the 19th century, in areas on the Gulf Coast, such as Galveston and Rockport.²⁷ Hurricane Harvey in 2017 caused historic rain totals—close to 50

26. "Failed State: Texas Power Grid Collapse Impacts Millions. Black & Brown Communities Are Worst Hit," Democracy Now!, accessed July 28, 2021, https://www.democracynow.org/2021/2/18/texas_power_shutoffs_robert_bullard; "Valentine's Week Winter Outbreak 2021: Snow, Ice, & Record Cold," accessed July 30, 2021, <https://www.weather.gov/hgx/2021ValentineStorm>; "Nobody Warned Texans About the Public Health Risks of the Winter Storm," The Texas Observer, March 11, 2021, <https://www.texasobserver.org/nobody-warned-texans-about-the-public-health-risks-of-the-winter-storm/>; Sami Sparber, "At Least 57 People Died in the Texas Winter Storm, Mostly from Hypothermia," The Texas Tribune, March 15, 2021, 57, <https://www.texastribune.org/2021/03/15/texas-winter-storm-deaths/>; "Texas Winter Storm Costs Could Top \$200 Billion — More than Hurricanes Harvey and Ike," accessed August 2, 2021, <https://www.cbsnews.com/news/texas-winter-storm-uri-costs/>; "The Texas Winter Storm And Power Outages Killed Hundreds More People Than The State Says," BuzzFeed News, accessed October 13, 2021, <https://www.buzzfeednews.com/article/peteraldous/texas-winter-storm-power-outage-death-toll>.
27. Collier, "A&M Study"; Andrea Thompson, "Rain, Storm Surge Combine to Put U.S. Coasts at Risk," accessed July 30, 2021, <https://www.climatecentral.org/news/rain-storm-surge-risk-for-coast-19284>; Andrea Thompson; Andrea Thompson, "Texas's Warmer Future: Drought and Heavy Rains?," accessed July 30, 2021, <https://www.climatecentral.org/news/texas-future-drought-heavy-rains-19076>.

inches—which restricted emergency aid and destroyed infrastructure.²⁸ Tornadoes can also cause serious injury and damage facilities, such as hospitals and power lines.²⁹

Extreme rainfall and flooding have been worsening and are expected to increase 15 percent in the next 15 years.³⁰ Floods frequently cause injury and death, while the aftermath can be even worse. Flooding exposes people to biological contaminants. It can also lead to mold, mildew, and associated health hazards such as pneumonia, cancer, and allergies.³¹

DROUGHT

Increased flooding and storms in certain areas are contrasted with dryness and drought especially in southern and western Texas.³² Texas faces a heightened risk of drought as temperatures continue to rise. Droughts affect a

wide range of industries (especially farmers and ranchers), road conditions, vegetation, and food supplies. A five-year drought from 2010-2015, for example, depleted water reserves, destroyed crops, and strained the electric grid.³³

WILDFIRES

Rising temperatures and dry conditions also can lead to wildfires, such as the Bastrop Complex Fire in 2011. This fire, the most destructive in state history, burned over 34,000 acres and more than 1,600 homes in Bastrop County. Currently, more than 72 percent of Texans are living in an area with an elevated risk of wildfires.³⁴ Wildfires can wipe out huge swaths of natural land, homes, and crops. Smoke from wildfires can cause eye and respiratory infections, bronchitis, asthma attacks, heart failure, and death. Certain populations including children, the elderly, and people with underlying

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28. "Climate Change & Health," 14, 15; "Valentine's Week Winter Outbreak 2021: Snow, Ice, & Record Cold"; "Harvey Floods Houston, Strands Thousands - WSJ," accessed October 16, 2021, <https://www.wsj.com/articles/hurricane-harvey-inundates-houston-with-widespread-flooding-1503841506>.
 29. "Climate Change & Health," 32.
 30. Collier, "A&M Study."
 31. "Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods," accessed July 30, 2021, <https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5508a1.htm>; OAR US EPA, "Biological Pollutants' Impact on Indoor Air Quality," Overviews and Factsheets, August 14, 2014, <https://www.epa.gov/indoor-air-quality-iaq/biological-pollutants-impact-indoor-air-quality>.
 32. "Texas | U.S. Drought Monitor," accessed July 30, 2021, <https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?TX>; "It's Going to Take a Lot of Rain to Dent Texas Drought," accessed July 30, 2021, <https://spectrumlocalnews.com/tx/south-texas-el-paso/weather/2021/04/15/it-s-going-to-take-a-lot-of-rain-to-dent-texas-drought>; "Drought Is Widespread Across Texas | Take Care of Texas," accessed July 30, 2021, <https://takecareoftexas.org/hot-wire/drought-widespread-across-texas>; "Everything You Need to Know About the Texas Drought," *StateImpact Texas* (blog), accessed July 30, 2021, <http://stateimpact.npr.org/texas/topic/drought/>; Brian Kahn, "Southwest, Central Plains Face 'Unprecedented' Drought," accessed July 30, 2021, <https://www.climatecentral.org/news/southwest-central-plains-unprecedented-drought-18657>; Andrea Thompson, "Texas's Warmer Future."
 33. "Everything You Need to Know About the Texas Drought."
 34. Bobby Magill, "Austin a 'Poster Child' for Urban Wildfire Threat," accessed July 30, 2021, <https://www.climatecentral.org/news/austin-a-poster-child-for-urban-wildfire-threat-17058>; Magill, "Wildfires and Disasters | Current Situation TFS," accessed July 30, 2021, <https://tfsweb.tamu.edu/currentsituation/>; "Texas' Wildfire Threat," accessed July 30, 2021, <http://statesatrisk.org/texas/wildfires>; "Forecast Fire Danger," 2021, accessed October 16, 2021, <https://twc.tamu.edu/tfs/rawsd/rawsfcast.png>; Amanda Ruiz, "2021 Marks 10 Year Anniversary of Bastrop County Complex Fire," Text.Article, FOX 7 Austin (FOX 7 Austin, September 4, 2021), <https://www.fox7austin.com/news/2021-marks-10-year-anniversary-of-batrop-county-complex-fire>.

health conditions are particularly vulnerable to the health effects.³⁵

AIR QUALITY

Climate change negatively impacts air quality and damages people's respiratory and cardiovascular systems. Drought and high heat create more wildfires, which in turn worsen air quality for hundreds of miles and release excess carbon dioxide. Changes in weather patterns lead to more ground-level ozone, which can cause chest pain, coughing, throat irritation, and congestion.³⁶ Houston, Dallas-Fort Worth, Beaumont, San Antonio, Austin, and El Paso already exceed EPA standards for safe ozone levels and are expected to worsen.³⁷ Global warming and shorter winters result in longer growing seasons, leading to increased pollen and allergens in the air. Coal-fired plants release carbon-based particles, toxic metals and carcinogens, while diesel engines release toxins. Air pollution, related largely to burning of fossil fuels that contribute to climate change, already causes six million premature deaths world-wide each year by elevating risk for heart attacks, stroke, diabetes, and respiratory conditions.³⁸ A report found that levels of particulate matter in

Houston and Dallas-Fort Worth are already close to EPA's upper standard.³⁹

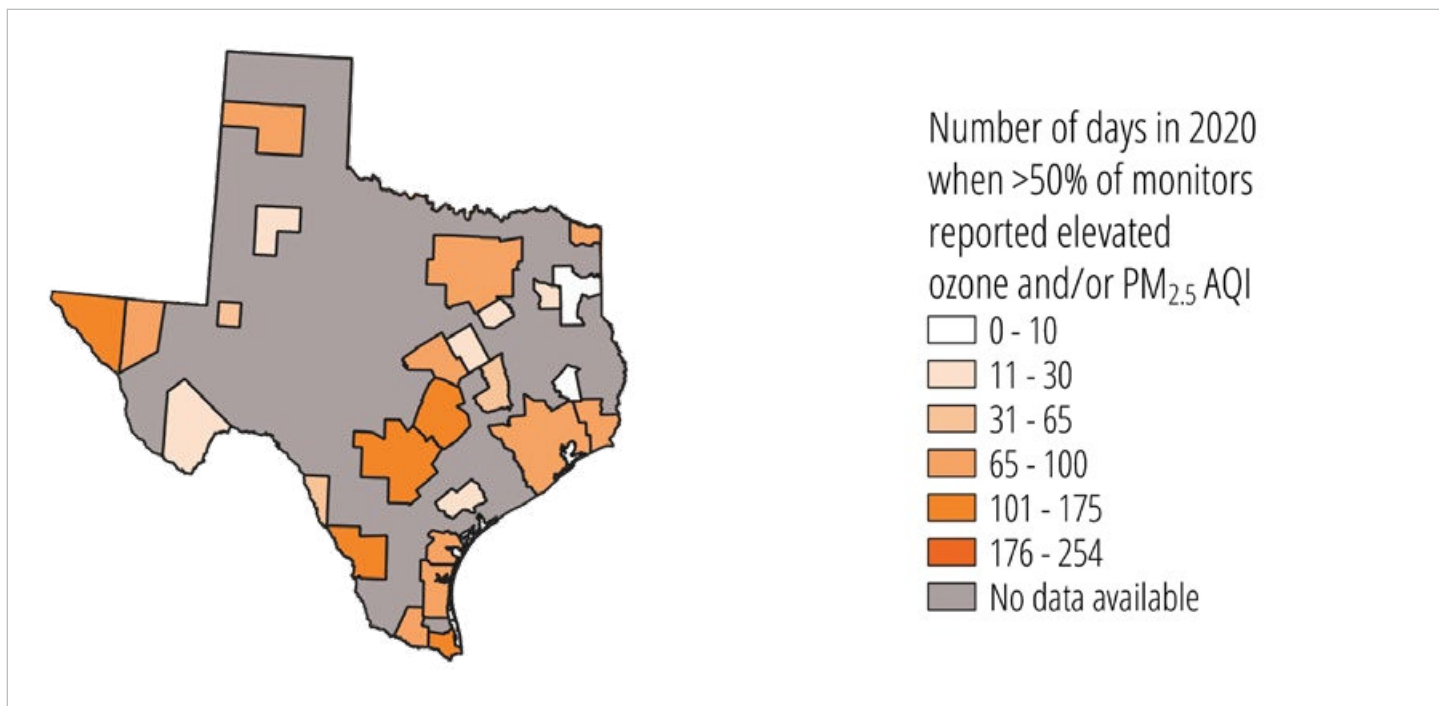
One study in 2013 found that more than 14,000 Texans die each year as a result of air pollution.⁴⁰ Particulate matter and pollution have caused billions of dollars in damages in the form of diseases, decreased work capability, and missed work days. Rising temperatures and wildfires and decreasing precipitation will lead to increases in ozone and particulate matter, elevating the risks of cardiovascular and respiratory illnesses and death.⁴¹

INFECTIONS AND ILLNESSES

Health conditions linked to climate change include vector-borne diseases and water- and food-related illnesses.

Several types of vector-borne diseases, which spread from person-to-person or animal-to-person, are changing in prevalence. The impact of climate change on mosquito populations is dependent on many factors, including temperature, humidity, and precipitation. Not all of Texas will be equally impacted. While some areas may become too hot for mosquitoes

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35. ORD US EPA, "Wildland Fire Research: Health Effects Research," Overviews and Factsheets, March 30, 2017, <https://www.epa.gov/air-research/wildland-fire-research-health-effects-research>.
 36. "Climate Change & Health," 15; "Health Impacts of Air Pollution," Environmental Defense Fund, accessed July 30, 2021, <https://www.edf.org/health/health-impacts-air-pollution>; Kim Knowlton et al., "Assessing Ozone-Related Health Impacts under a Changing Climate," *Environmental Health Perspectives* 112, no. 15 (November 1, 2004): 1557–63, <https://doi.org/10.1289/ehp.7163>; "Air Quality - Climate Change," accessed October 16, 2021, <https://www.doh.wa.gov/CommunityandEnvironment/ClimateandHealth/AirQuality>.
 37. OAR US EPA, "Ozone Designations - 2015 Standards - Texas State Recommendations and EPA Response," Other Policies and Guidance, November 7, 2016, <https://www.epa.gov/ozone-designations/ozone-designations-2015-standards-texas-state-recommendations-and-epa-response>.
 38. "Health Impacts of Air Pollution"; "Spare the Air Every Day," accessed July 30, 2021, <https://www.baaqmd.gov/alertstatus>; Jos Lelieveld et al., "Loss of Life Expectancy from Air Pollution Compared to Other Risk Factors: A Worldwide Perspective," *Cardiovascular Research* 116, no. 11 (September 1, 2020): 1910–17, <https://doi.org/10.1093/cvr/cvaa025>.
 39. "Air Sick," accessed July 28, 2021, <https://www.texmed.org/AirSick/>.
 40. Catherine Fraser, "Illegal Air Pollution in Texas," n.d., 53; "Homepage 070921 - TXE Austin Water," accessed August 4, 2021, <https://environmenttexas.org/homepage/homepage-070921-txe-austin-water>.
 41. "Climate Change & Health," 15, 31, 32; "Trouble in the Air," 4, 6–7, 14–16, 25, accessed October 15, 2021, <https://environmenttexas.org/reports/txe/trouble-air-1>.



Elevated ozone and PM_{2.5} AQI days in Texas. Source: Environment Texas.

during months when they used to thrive, other parts of the state may face an extended mosquito season as the temperature rises. Climate change-related storms and floods also increase the risk of mosquitoes—and the diseases, like West Nile and Zika, that they sometimes transmit.

Image above. Elevated ozone and PM_{2.5} AQI days in Texas.⁴²

Now the leading mosquito-borne disease in the U.S., West Nile virus is a neuroinvasive disease that emerged in the United States in 1999. Illness comes two to 14 days after a person is bitten by an infected mosquito. Symptoms can

include fever, headache, stupor, tremors, vision loss, and death. During the West Nile outbreak in 2012 in Dallas County, an estimated 1.8 percent of the population was infected, resulting in 19 deaths.⁴³ Ninety percent of cases occur from July through September, but warming temperatures mean changing seasons of infection.

Higher temperatures lead to an increase in the growth and survival of water-borne viruses, bacteria and toxins from harmful algae. Run off, extreme weather, and heavy rainfall can all contaminate drinking water, while increased toxic algae can indirectly cause illness. Contaminated water can cause diarrhea and other intestinal illnesses, brain-eating amoeba

42. "Trouble in the Air," 20.

43. "West Nile Virus In Texas," Texas Department of State Health Services, accessed July 24, 2021, <https://www.dshs.texas.gov/idcu/disease/arboviral/westNile/>; "West Nile Virus | West Nile Virus | CDC," July 22, 2021, <https://www.cdc.gov/westnile/index.html>; Lyle R Petersen, "Epidemiology of West Nile Virus in the United States: Implications for Arbovirology and Public Health," *Journal of Medical Entomology* 56, no. 6 (October 28, 2019): 1456–62, <https://doi.org/10.1093/jme/tjz085>; Wendy M. Chung et al., "The 2012 West Nile Encephalitis Epidemic in Dallas, Texas," *JAMA* 310, no. 3 (July 17, 2013): 297–307, <https://doi.org/10.1001/jama.2013.8267>.



"Pray for Rain" placard during drought time in Wichita Falls, TX. Photo credit: Billy Hawthorn.

(primary amebic meningoencephalitis), and death.⁴⁴ Currently, almost 140,000 Texans lack access to clean water, while millions more face issues with water quality.⁴⁵

AGRICULTURE AND FOOD SUPPLY

Drought, flooding, and other extreme events can disrupt food supply systems. The increased use of pesticides damages soil and soil carbon

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44. "Climate Postcards: Water-Borne Illness | PSR," *Physicians for Social Responsibility* (blog), accessed October 18, 2021, <https://www.psr.org/issues/environment-health/climate/climate-postcards-water-borne-illness/>; J. A. Patz et al., "Global Climate Change and Emerging Infectious Diseases," *JAMA* 275, no. 3 (January 17, 1996): 217–23.
45. "Clean Water for All Texans," Bold Solutions Network, accessed July 28, 2021, <http://solutions.leverforchange.org/lone-star-prize/clean-water-all-texans/>; "Texas' Water Problems Started Way before the Winter Storm," *Grist*, February 18, 2021, <https://grist.org/justice/texas-water-quality-contamination-winter-storm/>; Erin Douglas, "'Crisis upon Crisis': Industrial Pollutants Leave San Angelo Residents without Water as Winter Storm Bears Down," *The Texas Tribune*, February 12, 2021, <https://www.texastribune.org/2021/02/12/san-angelo-water-contamination/>; Benjamin Wermund, "Experts Fear Lead Poisoning Makes Fifth Ward One of 'Hundreds of Flints,'" *Houston Chronicle*, October 11, 2021, <https://www.houstonchronicle.com/politics/texas/article/They-are-being-exposed-Experts-fear-lead-16519913.php>; Bob Berwyn, "Surface Water Vulnerable to Widespread Pollution From Fracking, a New Study Finds," *Inside Climate News* (blog), August 20, 2021, <https://insideclimatenews.org/news/20082021/water-fracking-pollution-study/>.

sequestration, reduces non-target species populations (like honey bees), contributes to the emergence of pesticide resistant species, as well as causing health consequences.⁴⁶ Rising temperatures increase Salmonella prevalence in the food supply.⁴⁷

MENTAL HEALTH EFFECTS

Climate change can worsen mental health and well-being. Exposure to climate-related disasters can cause Post-Traumatic Stress Disorder (PTSD), depression, and anxiety.⁴⁸ After Hurricane Katrina in 2005, calls to mental crisis hotlines increased 61 percent, while chronic exposure to gradual climate change and climate disasters can cause chronic stress leading to a decline in mental health.⁴⁹ Major disruptive events like extreme weather along with general existential fear for the future and ecosystems can negatively impact emotional

health. Emotional reactions can present as acute traumatic stress disorder, persistent depressive disorder (dysthymia), generalized anxiety disorder, major depressive disorder, panic disorder, hypochondria, and insomnia. Chronic worry and eco-anxiety is becoming a clinical concern.⁵⁰ Climate change increases risk for distress, grief, behavioral health disorders, and social impacts while decreasing individual and community resilience.⁵¹

CLIMATE REFUGEES

Many people living in climate “hotspots” lack the resources to adapt to a more hostile environment. The increasing rate of disasters leaves communities with little time to recover, especially vulnerable populations. Migrants from Guatemala, Honduras, and El Salvador are being driven toward the United States not just by violence and a lack of economic opportunity,

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46. “Potential Health Effects of Pesticides,” Penn State Extension, accessed October 14, 2021, <https://extension.psu.edu/potential-health-effects-of-pesticides>; “How Pesticide Resistance Develops,” Grapes, accessed October 14, 2021, https://www.canr.msu.edu/grapes/integrated_pest_management/how-pesticide-resistance-develops; “Apodaca: Bees Are in Danger, and That Doesn’t Bode Well for Us,” Daily Pilot, September 29, 2021, <https://www.latimes.com/socal/daily-pilot/opinion/story/2021-09-29/apodaca-bees-are-in-danger-and-that-doesnt-bode-well-for-us>; Tari Gunstone et al., “Pesticides and Soil Invertebrates: A Hazard Assessment,” *Frontiers in Environmental Science* 9 (2021): 122, <https://doi.org/10.3389/fenvs.2021.643847>.
 47. “Extreme Weather Events Associated With Increased Salmonella Risk, New Study Says – Bloomberg,” accessed October 14, 2021, <https://www.bloomberg.com/news/articles/2015-07-15/extreme-weather-events-associated-with-increased-salmonella-risk-new-study-says>; Michele E. Morgado et al., “Climate Change, Extreme Events, and Increased Risk of Salmonellosis: Foodborne Diseases Active Surveillance Network (FoodNet), 2004-2014,” *Environmental Health* 20, no. 1 (September 18, 2021): 105, <https://doi.org/10.1186/s12940-021-00787-y>.
 48. “Climate Change Is Threatening Mental Health,” accessed July 30, 2021, <https://www.apa.org/monitor/2016/07-08/climate-change>.
 49. “Climate Change & Health,” 16.
 50. “Climate Change Is Threatening Mental Health”; Christine Ayala, “Climate Change Is Affecting Our Mental Health,” Text, TheHill, July 20, 2021, <https://thehill.com/opinion/healthcare/563984-climate-change-is-affecting-our-mental-health/>; Paolo Cianconi, Sophia Betrò, and Luigi Janiri, “The Impact of Climate Change on Mental Health: A Systematic Descriptive Review,” *Frontiers in Psychiatry* 0 (2020), <https://doi.org/10.3389/fpsy.2020.00074>; Susanta Kumar Padhy et al., “Mental Health Effects of Climate Change,” *Indian Journal of Occupational and Environmental Medicine* 19, no. 1 (2015): 3–7, <https://doi.org/10.4103/0019-5278.156997>; “How Climate Change Affects Mental Health » Yale Climate Connections,” Yale Climate Connections, February 4, 2020, <http://yaleclimateconnections.org/2020/02/how-climate-change-affects-mental-health/>; “How Climate Change Is Affecting Our Mental Health,” Healthline, April 16, 2021, <https://www.healthline.com/health/mental-health/climate-change-mental-health/>; “Eco-Anxiety: What It Is and How to Manage It,” December 19, 2019, <https://www.medicalnewstoday.com/articles/327354>.
 51. Padhy et al., “Mental Health Effects of Climate Change.”

but also by droughts caused by climate change.⁵² The United States is already seeing a migration of internally displaced individuals and that number is expected to increase.⁵³ A study published in the *Journal of the Association of Environmental and Resource Economists* found that one in twelve Americans in the southern half of the United States will migrate west to California, the Mountain West and the Northwest in the next 45 years. This movement is likely to increase poverty and economic disparities and urbanize areas that are not well-prepared for a rapid population increase.⁵⁴

HEALTH EQUITY AND ENVIRONMENTAL JUSTICE

Communities most vulnerable to the impacts of climate change are often those that already face higher rates of poverty and racial discrimination. Some of the most at-risk groups include older adults, children, people with preexisting health conditions, first responders and outdoor workers, housing insecure and financially insecure populations, immigrants, and people

of color. Racially discriminatory policies in the United States have created disparities in access and care between white and non-white populations.⁵⁵ Climate change is worsening these vulnerabilities.

More affluent areas are more likely to have tree canopies and substantial infrastructural support services, while redlining and discriminatory housing policies have created communities of color with fewer resources and heightened demand. Safe housing is one of the more protective factors against climate change effects such as extreme heat. Low-income people who live in mobile homes, or are housing insecure, are less likely to have the resources to weatherize their homes or pay utility bills to heat and cool.⁵⁶ Long-term unhoused persons and others experiencing temporary homelessness are at even greater risk. The Environmental Defense Fund (EDF) found that communities of color had almost twice the risk of pollution-related childhood asthma.⁵⁷ In the case of a climate disaster, individuals who lack English proficiency or education may find it more difficult to access services in times of need.⁵⁸

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52. "Climate Change Has Central Americans Fleeing to the U.S.," *Bloomberg.com*, June 8, 2021, <https://www.bloomberg.com/news/articles/2021-06-08/climate-change-has-central-americans-fleeing-to-the-u-s>; Abrahm Lustgarten, "The Great Climate Migration Has Begun," *The New York Times*, July 23, 2020, sec. Magazine, <https://www.nytimes.com/interactive/2020/07/23/magazine/climate-migration.html>.
 53. John Podesta, "The Climate Crisis, Migration, and Refugees," Brookings (blog), July 25, 2019, <https://www.brookings.edu/research/the-climate-crisis-migration-and-refugees/>; United Nations High Commissioner for Refugees, "Climate Change and Disaster Displacement," UNHCR, accessed October 18, 2021, <https://www.unhcr.org/climate-change-and-disasters.html>.
 54. "Climate Change Impacts and Emerging Population Trends: A Recipe for Disaster?," PRB, accessed October 18, 2021, <https://www.prb.org/resources/climate-change-impacts-emerging-population-trends-disaster/>.
 55. 2021, "Disparities in Health and Health Care: 5 Key Questions and Answers," *KFF* (blog), May 11, 2021, <https://www.kff.org/racial-equity-and-health-policy/issue-brief/disparities-in-health-and-health-care-5-key-question-and-answers/>.
 56. "Climate Change & Health," 34.
 57. "New Study Reveals Large and Unequal Health Burden from Air Pollution in California's Bay Area," Environmental Defense Fund, accessed July 28, 2021, <https://www.edf.org/media/new-study-reveals-large-and-unequal-health-burden-air-pollution-californias-bay-area>.
 58. "Climate Change & Health," 35.

Recommendations

Protecting Texans from the health impacts of climate change requires both short- and long-term action at the local, state, and national levels. We need large-scale cooperation and a cultural shift in economics and society to address the climate crisis and prioritize prevention and preparation.

FEDERAL RECOMMENDATIONS⁵⁹

- **Make investments that do no harm.** Investments must not fund or enable infrastructure and programs that worsen climate change or that harm health and exacerbate health inequities.
 - Reject investments in new fossil fuel infrastructure: The IPCC and the International Energy Agency have stated that we cannot meet our climate goals if we build new fossil fuel infrastructure.⁶⁰ Climate change and pollution from fossil fuels are already harming people. We need to stop making the problem worse.
 - Ensure that public investments do not subsidize the use of newer technologies to enhance and enable fossil fuel extraction and generation.⁶¹
- Ensure that projects funded with public resources meet strong environmental and labor standards and prioritize the use of materials and products with the lowest carbon, methane, and toxicity footprints to minimize unintended adverse health consequences.⁶²
- **Invest in clean, non-combustion renewable energy.** A clean electricity standard that achieves 100 percent renewable electricity by 2035 and rapid reductions in natural gas and coal use is necessary to drive a nationwide transition to pollution-free sources like wind, solar, geothermal, and tidal energy. To protect health equity, clean energy legislation should not include offset credits that would allow for increased pollution in communities

59. Many of our “Federal Recommendations” have been taken from a September 8, 2021, sign-on letter to Members of Congress shared with us by the American Lung Association. We would like to thank them for their help, in particular with this section of our report.

60. International Energy Agency (IEA) states we have to refrain from new oil, gas or coal development if the world is to reach net-zero emissions by 2050: “Net Zero by 2050 – Analysis,” IEA, accessed October 14, 2021, <https://www.iea.org/reports/net-zero-by-2050>; Leaked IPCC report draft. *The Guardian*: Fiona Harvey and Giles Tremlett, “Greenhouse Gas Emissions Must Peak within 4 Years, Says Leaked UN Report,” *The Guardian*, August 12, 2021, sec. Science, <https://www.theguardian.com/environment/2021/aug/12/greenhouse-gas-emissions-must-peak-within-4-years-says-leaked-un-report>.

61. For example, tax incentives for carbon capture and sequestration can allow oil and gas companies to improve drilling and revenue. “Why Green Groups Are Split on Subsidizing Carbon Capture Technology,” Yale E360, accessed October 14, 2021, <https://e360.yale.edu/features/why-green-groups-are-split-on-subsidizing-carbon-capture-technology>.

62. See example of Buy Clean Law: “Buy Clean California Act,” accessed October 14, 2021, <https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act>; “Clean Products Standard: A New Approach to Industrial Decarbonization,” *Rhodium Group* (blog), accessed October 14, 2021, <https://rhg.com/research/clean-products-standard-industrial-decarbonization/>.

already experiencing poor air quality.⁶³

- Provide long-term tax incentives for clean energy, energy efficiency, and clean transportation, including direct pay options.⁶⁴
- Provide funding to harden and modernize the electric grid, including grid storage, so that the grid is resilient to climate disasters.⁶⁵
- Remove direct and indirect fossil fuel subsidies and put a price on greenhouse gas emissions that reflects true social costs.⁶⁶
- **Make investments that advance health equity and environmental justice.** Ensure that at least 40 percent of investments are delivered to disadvantaged communities. Require and support robust community engagement in the allocation of investment dollars.
- **Establish long-term clean energy tax incentives.** Paired with a clean electricity standard, ten-year tax incentives for clean electricity, energy storage, and transmission will help drive innovation and deployment of pollution-free energy.
- **Make investments to substantially increase active and public transportation and other non-polluting forms of transportation.**
 - Improve public transit through funding for capital costs, operational improvement, growth of transit agencies, and addressing the public transit maintenance backlog.⁶⁷
 - Fund connected walking, biking, and trails infrastructure and programs and policies to make walking, biking, and wheeling safer to reduce pedestrian and bicyclist injuries and fatalities.⁶⁸
 - Support the transition of transit and school bus fleets to domestically manufactured zero-emission vehicles.⁶⁹
 - Build electric vehicle charging infrastructure through grants, rebates, and improved tax credits for 500,000 EV

63. "Biden's Climate Change Plan Calls for Carbon-Free Electricity by 2035 - The Washington Post," accessed October 14, 2021, <https://www.washingtonpost.com/climate-environment/2020/07/30/biden-calls-100-percent-clean-electricity-by-2035-heres-how-far-we-have-go/>.

64. "FACT SHEET: The American Jobs Plan Supercharges the Future of Transportation and Manufacturing," The White House, May 18, 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/05/18/fact-sheet-the-american-jobs-plan-supercharges-the-future-of-transportation-and-manufacturing/>.

65. "Modernizing the Electric Grid: State Role and Policy Options," accessed October 14, 2021, <https://www.ncsl.org/research/energy/modernizing-the-electric-grid-state-role-and-policy-options.aspx>.

66. "Wyden, Colleagues Introduce Legislation to Overhaul Energy Tax Code, Create Jobs, Combat Climate Crisis | The United States Senate Committee on Finance," accessed October 14, 2021, <https://www.finance.senate.gov/chairmans-news/-wyden-colleagues-introduce-legislation-to-overhaul-energy-tax-code-create-jobs-combat-climate-crisis>.

67. "FACT SHEET," May 18, 2021.

68. Rails-to-Trails Conservancy, "The INVEST in America Act of 2021 Is a Major Step Forward for Active Transportation," accessed October 14, 2021, <https://www.prnewswire.com/news-releases/the-invest-in-america-act-of-2021-is-a-major-step-forward-for-active-transportation-301310327.html>; Conservancy; Rails-to-Trails Conservancy, "Not Found," Rails-to-Trails Conservancy, accessed October 14, 2021, <http://www.railstotrails.org/traillblog/2021/june/08/the-invest-in-america-act-of-2021-is-a-major-step-forward-for-active-transportation/>.

69. "Health Professionals Letter: Support Federal Investments to Electrify National School Bus Fleet | American Lung Association," accessed October 14, 2021, <https://www.lung.org/policy-advocacy/take-action/action-alerts/school-bus-letter>; "Padilla, Warnock, Cárdenas, Hayes Introduce Clean Commute for Kids Act," *Senator Alex Padilla* (blog), accessed October 14, 2021, <https://www.padilla.senate.gov/newsroom/press-releases/padilla-warnock-cardenas-hayes-introduce-clean-commute-for-kids-act/>; "Sen. Booker, Rep. McEachin Announce Reintroduction of The Environmental Justice Legacy Pollution Cleanup Act | U.S. Senator Cory Booker of New Jersey," accessed October 14, 2021, <https://www.booker.senate.gov/news/press/sen-booker-rep-mceachin-announce-reintroduction-of-the-environmental-justice-legacy-pollution-cleanup-act>.

charging stations, ensuring that equitable access is prioritized in planning.⁷⁰

- Fund freight electrification and diesel emissions reductions from ports and freight vehicles and equipment.⁷¹
- Expand accessible urban passenger rail while avoiding additional pollution in hardest-hit communities.⁷²
- Promote transportation equity and help reconnect communities that have suffered from community severance due to infrastructure construction.⁷³
- **Make investments that strengthen health care and public health infrastructure, capacity, and climate resilience.** We need our health care and public health systems to be fully prepared and able to meet the needs of the American people in the face of the worsening health impacts of climate change.
 - Establish a core public health infrastructure program to ensure that state, local, tribal, and territorial health departments have the tools, workforce,

and systems in place to address existing and emerging health threats—including climate change—and reduce health inequities.⁷⁴

- Support hospitals and other critical health facilities, including the Veterans Health Systems, Indian Health Service, and other federal health facilities, to plan and prepare for climate-related risks, including provisions to ensure reliable power and water supplies during disasters; prioritize funding for tribal, territorial, safety net, and rural hospitals that support the most vulnerable communities.⁷⁵
- Expand home and community-based services to help protect seniors and people with disabilities from the health harms of climate change, while providing opportunities and security for home health workers.⁷⁶
- Include training and career pathways to family-sustaining jobs in health care and public health in a newly established

70. "FACT SHEET," May 18, 2021.

71. "Port Electrification Benefits the Local Economy and Environment While Providing New Electric Load for Utilities | ICF," accessed October 14, 2021, <https://www.icf.com/insights/energy/port-electrification-benefits-the-local-economy-and-environment-while-providing-new-electric-load-for-utilities>; "Road to Clean Air - Electric Vehicle Report," accessed October 14, 2021, <https://www.lung.org/clean-air/electric-vehicle-report>; "DOE Announces \$162 Million to Decarbonize Cars and Trucks," Energy.gov, accessed October 14, 2021, <https://www.energy.gov/articles/doe-announces-162-million-decarbonize-cars-and-trucks>.

72. "Seth Moulton Introduces Bill to Create \$205 Billion High-Speed Rail across the U.S.," accessed October 14, 2021, <https://www.lowellsun.com/2021/03/12/seth-moulton-reintroduces-bill-to-create-205-billion-high-speed-rail-across-the-u-s/>; "Moulton Rolls Out National High-Speed Rail Plan | U.S. Congressman Seth Moulton," accessed October 14, 2021, <https://moulton.house.gov/press-releases/moulton-rolls-out-national-high-speed-rail-plan>.

73. "FACT SHEET: The American Jobs Plan," The White House, March 31, 2021, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>.

74. Patty Murray, "S.674 - 117th Congress (2021-2022): Public Health Infrastructure Saves Lives Act," legislation, March 10, 2021, 2021/2022, <https://www.congress.gov/bill/117th-congress/senate-bill/674>; "Van Hollen, Murray Re-Introduce Public Health Infrastructure Save Lives Act As New Report Looks At Gaps In Preparedness | U.S. Senator Chris Van Hollen of Maryland," accessed October 14, 2021, <https://www.vanhollen.senate.gov/news/press-releases/van-hollen-murray-re-introduce-public-health-infrastructure-save-lives-act-as-new-report-looks-at-gaps-in-preparedness>; "Press Releases | Press | Ranking Member's Newsroom | Ranking Member | The U.S. Senate Committee on Health, Education, Labor & Pensions," accessed October 14, 2021, <https://www.help.senate.gov/ranking/newsroom/press/murray-introduces-legislation-to-build-and-maintain-core-public-health-infrastructure-needed-to-save-lives-fight-threats-like-covid-19->

75. "America's Health Organizations Call on Congress to Invest in Protecting and Promoting Health in Response to the Climate Crisis," accessed October 14, 2021, <https://climatehealthaction.org/cta/call-for-investments/>.

76. "FACT SHEET," March 31, 2021.

Civilian Climate Corps. Corps participants could play an important role in helping to identify and assist those most vulnerable to climate impacts and help communities build capacity to protect and promote health in the era of climate change.

- **Make investments in parks and greenspace, trees and urban forestry, and green infrastructure.** Expand funding for tree canopy and urban forestry, parks, green school yards, and green infrastructure.⁷⁷
- **Make investments that build community resilience to climate change and ensure that homes, schools, hospitals, and community buildings are carbon-neutral and able to sustain the impact of severe weather events and other consequences of a rapidly changing climate.**
 - Reduce the energy cost burden for low-income households through support for weatherization, energy retrofits, energy efficiency, and targeted energy assistance, especially in disadvantaged communities, multi-family housing, and low-income households.⁷⁸
 - Support community resilience hubs to protect against the health impacts of climate-related extreme weather such as heat and wildfire smoke events and to coordinate services and resources after natural hazard events.
- Provide funding for cool and green roofs, cool pavements, and greening to reduce risks from the urban heat island.⁷⁹
- **Make investments that assure access to clean and affordable drinking water for all and to ensure that our wastewater and stormwater infrastructure are adequate to meet the rising threats of climate change.**
 - Assure access to clean and affordable drinking water for everyone and protections for communities vulnerable to drought.⁸⁰
 - Ensure wastewater and stormwater infrastructure adequate to protect from the rising risk of floods and prioritizing the use of green infrastructure.⁸¹
- **Build healthy and sustainable food and agricultural systems.**
 - Fund sustainable agro-ecological practices that reduce reliance on environmentally damaging agricultural practices.
 - Support research to enable climate resilient and healthy food systems and land management.
- **Support programs that assure that workers**

77. "Sen. Booker, Rep. McEachin Announce Reintroduction of The Environmental Justice Legacy Pollution Cleanup Act | U.S. Senator Cory Booker of New Jersey"; OA US EPA, "EPA Announces \$50 Million to Fund Environmental Justice Initiatives Under the American Rescue Plan," News Release, July 9, 2021, <https://www.epa.gov/newsreleases/epa-announces-50-million-fund-environmental-justice-initiatives-under-american-rescue>.

78. "Cities Are Working to Boost Renewables - What about Energy Efficiency?," accessed October 14, 2021, <https://www.aceee.org/blog-post/2021/08/cities-are-using-emerging-model-boost-renewables-what-about-energy-efficiency>; "Clean Infrastructure Investment Could Boost Jobs by 400k for Years," accessed October 14, 2021, <https://www.aceee.org/press-release/2021/06/energy-saving-infrastructure-investments-could-boost-jobs-400000-years>.

79. "Bill Text - AB-585 Climate Change: Extreme Heat and Community Resilience Program.," accessed October 14, 2021, https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB585; Virginia Hewitt, Eric Mackres, and Kurt Shickman, "Cool Policies for Cool Cities;," n.d., 53

80. "FACT SHEET," March 31, 2021.

81. "Sen. Booker, Rep. McEachin Announce Reintroduction of The Environmental Justice Legacy Pollution Cleanup Act | U.S. Senator Cory Booker of New Jersey."

and communities do not suffer from the legacy health impacts of fossil fuels.

- Continue provision of Black Lung Disability Trust Fund benefits to miners disabled by black lung disease and their families.⁸²
- Fully fund the abandoned mine lands program to clean up polluting coal and uranium mines.⁸³
- Plug and reclaim dangerous orphaned oil and gas wells that endanger nearby communities by polluting their air and water.⁸⁴
- Provide funding and policy support for pollutant monitoring efforts and protect citizens' ability to sue environmental offenders. Ensure accountability for emission malfunctions and have the EPA work with state governments, such as the Texas Commission on Environmental Quality, to guarantee accurate monitoring and reporting of pollutants.

TEXAS AND LOCAL RECOMMENDATIONS

- **Make evidence-based climate action plans.** Cities with plans include Houston, Austin, and Dallas.⁸⁵ Both rural and urban centers should have climate action plans with diversity, inclusion, and equity integrated into implementation.⁸⁶ City, county, regional, and statewide governments should analyze all current and new policies as to their climate impact with formal, written "climate impact statements" similar to "fiscal impact statements" and make sure that policies do not worsen climate change and pose a threat to health. The federal government should offer incentives and support for entities that receive funding and have climate action plans with specific steps being taken to reduce carbon emissions, air and water pollution, plastic use, and waste. Government programs can collaborate with community organizations to increase green space, reduce pollution, train workers for new green jobs, and educate people. These plans should also address and prepare for "climate refugees."
- **Shift to renewable energy.** This should be

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82. "H.R.3876 - 116th Congress (2019-2020): Black Lung Benefits Disability Trust Fund Solvency Act," webpage, July 23, 2019, 2019/2020, <https://www.congress.gov/bill/116th-congress/house-bill/3876>.
83. "Sen. Booker, Rep. McEachin Announce Reintroduction of The Environmental Justice Legacy Pollution Cleanup Act | U.S. Senator Cory Booker of New Jersey."
84. "Sen. Cramer Leads Bipartisan Bill to Create Oil & Gas Jobs by Plugging Orphaned Wells Across America," accessed October 14, 2021, <https://www.cramer.senate.gov/news/press-releases/sen-cramer-leads-introduction-of-bipartisan-bill-to-create-oil-and-gas-sector-jobs-by-plugging-orphaned-wells-across-america>; "FACT SHEET," March 31, 2021.
85. "Austin Climate Equity Plan | SpeakUp Austin!," accessed July 30, 2021, <https://www.speakupaustin.org/community-climate-plan>; "Austin Community Climate Plan | AustinTexas.Gov," accessed July 30, 2021, <http://austintexas.gov/page/austin-community-climate-plan>; "Cities Connecting Children to Nature Initiative | AustinTexas.Gov," accessed July 30, 2021, <https://www.austintexas.gov/department/cities-connecting-children-nature-initiative>; "Home | Dallas Climate Action | City of Dallas," Dallas Climate, accessed July 30, 2021, <https://www.dallasclimateaction.com>; "Green Houston - Office of Sustainability," accessed July 30, 2021, <http://greenhoustontx.gov/>.
86. "Cities," Race to Zero, accessed July 30, 2021, <https://racetozero.unfccc.int/system/cities/>; "Cities: A 'cause of and Solution to' Climate Change," UN News, September 18, 2019, <https://news.un.org/en/story/2019/09/1046662>; "Austin, TX Is Taking Action on Climate Change," Global Covenant of Mayors, accessed July 30, 2021, <https://www.globalcovenantofmayors.org/cities/usa/united-states/austin-tx/>; "Race to Zero Pledge Form," accessed July 30, 2021, https://www.c40knowledgehub.org/s/race-to-zero-pledge-form?language=en_US.

done on a large scale by integrating the energy grid of Texas with the rest of the U.S., rapidly transitioning the grid to clean renewable energy, ending subsidies for fossil fuels, cleaning up existing coal plants, and transitioning to electric vehicles. Using renewable energy such as solar, geothermal and wind, instead of fossil fuels, reduces emissions and air pollution, slows global warming, and prevents many of the harmful health impacts of climate change. Climate disasters in Texas and California have shown that a greener and more electrified grid must be paired with upgrades in efficiency and storage where homes become their own power plants by connecting and contributing to the energy grid.

- If all power grids transition to 90 percent clean energy, this would nearly eliminate emissions from the U.S power sector, decrease carbon emissions by 88 percent, and reduce exposure to nitrogen oxide by 96 and sulfur dioxide emissions by 99 percent by 2035. This could prevent 85,000 premature deaths and save \$1.2 trillion in costs in the next 30 years. When considering environmental and health costs, a clean power grid is a lower cost option than the current power grid.⁸⁷ This can be accomplished by ending state subsidies for coal fired plants, enacting a coal tax, and implementing a moratorium on fossil fuel plants. Any existing plants should be retrofitted with technology to reduce air

pollution and ultimately retired.

- Small changes can also become effective when done on the state-wide level. For example, if all school buses and public transportation are shifted to electric, this dramatically decreases the amount of diesel exhaust and contaminants. Heavy duty trucks and buses are the largest contributor of nitrogen oxide and particulate pollution despite only representing four percent of all vehicles on the road. All trucks and buses should be zero-emissions. This would save 57,000 lives (especially impacting populations of color and persons living in urban areas and near highways), decrease air pollution, create jobs, and save almost half a trillion dollars in health costs by 2050 nationally.⁸⁸
- **Hold companies accountable for violating the law.**
 - Legislators need to eliminate the affirmative defense loophole which allows polluters to face no repercussions for illegal pollution if they file a report claiming the emissions were not foreseeable or the operator did everything they could to avoid it.⁸⁹ In 2019, private companies in Texas released illegal air pollution every single day, but only three percent of emission events received a fine from Texas Commission on Environmental Quality (TCEQ).⁹⁰ Penalties for polluting

87. "Health & Environment," *2035 The Report* (blog), accessed July 28, 2021, <https://www.2035report.com/electricity/health-environment/>.

88. "New Report Finds Clean Trucks and Buses Will Save Thousands of Lives and Billions of Dollars, Slash Air Pollution, Create Jobs," Environmental Defense Fund, accessed July 28, 2021, <https://www.edf.org/media/new-report-finds-clean-trucks-and-buses-will-save-thousands-lives-and-billions-dollars-slash>.

89. "What Is the Affirmative Defense?," accessed July 30, 2021, <https://onebreathhou.org/newsroom/2021/03/industrial-air-pollution-texas-law-affirmative-defense-loophole/>.

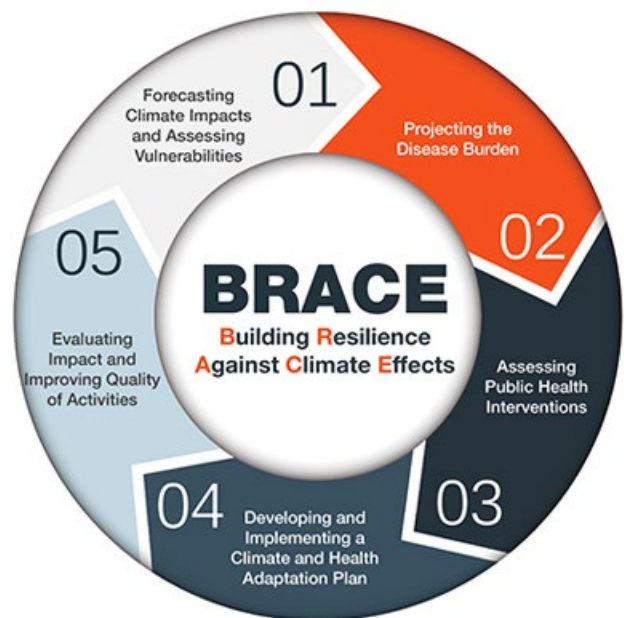
90. "What Is the Affirmative Defense?"

and transparent, accessible reporting of emissions—with revocation of permits after repeat violations—will encourage corporate compliance.

- For accurate assessment and tracking of air pollution, Texas needs to fund a sufficient number and appropriate placement of regulatory-quality air monitors and actively seek ongoing stakeholder input (focusing on stakeholders from communities most impacted by air pollution).
- The TCEQ needs to improve enforcement of air quality standards and enforce existing laws.
- **Increase the state’s public health climate change preparedness.** Adequate funding for public health, environmental monitoring, incident management, and healthcare resource readiness are needed to prepare for changes that are now inevitable and can strengthen collaborations between stakeholders. Health care systems need to have the capacity to respond to increasing demand and prepare for the real possibility that emergency room and hospital resources will be overwhelmed during climate disasters. Preventative measures can reduce long-term costs. A 2019 study found that illegal air pollution alone cost Texas \$241 million per year.⁹¹ On the other hand, climate action now can dramatically cut health care costs and create millions of jobs in the new Green Economy.⁹²
- **Promote sustainable and resilient food systems and farms.** The loss of farmland

to development and low wages for farm laborers means food production is decreasing. An emphasis on local farms means a smaller carbon footprint, a robust local economy, more jobs, and increased access to healthy produce.⁹³ Legislation should focus on incentivizing sustainable farms.

- **Ensure access to safe and affordable drinking water and a sustainable water supply.** Droughts and natural disasters mean water can become limited or contaminated. The water system should be protected and reinforced, to ensure accessible water for all Texans.



*Building Resilience Against Climate Effects (BRACE) Framework
Source: Centers for Disease Control and Prevention*

- **Prioritize environmental equity and justice.** Since climate change is intertwined with equity, local governments should have a health equity officer that helps to integrate equity issues into policies and plans. This

91. Fraser, “Illegal Air Pollution in Texas,” 23.

92. “Clean Energy Investment Could Create 10 Million Green Jobs,” World Economic Forum, accessed August 6, 2021, <https://www.weforum.org/agenda/2021/07/clean-energy-investment-green-jobs/>.

93. “A Sustainable Food System Is a Local Food System | AustinTexas.Gov,” accessed August 9, 2021, <https://austintexas.gov/blog/sustainable-food-system-local-food-system>.

should be coupled with education on systemic racism and structural inequities which affect resilience and recovery. The CDC's Building Resilience Against Climate Effects framework is one tool that state agencies can use to assess vulnerabilities, focus on high-risk populations, and then follow with interventions.⁹⁴

- **Promote widespread public education efforts.** Education and climate action buy-in is pivotal to impactful change. Texas legislators and state agencies should require all public education institutions to provide climate change education and information for students to improve scientific, environmental, and climate literacy.

INDIVIDUAL RECOMMENDATIONS

While by far the greatest impact on climate change is the result of governmental and corporate actions, individuals, too, can play a role in building a healthier and greener future.

- Bike, walk, reduce air travel, and use public transportation to lessen the effect of travel on climate change.
- Choose a plant-based diet to improve health and mitigate the effects of the meat industry on carbon levels. The environmental cost of beef is \$7.26 per kilo (\$16.01 per lb) while the plant-based alternative is \$0.48 (\$1.06 per lb). As of 2018, meat consumption releases 1.7 gigatonnes of CO2 emissions; however a ten

percent move to plant-based dietary sources by 2030 could reduce CO2 emissions by 176 million tonnes.⁹⁵

- Take action at the household and community level to increase use of electric vehicles, weatherize homes, and install solar.
- Take a deep dive into personal emissions using the EPA's carbon footprint calculator and find ways to reduce one's carbon footprint.⁹⁶

RECOMMENDATIONS FOR THE TEXAS HEALTH CARE COMMUNITY

- **Focus on climate health preparedness.** Educate patients on the health impacts of climate change and encourage dialogue about air quality, pollution, extreme weather events, physical and mental health, and how to take action to prevent adverse health outcomes.⁹⁷ Provide direct clinical guidance, such as "climate action prescriptions," to patients about the steps they can take to address the health impacts of climate change in their lives. This could include preparation for increased heat, flooding, and extreme weather events; addressing household mold, structural damage, and water quality; preventing vector-borne diseases; monitoring air quality or using air quality apps and taking preventive action on poor air quality days.
- **Acknowledge, address, and treat the mental health impacts of climate change.** The mental

94. "Climate and Health - CDC's Building Resilience Against Climate Effects (BRACE) Framework | CDC," September 9, 2019, <https://www.cdc.gov/climateandhealth/BRACE.htm>.

95. "Study Quantifies Game Changing Environmental Effect If Animal Food Is Replaced by Plant-Based Alternatives," AZoCleantech.com, October 22, 2020, <https://www.azocleantech.com/news.aspx?newsID=28229>. A "tonne" is another term for a metric ton.

96. US EPA, "Carbon Footprint Calculator | Climate Change | US EPA."

97. "Policy Statement Archives," *Physicians for Social Responsibility* (blog), accessed August 8, 2021, <https://www.psr.org/blog/resource/ama-policy-on-climate-change-education-for-healthcare-professionals-medical-students/>.

health effects of climate change, including trauma or stress stemming from a climate event, can be complex and are likely to increase. Health care providers should be well-informed, establish a connection and discuss patients' concerns, and offer practical steps to help mitigate persistent fear and encourage personal climate responsibility. Integrating mental health care into annual check-ups with a focus on chronic stress and climate-induced trauma can help identify patients who may be struggling.

- **Advocate for investments in health care infrastructure in preparation for the health effects of climate change.** The health effects of climate change are likely to contribute to higher demand on emergency rooms and for doctors trained to recognize and treat heat-related illnesses, vector-borne diseases, and other conditions related to a warming planet. Texas and the health care community should perform environmental health assessments to ensure health care systems are ready to treat patients impacted by natural disasters and other effects of climate change.

- **Recognize climate change as a public health emergency.**⁹⁸ Looking at climate change as a public health concern brings awareness by providing a fresh perspective. The strong inter-connectedness of health, climate change, and equity means a constellation of unknown and unresearched health problems that we have not seen before will become more common. There needs to be a widespread public health response.
- **Take an active role in achieving the state, federal, and individual recommendations in this report.** For example, physicians can get involved in the implementation of climate action plans, especially at the community level. They should advocate for climate action: join climate action advisory committees and help draft policies, strategies, and legislation; advance medical education on climate change; write articles, op-eds, letters to the editor; develop and implement eco-friendly clinical practice procedures; gather key medical data to advance the study of the impact of climate change on health; and model personal health practices.

98. Wellbery, "Climate Change Health Impacts."

Conclusion

Texans have always been independent, hardworking, and resilient people. Now is the time like no other, when we must band together to solve problems that are bigger than ourselves as individuals, bigger than the great state of Texas. The health impacts of climate change threaten the futures of every single one of us. Now is the time to act, on a personal, professional, local, state, and national level, for our children and grandchildren, and for every Texan to come.

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