

Climate Change Basics

March 2022



Top Line

Scientists strongly agree that climate change is real, and action is urgent. This paper lays out the facts.

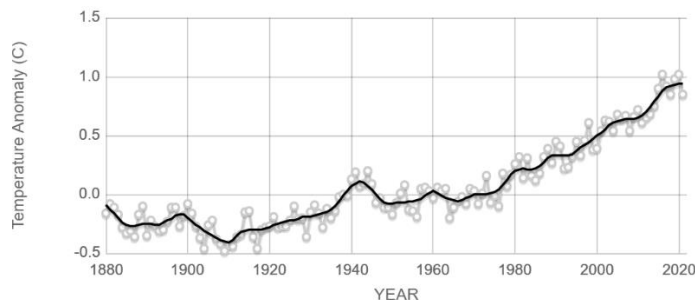
1. Climate change is happening now
2. Human activity is a major cause of climate change
3. Action is needed quickly to avoid the worst effects of climate change.
4. Affordable, effective actions are available.
5. Most Americans agree that climate change is a serious issue, and support actions to address it.

We need leaders who respect science and will take responsible action for the future of our planet.

Background

1. Climate change is happening now

- a. **NASA reports that Global Temperatures are increasing.**
 - NASA reports that since the early 1900's, global temperatures have increased about 1 degree Centigrade (1.6 degrees Fahrenheit) (1)
 - The 20 hottest years on record have all occurred since 1998.



Source: climate.nasa.gov

Source: NASA, at <https://climate.nasa.gov/vital-signs/global-temperature/>

- b. NOAA – the National Oceanic and Atmospheric Administration (a part of the US Government) states (2):
- “Impacts from climate change are happening now.”
 - “These impacts extend well beyond an increase in temperature, affecting ecosystems and communities in the United States and around the world.”
 - “Things that we depend upon and value — water, energy, transportation, wildlife, agriculture, ecosystems, and human health — are experiencing the effects of a changing climate.”
- c. National Geographic reports (3):
- **“The planet is warming**, from North Pole to South Pole. Since 1906, the global average surface temperature has increased by more than 1.6 degrees Fahrenheit (0.9 degrees Celsius)”
 - **“Ice is melting worldwide**, especially at the Earth’s poles. This includes mountain glaciers, ice sheets covering West Antarctica and Greenland, and Arctic sea ice.”
 - “In Montana's Glacier National Park the **number of glaciers has declined** to fewer than 30 from more than 150 in 1910”.
 - **“Global sea levels are rising** 0.13 inches (3.2 millimeters) a year, and the rise is occurring at a faster rate in recent years”.
 - **“Precipitation (rain and snowfall) has increased** across the globe, on average. Yet some regions are experiencing more **severe drought**, increasing the risk of wildfires, lost crops, and **drinking water shortages**”.
 - **“Some species—including mosquitoes, ticks, jellyfish, and crop pests—are thriving**. Booming populations of bark beetles that feed on spruce and pine trees, for example, have devastated millions of forested acres in the U.S.”

2. Human activity is a major cause of climate change

- a. **NASA identifies the following human effects (4):**
- Human activities (primarily the burning of fossil fuels) have fundamentally increased the concentration of greenhouse gases in Earth’s atmosphere, warming the planet.
 - Scientists attribute the global warming trend observed since the mid-20th century to the human expansion of the “greenhouse effect” — warming that results when the atmosphere traps heat radiating from Earth toward space.
 - Humans have increased atmospheric CO₂ concentration by 48% since the Industrial Revolution began. This is the most important long-lived “forcing” of climate change.
 - *(More explanation on the science of climate change and greenhouse gases can be found on the NASA website at <https://climate.nasa.gov/causes/>)*

- b. **NASA also reports that this increase in greenhouse gases, caused by human activity, has caused the planet to warm (4).**
- “In its Fifth Assessment Report (2013), the Intergovernmental Panel on Climate Change, a group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded there's a more than 95 percent probability that human activities over the past 50 years have warmed our planet”.
 - “The panel also concluded there's a better than 95 percent probability that human-produced greenhouse gases such as carbon dioxide, methane and nitrous oxide have caused much of the observed increase in Earth's temperatures over the past 50 years”.
 - Natural drivers (such as changes in the sun’s radiation) can’t explain the warming. “Natural drivers, without human intervention, would push our planet toward a cooling period”.
- a. **The American Association for the Advancement of Science**, which describes itself as “the world's largest multidisciplinary scientific society”, has issued “**What We Know**”, a pdf document that summarizes the science on climate change. (17)
- “Based on well-established evidence, about 97% of climate scientists have concluded that human-caused climate change is happening.
 - This agreement is documented not just by a single study, but by a converging stream of evidence over the past two decades from surveys of scientists, content analyses of peer-reviewed studies, and public statements issued by virtually every membership organization of experts in this field.
 - The sooner we act, the lower the risk and cost.
 - **...we consider it to be our responsibility as professionals to ensure, to the best of our ability, that people understand what we know: human-caused climate change is happening, we face risks of abrupt, unpredictable and potentially irreversible changes, and responding now will lower the risk and cost of taking action.”**

3. Action is needed quickly to avoid the worst effects of climate change

- a. National Geographic identifies the following results that could occur this century if warming continues (6):
- Sea levels are expected to rise between 10 and 32 inches (26 and 82 centimeters) or higher by the end of the century.

- Hurricanes and other storms are likely to become stronger. Floods and droughts will become more common. Large parts of the U.S., for example, face a higher risk of decades-long "megadroughts" by 2100.
 - Less freshwater will be available, since glaciers store about three-quarters of the world's freshwater.
 - Some diseases will spread, such as mosquito-borne malaria
 - Ecosystems will continue to change: Some species will move farther north or become more successful; others, such as polar bears, won't be able to adapt and could become extinct.
- b. As noted above, we have already increased global temperatures by about 1 degree C, and we are likely to reach 2 degrees C within the next few decades if we continue on our current course. Scientists warn that a 2 degree C increase would have very negative effects, including (7):
- "The world will be a lot drier, which will impact economies, agriculture, infrastructure, and weather patterns.
 - Rising temperatures will damage ecosystems and species that cannot adapt, including those in coral reefs and Arctic areas.
 - Low-lying coastal regions and small islands worldwide are at risk of disappearing as sea levels rise due to the Greenland ice sheet and polar ice melting at continuously faster rates.
 - 2 degrees Celsius could determine the existence of whole nations".
- c. In June 2016 a group of 31 non-partisan scientific organizations issued an open letter to Congress, calling for action on climate change (8).
- The open letter states: "Observations throughout the world make it clear that climate change is occurring, and rigorous scientific research concludes that the greenhouse gases emitted by human activities are the primary driver... To reduce the risk of the most severe impacts of climate change, greenhouse gas emissions must be substantially reduced"
 - Signatories to the letter include the American Chemical Society, American Meteorological Society, Geological Society of America, American Public Health Association, and the American Association for the Advancement of Science.
- d. Southern and coastal states are most at risk (9).
- **Texas:**
 - According to analysis by Climate Central, Texas is in the top 10 most at-risk states for climate change, including risks of **extreme heat and wildfires**.
 - Texas faces the highest overall **drought** threat of any state.
 - Texas has also done very little to prepare, receiving a grade of F for its climate change preparation efforts to date.

- **Florida:**
 - Florida and California have the largest populations vulnerable to **inland flooding**.
 - Florida and Louisiana face the greatest risk of **coastal flooding**.
- **Arizona:**
 - Arizona is one of the top four states with a growing threat of **wildfires**.
 - Arizona is also at risk for even more intense **heat waves and droughts**.

4. **Affordable, effective actions are available**

- a. National Geographic explains that solutions to climate change are already known (10):
 - Addressing climate change will require many solutions—there's no magic bullet.
 - **Yet nearly all of these solutions exist today, and many of them hinge on humans changing the way we behave, shifting the way we make and consume energy.**
 - For example,
 - improvements to energy efficiency and vehicle fuel economy,
 - increases in wind and solar power,
 - biofuels from organic waste,
 - setting a price on carbon,
 - and protecting forests
 are all potent ways to reduce the amount of carbon dioxide and other gases trapping heat on the planet.
 - While halting new greenhouse gas emissions is critical, scientists have also emphasized that we need to extract existing carbon dioxide from the atmosphere...planting trees, restoring seagrasses, and boosting the use of agricultural cover crops could help clean up significant amounts of carbon dioxide.
- b. Corporations, investors, local governments, universities, and faith-based organizations are already taking action.
 - **The “We Are Still In” Declaration** is a statement signed by 3,800 governments, businesses, universities, and non-profits in the US (as of March 2022) (11). It affirms that the participating organizations are committed to the goals of the Paris Climate Accord. The Declaration states:
 - “In the absence of leadership from Washington, states, cities, counties, tribes, colleges and universities, healthcare organizations, businesses and investors, representing a sizeable percentage of the U.S. economy will pursue ambitious climate goals, working together to take forceful action and to ensure that the U.S. remains a global leader in reducing emissions”.

- “It is imperative that the world know that in the U.S., the actors that will provide the leadership necessary to meet our Paris commitment are found in city halls, state capitals, colleges and universities, investors, and businesses.
 - Together, we will remain actively engaged with the international community as part of the global effort to hold warming to well below 2°C and to accelerate the transition to a clean energy economy that will benefit our security, prosperity, and health”.
- Major organizations have signed the “We Are Still In” Declaration, affirming their commitment to do their part to fulfill the Paris objectives, even if the US government pulls out of the Paris Agreement (as the Trump Administration attempted to do). This includes (11):
 - **Over 2300 businesses and investors**, including major companies such as Amazon, Citi, DuPont, eBay, Facebook, Google, IBM, and Tesla (9).
 - **Over 400 colleges and universities**, including Columbia, Duke, MIT, and the Universities of Delaware, Iowa, Maryland, and California.
 - **Over 900 faith-based organizations**, including the Presbyterian Church USA, United Methodist Women, the Association of US Catholic Priests, and many Jewish, Catholic and Protestant congregations and organizations.
 - The Global Covenant of Mayors for Climate and Energy includes over **11,000 cities and local governments**, in 139 countries (12).
 - They are working toward “a resilient and low-emission society.”
 - The organization is working on collecting data, providing ideas for climate finance, and conducting and sharing research on effective climate actions.
 - You can search for specific cities to see if they are members of the Covenant, at <https://www.globalcovenantofmayors.org/our-cities/?search-city=>

5. **Most Americans agree that climate change is a serious issue and support actions to address it.**

- a. The Yale Program on Climate Change Communication has surveyed Americans about climate change for several years. They find that concern about climate change has been increasing in recent years. Some key findings from the 2021 survey (13):
 - 76% of Americans think global warming is happening. Only 12% think it isn’t happening.
 - 60% of Americans understand that global warming is mostly human-caused
 - 70% of Americans are at least “somewhat worried” about global warming
 - 74% of Americans believe that global warming will hurt future generations of people.

- b. Gallup reported in March 2019 (14):
- 65% of Americans are worried about global warming – 43% “a great deal” and 22% “a fair amount”.
 - 64% of Americans believe global warming is due mainly to “the effects of pollution from human activities.”
 - Concern varies widely by political party identification. 91% of Democrats worry a great deal or a fair amount, vs. 67% of Independents and 32% of Republicans.
 - Younger and more highly educated Americans are more likely to worry about global warming, and to understand that it is caused by human activities.
- c. A survey by Pew Research found that a solid majority of Americans want the government to do more to address climate change (15):
- 65% of Americans believe the Federal government is “doing too little to reduce the effects of climate change”.
 - Strong majorities support specific policies to address climate change:
 - 90% support “planting about a trillion trees to absorb climate emissions”
 - 84% support providing a tax credit to businesses for developing carbon capture/storage
 - 80% support tougher restrictions on power plant carbon emissions
 - 73% support taxing corporations based on their carbon emissions
 - 71% support tougher fuel efficiency standards for cars.
 - Although support for these policies is strongest among Democrats, a majority of Republican/Lean Republican voters support them as well.
- d. **State and local opinions** – The Yale research provides data by state, county, and US congressional district on how Americans view climate change and climate change policies. (16)
- For example, 72% of Americans in total believe global warming is happening based on Yale’s surveys.
 - At the state level, this percentage is well above 50% in every state. 72% of respondents in Texas and Arizona agree with this, and 73% of respondents in Florida.
 - By Congressional district, a solid majority in all districts in these three states believe that climate change is happening.
 - The Yale program also gauges support for specific policies by state, county, and US congressional district.
 - Overall, 66% of Americans support a carbon tax. This is 64% in Texas, 63% in Arizona, and 65% in Florida.
 - **Overall, a majority of Americans support a wide range of climate policies, in every state, and in almost every county and congressional district.**

More Information

1. The US Government’s “National Climate Assessment” provides a clear, in-depth discussion of climate change causes, effects, and solutions. The 4th Assessment, issued in 2018, is at <https://nca2018.globalchange.gov/>.
2. American Association for the Advancement of Science, “What We Know” – a good summary of the science and the scientific consensus around climate change, <http://whatweknow.aaas.org/get-the-facts/>.
3. NASA Climate Change website - <https://climate.nasa.gov/>
4. MIT’s “A Plan for Action on Climate Change”, a detailed 18 page report on actions the university is taking now. <http://web.mit.edu/climateaction/ClimateChangeStatement-2015Oct21.pdf>
5. Yale Program on Climate Change Communication – Research reports on Americans’ attitudes about climate change and climate action - <https://climatecommunication.yale.edu/>.
 - a. This site includes an interactive map of the US showing data about climate change perspectives by state, county, and US Congressional district (for example, what percent of people in Harris county, Texas, believe climate change is happening?), at <https://climatecommunication.yale.edu/visualizations-data/ycom-us/>
 - b. The site also includes a report on Public Support for International Climate Action, at <https://climatecommunication.yale.edu/wp-content/uploads/2021/10/public-support-international-climate-action-september-2021.pdf>

Sources

1. NASA – Vital Signs of the Planet - <https://climate.nasa.gov/vital-signs/global-temperature/>
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3. National Geographic – Causes and Effects of Climate Change - <https://www.nationalgeographic.com/environment/global-warming/global-warming-effects/>
4. NASA – The Causes of Climate Change - <https://climate.nasa.gov/causes/>
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9. Climate Central, “States at Risk”, November 2015, <https://www.climatecentral.org/news/states-at-risk-preparedness-report-card-19690>
10. National Geographic, “Global Warming Solutions”, <https://www.nationalgeographic.com/environment/global-warming/global-warming-solutions/>
11. “We Are Still In” Declaration website, <https://www.wearestillin.com/we-are-still-declaration>
12. Global Compact of Mayors for Climate & Energy Website, <https://www.globalcovenantofmayors.org/>
13. Yale Program on Climate Change Communication – “Climate Change in the American Mind” - September 2021 - <https://climatecommunication.yale.edu/wp-content/uploads/2022/03/climate-change-american-mind-september-2021b.pdf>
14. Gallup, “Are Americans Concerned about Global Warming?”, October 5, 2021 - <https://news.gallup.com/poll/355427/americans-concerned-global-warming.aspx>
15. Pew research, “Two-Thirds of Americans Think Government should to more on Climate”, June 23, 2020, <https://www.pewresearch.org/science/2020/06/23/two-thirds-of-americans-think-government-should-do-more-on-climate/>
16. Yale Program on Climate Change Communication, Yale Climate Opinion Maps 2021, <https://climatecommunication.yale.edu/visualizations-data/ycom-us/>