



Debatetrack



Climate Change
Impact Brief

Notes Brief

- **Sections:** This brief is broken down into 3 sections:
 1. **Links:** things that *cause or contribute to* climate change
 2. **Link Blocks:** rebuttals to link arguments
 3. **Impacts:** why climate change is bad
 4. **Impact Turns:** why climate change is good
 - **caution** – saying ‘climate change is good’ will be unpopular with most judges / circuits
- **Purpose:** This brief is intended to be:
 1. **A starting point:** Please continue researching interesting & relevant areas as you make cases.
 2. **A toolbox:** Not all of the cards in this brief will be useful to you—use them at your discretion.
- **Navigation:** please use the Navigation Panel to view this brief (View→ Navigation Pane in Word)
- **Mistakes:** please let me know if you find any mistakes! Especially glaring ones. I’m happy to correct and re-release the brief as an updated version.
- For questions, comments or suggestions on evidence, please reach out to **Joel:** joel@debate-track.com

Research Assistant

Elene Tsertsvadze is currently pursuing her master’s degree in International Human Rights and Development at London South Bank University. She is originally from Tbilisi, Georgia, where she completed her undergraduate studies in Law with a minor in International Relations. Elene has passed the Bar Qualification Exam of Georgia and the Qualification Examination of the Prosecutor’s Office. Prior to her master’s studies, Elene gained valuable experience working at the Department of Legal Provision and Research in the Constitutional Court of Georgia.

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Links

Big Companies

A few big companies, mainly in oil, gas, and coal, have caused most of the climate crisis by producing nearly two-thirds of greenhouse gases.

Goldenberg 13 - [Goldenberg, Suzanne. "Just 90 Companies Caused Two-Thirds of Man-Made Global Warming Emissions." The Guardian. The Guardian. November 20, 2013. <https://www.theguardian.com/environment/2013/nov/20/90-companies-man-made-global-warming-emissions-climate-change>.]

[Suzanne Goldenberg is a Canadian-born author and journalist currently employed by The Guardian as their United States environmental correspondent. As The Guardian's United States environmental correspondent, she has been commended for her work on climate change and other environment issues.]

The climate crisis of the 21st century has been caused largely by just 90 companies, which between them produced nearly two-thirds of the greenhouse gas emissions generated since the dawning of the industrial age, new research suggests.

The companies range from investor-owned firms – household names such as Chevron, Exxon and BP – to state-owned and government-run firms.

The analysis, which was welcomed by the former vice-president Al Gore as a "crucial step forward" found that **the vast majority of the firms were in the business of producing oil, gas or coal, found the analysis, which has been published in the journal Climatic Change.**

"There are thousands of oil, gas and coal producers in the world," climate researcher and author Richard Heede at the Climate Accountability Institute in Colorado said. "But the decision makers, the CEOs, or the ministers of coal and oil if you narrow it down to just one person, they could all fit on a Greyhound bus or two."

Half of the estimated emissions were produced just in the past 25 years – well past the date when governments and corporations became aware that rising greenhouse gas emissions from the burning of coal and oil were causing dangerous climate change.

Gore in his comments said the analysis underlined that it should not fall to governments alone to act on climate change.

Between them, **the 90 companies on the list of top emitters produced 63% of the cumulative global emissions of industrial carbon dioxide and methane between 1751 to 2010, amounting to about 914 gigatonne CO2 emissions, according to the research.** All but seven of the 90 were energy companies producing oil, gas and coal. The remaining seven were cement manufacturers.

The largest of the investor-owned companies were responsible for an outsized share of emissions. Nearly 30% of emissions were produced just by the top 20 companies, the research found.

ChevronTexaco was the leading emitter among investor-owned companies, causing 3.5% of greenhouse gas emissions to date, with Exxon not far behind at 3.2%. In third place, BP caused 2.5% of global emissions to date.

Cities

Cities are significant contributors to climate change, accounting for the majority of energy consumption and greenhouse gas emissions, posing disproportionate risks to urban populations.

United Nations 21 - [United Nations. "Cities and Pollution." United Nations. United Nations. 2021. <https://www.un.org/en/climatechange/climate-solutions/cities-pollution>.]

[The United Nations is an international organization founded in 1945. Currently made up of 193 Member States, the UN and its work are guided by the purposes and principles contained in its founding Charter. The UN has evolved over the years to keep pace with a rapidly changing world.]

Cities are major contributors to climate change. According to UN Habitat, **cities consume 78 per cent of the world's energy and produce more than 60 per cent of greenhouse gas emissions.** Yet, they account for less than 2 per cent of the Earth's surface.

The sheer density of people relying on fossil fuels makes urban populations highly vulnerable to the effects of climate change. **Fewer green spaces exacerbate the problem.** According to the IPCC report, limiting global warming to 1.5 degrees Celsius would "require rapid and far-reaching transitions in uses of energy, land, urban and infrastructure (including transport and buildings), and industrial systems."

An added challenge is the projection, in a UN report, that another 2.5 billion people will reside in urban areas by 2050; nearly 90 per cent of them in cities in Asia and Africa. The good news is that cities around the world have already begun to take measures to reduce greenhouse gas emissions and are putting policies in place that encourage the use of alternative energy sources. Efforts by policy makers and administrators to address climate change, however, will need to accelerate to keep pace with population growth and the rapid climate change.

The effects of climate change are worse among poor and low-income communities, in part because many live on the margins of society, in unstable structures, and in areas more susceptible to flooding, landslides, earthquakes, but also because of inadequate capacities, inadequate resources and reduced access to emergency response systems. This is even more pronounced in developing countries.

To address the issue of climate change in cities, UN-Habitat, UNEP, the World Bank and Cities Alliance have established the Joint Work Programme to assist cities in developing countries to mainstream environmental considerations into urban policymaking.

Pollution, mostly associated as a by-product of urban landscapes, is also linked with climate change. Both climate change and air pollution are exacerbated by the burning of fossil fuels, which increase CO2 emissions, the cause of global warming.

In October 2018, the World Health Organization (WHO) said in a report that 93 per cent of the world's children breathe toxic air every day. According to the report, 1.8 billion children breathe air that is so polluted it puts their health and development at serious risk. WHO estimates that in 2016, 600,000 children died from acute lower respiratory infections caused by polluted air.

Colonialism

The IPCC's latest report acknowledges the role of colonialism in exacerbating the effects of climate change.

Mercer 22 – [Mercer, Harriet. “Colonialism: Why Leading Climate Scientists Have Finally Acknowledged Its Link with Climate Change.” The Conversation. April 22, 2022. <https://theconversation.com/colonialism-why-leading-climate-scientists-have-finally-acknowledged-its-link-with-climate-change-181642>.]

[Harriet Mercer has completed PhD at the University of Oxford in 2021 and currently hold a postdoctoral research position as part of the Making Climate History project at the University of Cambridge. He has a particular interest in understanding the changing ways atmospheric data has been collected, analysed, and represented over time.]

The International Panel on Climate Change (IPCC)‘s sixth and latest report on the impact of global warming on our planet, published earlier this month, reiterates many of its predecessors’ warnings: chiefly that climate change threatens global disaster if we do not act to avert it. Yet it contains one key difference. **For the first time in the institution’s history, the IPCC has included the term “colonialism” in its report’s summary.**

Colonialism, the report asserts, has exacerbated the effects of climate change. In particular, historic and ongoing forms of colonialism have helped to increase the vulnerability of specific people and places to the effects of climate change.

The addition of one new term to the IPCC’s lexicon might not seem significant. But colonialism is a deeply complex word. Referring to the practice of acquiring full or partial control over another group’s territory, it can include the occupation of that land by settlers as well as the economic exploitation of land to benefit the colonising group.

In Australia, where I come from, British colonists invaded Aboriginal people’s land in the late 18th century and have since worked to establish a permanent settlement there. This was not a peaceful process. **It involved violent acts of dispossession including widespread massacres of Aboriginal and Torres Strait Islander people, the forced removal of those people from their land, and the forced separation of children from their families.**

Researchers have shown, for example, that the scale of bushfires in Australia today – including the catastrophic fires of 2019-20 – is not being exacerbated by climate change alone. It’s also amplified by the colonial displacement of Indigenous people from their lands and the disruption of their land management practices that skilfully used controlled burning to help landscapes flourish.

This is why it’s significant that the term colonialism is not only included within the full, more technical part of the latest report. It’s also included within the concise “summary for policymakers”, the most widely cited and read part of the IPCC’s reports.

By connecting climate change to colonialism in this summary, the IPCC is sending a message to the governments and policymakers of the world that addressing the effects of climate change cannot be achieved without also addressing the legacies of colonialism.

Deforestation

Cutting down tropical forests releases stored carbon and worsens global warming. Protecting and restoring these forests is vital not just for fighting climate change but also for preserving wildlife and supporting sustainable development.

Union of Concerned Scientists 21 - [Union of Concerned Scientists. "Tropical Deforestation and Global Warming." Union of Concerned Scientists. November 10, 2021. <https://www.ucsusa.org/resources/tropical-deforestation-and-global-warming>.]

[The Union of Concerned Scientists (UCS) is a national nonprofit organization founded more than 50 years ago by scientists and students at the Massachusetts Institute of Technology. The Union of Concerned Scientists puts rigorous, independent science into action, developing solutions and advocating for a healthy, safe, and just future.]

The trees of tropical forests, like all green plants, take up carbon dioxide from the atmosphere and release oxygen during photosynthesis. They also carry out the opposite process—known as respiration—but when forests are growing, photosynthesis exceeds respiration, and the surplus carbon is stored in tree trunks and roots and in the soil. This is called “sequestration.”

When forests are cut down, much of that stored carbon is released into the atmosphere again as carbon dioxide (CO₂). This is how deforestation and forest degradation contribute to global warming.

The consensus among climate scientists is that CO₂ from tropical deforestation now makes up less than 10 percent of global warming pollution. **This percentage has gone down in recent decades, partly due to some success in reducing deforestation, but also because greenhouse gases from burning fossil fuels—by far the principal cause of climate change—have continued to increase.**

The planet’s largest areas of tropical forest are the Amazon basin in South America, the Congo Basin in Central Africa, and Southeast Asia. The amount of deforestation, and its causes, are quite different in these three regions.

Amazonia has both the largest area of tropical forest and the highest rate of deforestation.

Clearing forest to produce commodity crops, especially pasture for beef cattle and cropland for soybeans, is a main driver.

Ending deforestation alone will not stop climate change—urgent action is needed to reduce the other 90 percent of emissions. But neither can the need to protect tropical forests, and grow them back where they’ve been cleared, be ignored.

It’s now known that even mature tropical forests sequester carbon; they took over a billion tons of heat-trapping gases out of the atmosphere in the 1990s and early 2000s. And young secondary forests—those growing back after clearing—make up about 28 percent of tropical forest area. Their potential sequestration is conservatively estimated at about 40 percent as much as would be achieved by ending deforestation, making them an important additional “natural climate solution.”

And ending deforestation and restoring forests has other benefits beyond reducing global warming pollution. Tropical forests are home to many unique species of animals and plants that risk extinction if we do not protect their habitat.

Tropical forests help regulate regional rainfall and prevent both floods and droughts. Reducing deforestation is not only a beneficial action against global warming—it also can make important contributions to saving biodiversity and supporting sustainable development.

Fossil Fuels and Carbon Sinks

Burning fossil fuels releases greenhouse gases, while the destruction of carbon sinks reduces the Earth's capacity to absorb carbon dioxide.

Salovey & Strobel 21 - [Salovey, Peter. Scott, Strobel. "Yale Experts Explain Climate Change | Yale Sustainability." Sustainability.yale.edu. June 25, 2021. <https://sustainability.yale.edu/explainers/yale-experts-explain-climate-change>.]

[Peter Salovey is the twenty-third president of Yale University and the Chris Argyris Professor of Psychology. He holds secondary faculty appointments in the School of Management, the School of Public Health, the Institution for Social and Policy Studies, and the Sociology Department.

Scott Strobel was appointed Yale University Provost in 2020. As Provost, he serves as the university's chief academic and chief budgetary officer, responsible for setting and advancing Yale's academic and research priorities. Provost Strobel is also the Henry Ford II Professor of Molecular Biophysics and Biochemistry (MB&B).]

"The fundamental changes to the stability of our climate are primarily due to the burning of fossil fuels like oil, coal, and natural gas, which started at a mass scale during the Industrial Revolution," Massie says.

Dan Esty, Hillhouse Professor of Environmental Law and Policy at the Yale School of the Environment and Yale Law School, explains that **when we burn fossil fuels to do things like power our homes and vehicles and engage in most agricultural and manufacturing processes, we emit greenhouse gases.** Often referred to as "GHGs", these gases act like a heat-trapping blanket over the planet and prevent the heat that comes from sunlight from leaving the atmosphere.

"In addition to emitting greenhouse gases, another contributor to climate change is our destruction of carbon sinks, or places that would naturally store this carbon for us and keep it out of the atmosphere," Esty says. **"Plants and trees, for example, are natural carbon sinks. When we have a forest that is cut or burned down, we lose a sink, and we therefore lose some of the ability of the earth to absorb carbon dioxide."**

"The cultural and social context for the climate crisis is critical. Inevitably, the burning of fossil fuels as our primary source of energy both comes from and reinforces basic social understandings and practices developed over time: how human beings have come to relate to the rest of the natural world and to each other. **At the heart of this lies a culture of exploitation—the sense that the rest of nature exists, inexhaustibly, for human use alone—and that some human beings similarly exist as resources for others with more social power.** Colonization, rigid racial hierarchies, and the simultaneous fetishization and abuse of coal miners are examples of exploitation and dehumanization in our history and culture. These dynamics are deeply bound up with the fossil fuel economy," Massie says. "Therefore, the entire organization of society and culture can also be usefully understood as the cause of climate change."

Greenhouse Gases

Greenhouse gases, like carbon dioxide, trap heat in the Earth's atmosphere, leading to global warming and significant implications for climate, ecosystems, and human societies.

Hong Kong Observatory n.d. [Hong Kong Observatory. "Causes of Climate Change." Www.hko.gov.hk. https://www.hko.gov.hk/en/climate_change/human_activities.htm.]

[The Hong Kong Observatory is a government department responsible for monitoring and forecasting weather, as well as issuing warnings on weather-related hazards. The Observatory also provides other meteorological and geophysical services to meet the needs of the public, special users, the shipping and aviation communities.]

The heat content at the surface of the Earth is mainly derived from the Sun. **When solar radiation (visible light) reaches the Earth, part of it is reflected back to space by bright surfaces (e.g. sea ice and clouds), and part of it heats up the Earth.** The Earth's surface emits infra-red radiation to space and the Earth cools. **If the heating and cooling of the Earth are comparable, the long-term mean temperature of the Earth will remain more or less unchanged.**

If the Earth has no atmosphere, laws of physics suggest that the average surface temperature of the Earth would be around -18°C .

But the Earth does have an atmosphere. Gases in the air (e.g. carbon dioxide) hinder the radiation of heat from the Earth to space, absorb part of the infra-red radiation emitted from the Earth and then re-emit energy in all directions, also in the form of infra-red radiation. Part of the infra-red radiation will escape to space but part of it will go back to the Earth, heating up the surface. This is known as the greenhouse effect, and the gases known as greenhouse gases. In the current situation, the average surface temperature of the Earth is around 15°C .

Increase in greenhouse gases concentration causes a reduction in the outgoing infrared radiation, allowing heat energy to accumulate on Earth and leading to warming of the climate system.

Warming at the Earth's surface is one of the indicators of a warming climate. A rise in the Earth's surface temperature will induce many other changes. Some of these changes may even act to enhance the warming (positive feedbacks). For instance, climate warming leads to reduction of sea ice and snow cover, exposing more ocean and land surfaces. Since sea water and land have lower reflectivity than sea ice and snow, the Earth's capability of absorbing solar energy will increase. The ocean and land absorb more heat and warm, promoting further reduction of sea ice and snow cover in a vicious cycle. According to the IPCC Sixth Assessment Report, the global mean surface temperature in 2081–2100 is very likely higher than the average of 1850–1900 by $3.3\text{--}5.7^{\circ}\text{C}$ under the very high (SSP5-8.5) greenhouse gas emissions scenario. Global warming will bring changes not just to the climate patterns and natural systems, but will also have implications for human activities, societies and civilization as we know it.

Human Activities

Human activities, particularly the burning of fossil fuels, are the primary cause of climate change, leading to widespread impacts such as rising temperatures, extreme weather events, and environmental harm.

United Nations 23 - [United Nations. Myth Busters. [online] United Nations. Available at: <https://www.un.org/en/climatechange/science/mythbusters.>]

[The United Nations is an international organization founded in 1945. Currently made up of 193 Member States, the UN and its work are guided by the purposes and principles contained in its founding Charter. The UN has evolved over the years to keep pace with a rapidly changing world.]

Climate change is already affecting every region on Earth. Changes in rainfall patterns, rising sea levels, melting glaciers, a warming ocean, and more frequent and intense extreme weather events are just some of the changes already impacting millions of people.

Natural changes in the sun's activity or large volcanic eruptions have caused ancient shifts in the Earth's temperatures and weather patterns, but over the last 200 years, these natural causes have not significantly affected global temperatures. Today, **it's human activities that are causing climate change, primarily due to the burning of fossil fuels like coal, oil, and gas.**

Burning fossil fuels creates a blanket of pollution trapping the sun's heat on Earth and raising global temperatures. (Global warming then leads to other changes like droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, intense storms and declining biodiversity.)

Multiple independent studies over the past 19 years have found that **between 90 and 100 per cent of scientists agree that humans are responsible for climate change, with most of the studies finding a 97 per cent consensus.**

The Synthesis Report by the Intergovernmental Panel on Climate Change (IPCC), released in March 2023, **categorically confirmed that human activity is the overwhelming cause of climate change.** The IPCC's comprehensive assessments are written by hundreds of leading scientists from around the globe, with contributions from thousands of experts, and endorsed by the governments of every country in the world.

Greenhouse gases, such as carbon dioxide, from human activities are responsible for approximately 1.1°C of warming since 1850-1900. This has already caused significant changes in the climate, including more extreme weather events, which have caused widespread harm to people and nature.

If global warming exceeds 1.5°C above pre-industrial levels, there will be more heat waves, longer warm seasons and shorter cold seasons. At 2°C of global warming, extreme heat would more often cross critical tolerance thresholds with devastating impacts on agriculture and human health. Increasing changes to wetness and dryness, to winds, snow and ice, coastal areas and oceans, will affect different regions in different ways.

Natural Changes

Natural factors such as volcanic eruptions and variations in solar radiation play a significant role in climate change

Met Office 19 - [Met Office. "Causes of Climate Change." Met Office. November 29, 2019. <https://www.metoffice.gov.uk/weather/climate-change/causes-of-climate-change>.]

[The Met Office is the UK's national weather service. It provides weather and climate-related services to the Armed Forces, government departments, the public, civil aviation, shipping, industry, agriculture and commerce. Met Office is an executive agency, sponsored by the Department for Science, Innovation and Technology.]

The climate on Earth has been changing since it formed 4.5 billion years ago. **Until recently, natural factors have been the cause of these changes.** Natural influences on the climate include volcanic eruptions, changes in the orbit of the Earth, and shifts in the Earth's crust (known as plate tectonics).

Over the past one million years, the Earth has experienced a series of ice ages, including cooler periods (glacials) and warmer periods (interglacials). Glacial and interglacial periods cycle roughly every 100,000 years, caused by changes in Earth's orbit around the sun. For the past few thousand years, Earth has been in an interglacial period with a constant temperature.

However, since the Industrial Revolution in the 1800s, the global temperature has increased at a much faster rate. By burning fossil fuels and changing how we use the land, **human activity has quickly become the leading cause of changes to our climate.**

The leading cause of climate change is human activity and the release of greenhouse gases. However, there are lots of natural causes that also lead to changes in the climate system.

Natural cycles can cause the climate to alternate between warming and cooling. There are also natural factors that force the climate to change, known as 'forcings'. Even though these natural causes contribute to climate change, we know that they are not the primary cause, based on scientific evidence.

Some of these natural cycles include:

- Milankovitch cycles – As Earth travels around the sun, its path and the tilt of its axis can change slightly. **These changes, called Milankovitch cycles, affect the amount of sunlight that falls on Earth. This can cause the temperature of Earth to change.** However, these cycles take place over tens or hundreds of thousands of years and are unlikely to be causing the changes to the climate that we are seeing today.
- El Niño Southern Oscillation (ENSO) – ENSO is a pattern of changing water temperatures in the Pacific Ocean. **In an 'El Niño' year, the global temperature warms up, and in a 'La Niña' year, it cools down. These patterns can affect the global temperature for a short amount of time** (months or years) but cannot explain the persistent warming that we see today.

Natural forcings that can contribute to climate change include:

- Solar irradiance – **Changing energy from the sun has affected the temperature of Earth in the past.** However, we have not seen anything strong enough to change our climate. Any increase in solar energy would make the entire atmosphere of Earth warm, but we can only see warming in the bottom layer.

Debate Track: Evidence Packet (Abolish P5 Status) - Climate Change Impacts

Resolved: The United Nations should abolish permanent membership on its Security Council.

- Volcanic eruptions – **Volcanoes have a mixed effect on our climate. Eruptions produce aerosol particles that cool Earth, but they also release carbon dioxide, which warms it.** Volcanoes produce 50 times less carbon dioxide than humans do, so we know they are not the leading cause of global warming. On top of this, cooling is the dominant effect of volcanic eruptions, not warming.

Older People

Older people emit more greenhouse gases due to their consumption patterns

EU Science Hub 23 - [Eu Science Hub. "Demography and Climate Change: New Study Explores Links between the Two Mega-Trends of Our Century." Joint-Research-Centre.ec.europa.eu. July 28, 2023. https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/demography-and-climate-change-new-study-explores-links-between-two-mega-trends-our-century-2023-06-05_en.]

[Scientists of the European Commission's Joint Research Centre (JRC) carry out research in various fields to provide independent advice to EU policymakers and put science at the heart of European policies. The JRC provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society.]

The world population has reached 8 billion, and will continue to grow for the next 40 years.

This is happening in parallel with rapid changes in our climate.

A new Joint Research Centre (JRC) study explores the connections, opportunities and challenges of demographic and climate change.

Population growth is projected to reach almost 10 billion people by 2060.

Almost by definition, this will have a strong effect on global emissions: More people consume more resources, emit more greenhouse gases and require larger-scale food production, all of which exacerbate emission levels and rising temperatures.

However, the relationship between population size and climate change is neither linear nor straightforward.

The report shows that emissions tend to be closely linked to the level of income, but also the age profile of consumers. **Older people tend to emit more, as they often live in smaller households and have their consumption concentrated on carbon-intensive needs such as heating or electricity of the houses.**

Research also shows that older generations are also less likely to believe that climate change is a very serious problem and less open to changing their personal behaviours.

As the European population ages, the older generations will be more and more responsible for the overall emissions. **The scientists estimate that by 2060, 39% of total emissions will be produced by people above 65.**

In the EU, intergenerational differences in consumption, attitudes and behaviours add new dimensions to the already strong differences in the responsibility of emissions across income levels.

Therefore, it will be more and more important to tackle these differences, and target policy measures for energy efficiency and green transitions for the older generations.

Overpopulation and Agriculture

Overpopulation exacerbates climate change by increasing demand for resources like food, leading to deforestation, pollution from fossil fuels, and water scarcity.

Peluso 22 - [Peluso, Cody. "How Are Population Growth and Climate Change Related?" Population Media Center. December 2, 2022.

<https://www.populationmedia.org/the-latest/population-growth-and-climate-change.>]

[Cody is specialized in a participatory approach to marketing, advocacy, and community building. He constantly involves PMC team members in his content creation role, with a goal to share more stories and voices across PMC's public media channels. Prior to PMC, Cody has spent 15 years working in marketing roles across governments, non-profits, trade groups, unions, and political campaigns.]

Two of the major concerns facing the world today are overpopulation and climate change.

Overpopulation is directly contributing to climate change, and that, in turn, is causing devastating effects, especially in communities with less wealth.

Overpopulation is filling our dumps with plastic, overpopulation is causing deforestation across the world, overpopulation is causing massive pollution by dependence on fossil fuels.

Overpopulation means more factory farms, more consumption and the earth cannot handle much more. In my humble opinion, one can't address climate change without addressing sustainable populations.

People need food to survive, and as the world's population grows, so too does the demand for food. To meet this demand, **agricultural development has caused deforestation on a large scale. The shrinking forests are unable to counteract the effects of the increasing carbon emissions, causing temperatures to rise.** This, in turn, has caused desertification, especially in the already vulnerable Middle East and North Africa (MENA) region.

Because of the increased need for agriculture, precious water resources are being used to grow food, leading to less water available for human consumption. Agricultural water use tends to consume water at a rate greater than natural processes can replenish it, causing further loss of water and increased desertification.

The relationship between population growth and climate change is obvious, and to combat the worst effects of climate change, the overpopulation problem must be dealt with – by empowering women and girls. Failure to do so will cause frustration and setbacks in the battle against climate change. The first step must be to recognize the population growth problem and its impact on climate change. By doing so, efforts can be directed to slow the rate of population growth, leading to improving the health and well-being of billions of people and far more success in dealing with climate change.

Rich People

The richest tenth of people, who use about 20 times more energy than the poorest tenth, are mostly responsible for the climate crisis.

Harrabin 20 - [Harrabin, Roger. 'The Rich Are to Blame for Climate Change.' *BBC News*, March 16, 2020, sec. Business. <https://www.bbc.co.uk/news/business-51906530>.]

[Roger Harrabin is a British journalist who was the BBC's energy and environment analyst until July 2022. He is an honorary Fellow at St. Catharine's College, Cambridge, a visiting fellow at Green Templeton College, Oxford, an Associate Press Fellow at Wolfson College, Cambridge.]

The rich are primarily to blame for the global climate crisis, a study by the University of Leeds of 86 countries claims. **The wealthiest tenth of people consume about 20 times more energy overall than the bottom ten, wherever they live.** The gulf is greatest in transport, where the top tenth gobble 187 times more fuel than the poorest tenth, the research says.

That's because people on the lowest incomes can rarely afford to drive.

The researchers found that the richer people became, the more energy they typically use. And it was replicated across all countries.

The researchers combined European Union and World Bank data to calculate how different income groups spend their money. It found that in transport the richest tenth of consumers use more than half the energy.

The study, published in *Nature Energy*, showed that energy for cooking and heating is more equitably consumed. **But even then, the top 10% of consumers used roughly one third of the total, presumably reflecting the size of their homes.**

Co-author Professor Julia Steinberger, leader of the project at Leeds, asked: "How can we change the vastly unequal distribution of energy to provide a decent life for everyone while protecting the climate and ecosystems?"

Governments could reduce transport demand through better public transport, higher taxes on bigger vehicles and frequent flyer levies for people who take most holidays.

They say another alternative is to electrify vehicles more quickly, although previous studies suggest even then demand for driving must be reduced in order to reduce the strain on resource use and electricity production and distribution.

The study is likely to ignite future UN climate negotiations, where the issue of equity is always bitterly contentious.

Professor Kevin Anderson, from the Tyndall Centre in Manchester, who was not involved in the study, told BBC News: "This study tells relatively wealthy people like us what we don't want to hear.

"The climate issue is framed by us high emitters – the politicians, business people, journalists, academics. When we say there's no appetite for higher taxes on flying, we mean WE don't want to fly less.

"The same is true about our cars and the size our homes. We have convinced ourselves that our lives are normal, yet the numbers tell a very different story," he said.

Short-lived and long-lived climate forcers

Carbon Dioxide and Nitrous Oxide act as long-lived greenhouse gases with long-term effects, but other chemicals like black carbon and methane also contribute shorter-lived changes

Government of Canada 19 - [Government of Canada. "Causes of Climate Change ." Canada.ca. Government of Canada. March 28, 2019. <https://www.canada.ca/en/environment-climate-change/services/climate-change/causes.html>.]

Carbon dioxide is the main cause of human-induced climate change. It has been emitted in vast quantities from the burning of fossil fuels and it is a very long-lived gas, which means it continues to affect the climate system during its long residence time in the atmosphere. **However, fossil fuel combustion, industrial processes, agriculture, and forestry-related activities emit other substances that also act as climate forcers.** Some, such as **nitrous oxide, are long-lived greenhouse gases like carbon dioxide, and so contribute to long-term climate change.** Other substances have shorter atmospheric lifetimes because they are removed fairly quickly from the atmosphere. Therefore, their effect on the climate system is similarly short-lived. Together, these short-lived climate forcers are responsible for a significant amount of current climate forcing from anthropogenic substances. Some short-lived climate forcers have a climate warming effect ('positive climate forcers') while others have a cooling effect ('negative climate forcers').

If atmospheric levels of short-lived climate forcers are continually replenished by ongoing emissions, these continue to exert a climate forcing. However, reducing emissions will quite quickly lead to reduced atmospheric levels of such substances. **A number of short-lived climate forcers have climate warming effects and together are the most important contributors to the human enhancement of the greenhouse effect after carbon dioxide.** This includes methane and tropospheric ozone – both greenhouse gases – and black carbon, a small solid particle formed from the incomplete combustion of carbon-based fuels (coal, oil and wood for example).

Other short-lived climate forcers have climate cooling effects, most notably sulphate aerosols. Fossil fuel combustion emits sulphur dioxide into the atmosphere (in addition to carbon dioxide) which then combines with water vapour to form tiny droplets (aerosols) which reflect sunlight. Sulphate aerosols remain in the atmosphere for only a few days (washing out in what is referred to as acid rain), and so do not have the same long-term effect as greenhouse gases. The cooling from sulphate aerosols in the atmosphere has, however, offset some of the warming from other substances. That is, the warming we have experienced to date would have been even larger had it not been for elevated levels of sulphate aerosols in the atmosphere.

Skepticism

Some Americans doubt the urgency of climate change due to a gap between crisis rhetoric and personal experiences. It leads to a lack of motivation and reluctance to take action, which exacerbates the problem of climate change.

Pasquini et al – 23 [Pasquini, Giancarlo. et al. “Why Some Americans Do Not See Urgency on Climate Change.” Pew Research Center Science & Society. August 9, 2023. <https://www.pewresearch.org/science/2023/08/09/why-some-americans-do-not-see-urgency-on-climate-change>] [Giancarlo Pasquini is a research associate focusing on science and society research at Pew Research Center.]

As the Earth’s temperature continues to rise, fueling more intense storms and extreme weather, scientists are calling for immediate action to address climate change. **However, climate change remains a lower priority for some Americans, and a subset of the public rejects that it’s happening at all.**

The interviews revealed that language describing climate change as a crisis and an urgent threat was met with suspicion by many participants. The disconnect between crisis rhetoric and the participants’ own beliefs and experiences drove doubt about the motivations of the people making these claims, sowing suspicion and deeper mistrust.

Nationally representative Pew Research Center surveys show that **fewer than half of all Americans reject that humans are major contributors to climate change or say addressing the issue is not too important for the country.** Even smaller shares take the most skeptical views and say the Earth is not warming at all and that no action should be taken.

When it comes to policy action, 37% of Americans think addressing climate change should be a top priority for the president and Congress, and another 34% say it is an important but lower priority. By contrast, about three-in-ten say action on climate change is not too important (17%) or should not be done (11%). **Republicans are much less likely than Democrats to prioritize climate action,** though individuals who are skeptical about addressing climate change are seen within both party coalitions and across demographic groups.

A common explanation across interviews was that **any changes to Earth’s climate are a natural part of the planet’s cycles that humans cannot control.** Extreme weather was explained in a similar way, with many saying these events are natural occurrences that have not become more frequent and severe because of climate change.

Most of the 32 interviewees perceived claims of a climate crisis as exaggerated, and they connected this sense of overblown rhetoric with a need for increased scrutiny toward such claims.

Most of the 32 interviewees were in agreement that the Earth’s climate is changing, but they typically explained **these changes as part of natural patterns over time, with humans described as having little control over these changes.** Two interviewees expressed extreme skepticism, calling climate change a “hoax.”

The role of ordinary citizens is to recycle and not be wasteful. With doubts about the urgency of climate change, few participants saw a need for direct personal action on the issue. However, saw value in individual efforts to help protect the environment.

Transportation

Transport poses significant environmental and health challenges, contributing to greenhouse gas (carbon dioxide) emissions, air and noise pollution, particularly in Europe.

European Environment Agency 24 - [European Environment Agency. "Transport and Mobility." Www.eea.europa.eu. January 19, 2024. <https://www.eea.europa.eu/en/topics/in-depth/transport-and-mobility#:~:text=The%20transport%20sector%20causes%20substantial.>]

[European Environment Agency's mandate is to help the EU and its member countries make informed decisions about improving the environment, integrating environmental considerations into economic policies and moving towards sustainability. develop and coordinate Eionet, the network of national environmental bodies set up to help the agency.]

Transport connects people, cultures, cities, countries and continents. **It is one of the main pillars of modern societies and economies, allowing producers to sell their products across the world and travellers to discover new places.** Transport networks also ensure access to key public services, such as education and health, contributing to a better quality of life. Connecting to transport helps boost the economy in remote areas, creating jobs and spreading wealth.

There is, however, a downside to our current transport model. **The transport sector causes substantial negative impacts on the environment and human health. Transport is responsible for about a quarter of the EU's total greenhouse gas (GHG) emissions, and causes air pollution, noise pollution and habitat fragmentation.**

More concretely, it is the only major economic sector in Europe where **GHGs have increased since 1990 and is also the largest contributor to nitrogen oxides emissions, which harm health and the environment.** Similarly, road transport is one of the main sources of environmental noise pollution in Europe.

As demand has increased, so has the overall energy efficiency of new passenger cars, vans and trucks, planes and ships, but not at the same pace as total transport emissions. The sheer volume of transport activity has impacted our GHG emissions and demands on all types of transport are expected to increase.

Trump Policy

The Trump administration dismantled numerous climate policies and environmental regulations that significantly increased carbon dioxide emission and air pollution.

Popovich, Albeck-Ripka & Pierre-Louis 21 - [Popovich, Nadja. Albeck-Ripka, Livia. Pierre-Louis, Kendra. "The Trump Administration Is Reversing Nearly 100 Environmental Rules. Here's the Full List." *The New York Times*, January 20, 2021, sec. Climate. <https://www.nytimes.com/interactive/2020/climate/trump-environment-rollbacks-list.html>.]

[Nadja Popovich is a reporter and graphics editor covering climate change and the environment for The Times.

Livia Albeck-Ripka is a reporter for The New York Times, based in California. She was previously a reporter for The Times's Australia bureau and a James Reston Reporting Fellow on the climate desk in New York City.

Kendra Pierre-Louis is an award winning climate reporter. Her work looks at how our climate is changing and the impact of those changes on people.]

Over four years, the Trump administration dismantled major climate policies and rolled back many more rules governing clean air, water, wildlife and toxic chemicals.

In all, a New York Times analysis, based on research from Harvard Law School, Columbia Law School and other sources, counts nearly 100 environmental rules officially reversed, revoked or otherwise rolled back under Mr. Trump.

The bulk of the rollbacks identified by the Times were carried out by the Environmental Protection Agency, which weakened Obama-era limits on planet-warming carbon dioxide emissions from power plants and from cars and trucks; removed protections from more than half the nation's wetlands; and withdrew the legal justification for restricting mercury emissions from power plants.

In justifying many of the rollbacks, the agencies said that previous administrations had overstepped their legal authority, imposing unnecessary and burdensome regulations that hurt business.

All told, the **Trump administration's deregulatory actions were estimated to significantly increase greenhouse gas emissions over the next decade and lead to thousands of extra deaths from poor air quality each year.**

Many of the rollbacks have been challenged in court by states, environmental groups and others, and some have already been struck down. In the final days of Mr. Trump's term, a federal appeals court overturned a plan to relax Obama-era restrictions on carbon dioxide emissions from coal- and natural gas-burning power plants, arguing that the agency misinterpreted its obligation under the Clean Air Act to reduce carbon pollution.

Unmotivated People

It is difficult for people to feel motivated to take action against climate change because of the multifaceted nature of it.

Markman 18 - [Markman, Art. "Why People Aren't Motivated to Address Climate Change." Harvard Business Review. October 11, 2018.

[https://hbr.org/2018/10/why-people-arent-motivated-to-address-climate-change.](https://hbr.org/2018/10/why-people-arent-motivated-to-address-climate-change)]

[Art Markman, PhD, is the Annabel Irion Worsham Centennial Professor of Psychology and Marketing at the University of Texas at Austin and founding director of the program in the Human Dimensions of Organizations. He has written over 150 scholarly papers on topics including reasoning, decision-making, and motivation.]

People are often highly motivated to avoid threats. If you are walking down a dark, isolated city street, you are vigilant for unexpected sights and sounds and probably pick up the pace to get back to a populated area as quickly as possible. If you step into the street and see a bus bearing down on you, you jump back.

Unfortunately, climate change involves a combination of factors that make it hard for people to get motivated.

First, acting on climate change represents a trade-off between short-term and long-term benefits, which is the hardest trade-off for people to make. Decades of work on temporal discounting point out that we overvalue benefits in the short term relative to benefits in the long term. People don't save enough money for retirement, preferring to spend money now rather than having it in their old age.

Ignoring climate change in the short term has benefits both to individuals and to organizations. Individuals do not have to make changes in the cars they drive, the products they buy, or the homes they live in if they ignore the influence their carbon footprint has on the world. Companies can keep manufacturing cheaper if they don't have to develop new processes to limit carbon emissions. Governments can save money today by relying on methods for generating power that involve combustion rather than developing and improving sources of green energy, even those that are more cost-effective in the long run.

Second, climate change is a nonlinear problem. People are really good at making judgments of linear trends. If you spend \$5 a day on coffee, then it is easy to think about the influence that has on your weekly budget, without needing a spreadsheet.

Third, many effects of climate change are distant from most people. Research on construal level theory argues that people conceptualize things that are psychologically distant from them (in time, space, or social distance) more abstractly than things that are psychologically close. When there are weather disasters that are probably a reflection of climate change (like wildfires or extreme storms), they tend to happen far away from where most people live. **As a result, most people are not forced to grapple with the specifics of climate change, but rather can treat it as an abstract concept. And abstract concepts simply don't motivate people to act as forcefully as specific ones do.**

Fourth, the future is always more uncertain than the present. That is one reason people value the present so much more strongly. After all, if you save a lot of money for retirement, there is no guarantee that you will live long enough to enjoy it. In the case of climate change, there are skeptics who argue that it is not certain that the influence of human activity on climate will have the dire consequences that some experts have projected.

Unsystematic Policies

Environmental policies can have unintended consequences if not carefully planned, which could undermine climate change mitigation efforts.

University of Bonn Researchers 20 - [University of Bonn. "Environmental Policy Often Has Undesirable Side Effects." Phys.org. March 19, 2020. <https://phys.org/news/2020-03-environmental-policy-undesirable-side-effects.html>.]

[The University of Bonn is one of Germany's top universities. Today, the University of Bonn is among the world's leading research universities.]

"Good intentions" do not generally produce "good results." This wisdom also applies to establishing coherent environmental policies. **Without proper oversight and planning, environmental policies can lead to unintended and harmful side effects.**

Bioplastics is frequently understood as synonymous with green, sustainable and environmentally friendly alternatives to petroleum based plastic products. After all, plant based raw materials are produced on land and unregulated agricultural expansion often leads to the conversion of natural, such as tropical forests. This jeopardizes climate change mitigation efforts, because forests bind considerably more carbon than, for instance, corn or sugar cane plantations. Hence, the unintended consequences of promoting "green" products through ill-designed environmental policies, could potentially lead to more harm than good for the global climate, not to mention other consequences, such as rising food prices and biodiversity loss.

Policies intended to combat climate change and environmental destruction often produce impacts that planners had not anticipated in the design phase. "It is therefore important to assess potential undesired consequences in advance and, if necessary, adjust or even pull the plug before it's too late," emphasizes Dr. Jan Börner, who holds the Chair of Economics of Sustainable Land Use and Bioeconomy at the University of Bonn. "To this end, we have to get better at understanding how these so-called spillover effects occur and how they can be minimized. The collection of papers in this special issue contributes to this aim."

Policy design is further complicated when spillovers occur far away from where policy decisions are made. **While the decision to replace fossil fuels with biogenic raw materials has an immediate positive effect on the German carbon emission balance, it also means that Germany has to import more biomass, potentially driving deforestation in regions such as South America and Southeast Asia.** These dynamics have measurably increased the ecological footprint that the EU generates through its imports from other countries, as shown by a study in the special issue. Moreover, these ecological costs usually arise in countries with weak environmental legislation. This can potentially turn a net-benefit of a well-intended environmental policy into a net-cost.

USA

The USA has been responsible for 20% of historical carbon emissions, with a handful of other countries, like China, also contributing a large amount

Evans 21 - [Evans, Simon. "Which Countries Are Historically Responsible for Climate Change?" Carbon Brief. October 5, 2021. <https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change/>.]

[Dr Simon Evans is deputy editor and policy editor. Simon covers climate and energy policy. He holds a PhD in biochemistry from Bristol University and previously studied chemistry at Oxford University. He worked for environment journal The ENDS Report for six years, covering topics including climate science and air pollution.]

History matters because the cumulative amount of carbon dioxide (CO₂) emitted since the start of the industrial revolution is closely tied to the 1.2C of warming that has already occurred.

In total, humans have pumped around 2.500bn tonnes of CO₂ (GtCO₂) into the atmosphere since 1850, leaving less than 500GtCO₂ of remaining carbon budget to stay below 1.5C of warming.

This means that, by the end of 2021, the world will collectively have burned through 86% of the carbon budget for a 50-50 probability of staying below 1.5C, or 89% of the budget for a two-thirds likelihood.

In this article, Carbon Brief looks at national responsibility for historical CO₂ emissions from 1850-2021, updating analysis published in 2019.

In first place on the rankings, **the US has released more than 509GtCO₂ since 1850 and is responsible for the largest share of historical emissions, Carbon Brief analysis shows, with some 20% of the global total.**

China is a relatively distant second, with 11%, followed by Russia (7%), Brazil (5%) and Indonesia (4%). The latter pair are among the top 10 largest historical emitters, due to CO₂ from their land.

Meanwhile, large post-colonial European nations, such as **Germany and the UK, account for 4% and 3% of the global total, respectively, not including overseas emissions under colonial rule.**

These national totals are based on territorial CO₂ emissions, reflecting where the emissions take place. In addition, the analysis looks at the impact of consumption-based emissions accounting in order to reflect trade in carbon-intensive goods and services. Such accounts are only available for recent decades, even though trade will have influenced national totals throughout modern history.

US Governments

U.S. governments failed to adequately prioritize and address climate change, which was influenced by industry pressure and short-term economic goals.

Speth 21 - [Speth, James Gustave. They Knew: How the U.S. Government Helped Cause the Climate Crisis Interview by Bill McKibben. September 15, 2021 <https://e360.yale.edu/features/they-knew-how-the-u-s-government-helped-cause-the-climate-crisis>.]

[James Gustave Speth is an American environmental lawyer and advocate who co-founded the Natural Resources Defense Council. He is Professor of Law at the Vermont Law School and a senior fellow at Demos, the Democracy Collaborative, and the Tellus Institute.]

Few people have followed the climate issue longer or more closely than James Gustave Speth. From his time in Jimmy Carter’s White House — where he issued reports on the imminent dangers of global warming — through his five-decade career as an environmental leader, Speth has consistently sounded the alarm and sought to spur action on climate change.

In the interview, Speth talks about how the government knew about climate change and its impacts as early as the 1970s, when President Carter called for a transition to renewable energy. But the Reagan administration reversed course, keeping the United States on a fossil fuel-dependent path that continued even as the scientific community’s warnings became ever more urgent.

Speth: It’s been enormously frustrating to realize that **if we had started with Carter — this is now more than 40 years ago — and continued after his administration, we could have been on a path, a smooth trajectory of sensible reductions in fossil fuel use, to the point that today we could be approximating getting out of the fossil fuel business.** But of course, that’s not what happened. In fact, our carbon emissions went up in that 40-year period.

McKibben: The story turns very tragic very fast with [President Ronald] Reagan. And you have all the documentation in your book about the particular steps that [the Reagan administration] took.

Speth: **I think there was an ideological component, but of course they were under a lot of pressure from various parts of the fossil fuel industry.** We even see that today, right now, with the industry pressures on Senator [Joe] Manchin [of West Virginia], for example.

This problem, if taken seriously, means that **we’re going to have to have a very strong government intervention, particularly at the federal level, to drive down emissions sharply over time.** The more time we have, the less sharp it has to be. But it still involves major government intervention in the economy. And you may recall that Reagan famously said, “Government is not the solution to our problems. Government is the problem.” **And so this was the anti-government, anti-regulation ideology that drove his administration and that has really been prominent in our politics now for decades.**

McKibben: In some ways, for me, the most tragic parts of your book are the George H.W. Bush and, especially, the Clinton years, when any early momentum on taking action on climate just disappears.

Speth: Yes, the early momentum was reflected in the [U.N.] Climate Treaty [of 1992] and the whole process leading up to that. **I can list 20 major international treaties on the environment that the United States has never ratified.** But Lord, behold, we ratified the Climate Treaty. And it’s one of the

only ones that ever made it into treaty law in the U.S. That was '92, and Clinton and Gore came in right about then, right after George Herbert Walker Bush, and **got nowhere with getting it successfully implemented in the U.S. And that was a great tragedy.**

McKibben: Talk about the Obama years a bit. On the one hand, he was talking eloquently sometimes about climate change, and on the other hand, overseeing the dramatic expansion of natural gas production as a kind of economic panacea to the financial crisis he inherited.

Speth: I think in the first part of the Obama years, Obama's first term, [Chief of Staff] Rahm Emanuel was calling a lot of shots in the White House. **And there was a bipartisan effort in the Congress at that time to promote climate legislation. But Rahm Emanuel just didn't have any interest in getting anything done on this.** I'm not sure why. And basically, the White House did not support vigorously what might have been possible out of the Hill. And I think it was late in the second Obama years when things began to get more serious about climate action. John Podesta came into the White House [as chief of staff], and he was determined to do something, I think. **And they got the Clean Power Plan out, and it was definitely a step forward.**

But at the end, Obama summarized what he thought was important in his accomplishments, and high on his list was promoting fossil fuels in general, and U.S. exports of fossil fuels, and fracking. And this, I think, reflected the grip that this energy economy has on our political life. It's partly the power, political power, and political money of the fossil fuel companies. And it's partly this fear of taking on the ideological right and all the misleading information it provides about scaring people that they're going to lose their jobs and prices are going to go up, and on and on. And partly just the need to keep things growing, and the fear that any move would not only slow growth but perhaps affect the market.

McKibben: Let's end with the one administration you didn't get to, because it's unfolding in front of us. What's your sense for the likeliest outcome of this huge fight unfolding this autumn over [President] Joe Biden's infrastructure bill?

Speth: Well, I do think that it will be a huge fight. I don't have a crystal ball. But the \$3.5 trillion [in spending] has a lot in it that would put us on a good path to dealing with the climate issue. We start with Biden's goals. **Fifty percent below 2005 levels in greenhouse gas emissions by 2030, right around the corner, an ambitious goal.** Net-zero emissions by mid-century. And 100 percent clean power by 2035. I mean **these are ambitious goals.** They signal a sharp turndown in fossil fuel reliance. And I think we need this mass movement that we've talked about and other things to push these goals forward and not lose sight of them.

How it's going to turn out? I really don't know. But I can't imagine a more important moment for planetary history and the history of our country. Because if this flops, it's going to a tremendous tragedy. Because there's nothing in the system that's going to automatically reduce our emissions. And people who hope that something magic is going to change, they're just fooling themselves.

US Healthcare Sector

The healthcare sector contributes significantly to greenhouse gas emissions, especially from hospital care and prescription drugs.

The Commonwealth Fund 22 - [The Commonwealth Fund. "How the U.S. Health Care System Contributes to Climate Change." [www.commonwealthfund.org](https://www.commonwealthfund.org/publications/explainer/2022/apr/how-us-health-care-system-contributes-climate-change). April 19, 2022. <https://www.commonwealthfund.org/publications/explainer/2022/apr/how-us-health-care-system-contributes-climate-change>.]

[The Commonwealth Fund is a private U.S. foundation whose stated purpose is to "promote a high-performing health care system that achieves better access, improved quality, and greater efficiency, particularly for society's most vulnerable, including low-income people, the uninsured, and people of color." It is active in a number of areas related to health care and health policy. It is led by Joseph R. Betancourt, M.D., M.P.H.]

Climate change, possibly the gravest threat facing humanity, is already taking a toll on people's physical and mental health. **While health care systems shoulder the burden of caring for individuals affected by climate change, they also contribute to the problem.**

Worldwide, **the health care sector is responsible for as much as 4.6 percent of total greenhouse gas (GHG) emissions, which include carbon dioxide, methane, and ozone, among others.** In the United States, where the share is 8.5 percent, the health care system is becoming more, not less, polluting: **emissions increased 6 percent from 2010 to 2018.** These emissions exacerbate climate change and its negative health impacts.

Some people believe that health care organizations have an obligation to reduce GHG emissions, given the industry's size, its substantial carbon footprint, and its mission to improve health. Fortunately, there are a number of opportunities for the U.S. health system to do its part in alleviating climate change.

The sectors contributing the most to carbon emissions in the health system are hospital care (36%), physician and clinical services (12%), and prescription drugs (10%). The Greenhouse Gas Protocol offers another way to look at GHG emissions, categorizing them as:

Scope 1: Emissions from sources owned or directly controlled by the health sector, including emissions from health care facilities, such as on-site boilers and certain medical gases. These emissions account for around 7 percent of health sector emissions overall.

Scope 2: Indirect emissions from the generation of energy purchased by health systems, mostly electricity. These account for around 11 percent of emissions related to health care.

Scope 3: All other indirect emissions from the production and transportation of goods and services procured by the health sector, such as those related to pharmaceuticals and other medical products and devices. These account for more than 80 percent of overall health care emissions.

While health systems exert direct control over Scopes 1 and 2 emissions, they can only influence, not control, Scope 3 emissions, by far the largest source of GHGs produced by the health sector. Understanding the different sources of emissions and where health systems could have the most influence is key to deciding how to begin reducing health care's carbon footprint.

Wars

Conflicts can significantly contribute to greenhouse gas emissions by damaging infrastructures and displacing people.

Conflict and Environment Observatory (CEOBS) 21 - [Conflict and Environment Observatory (CEOBS). "How Does War Contribute to Climate Change?" CEOBS. June 14, 2021. <https://ceobs.org/how-does-war-contribute-to-climate-change/>.]

[The Conflict and Environment Observatory (CEOBS) monitors and raises awareness of the environmental dimensions of armed conflicts and military activities. CEOBS was launched in 2018 with the primary goal of increasing awareness and understanding of the environmental and derived humanitarian consequences of conflicts and military activities.]

Many of the environmental and societal changes that occur in conflicts can create new and significant sources of greenhouse gas (GHG) emissions.

Emissions during conflicts are typically a function of how and where conflicts are fought, as well as their intensity. Oil production, storage or transportation infrastructure is often a target of fighting, as has been the case in Colombia, Libya, Syria and Iraq. **Fires and spills generate emissions, and at times oil infrastructure is actively weaponised. It has been estimated that the 1991 Gulf War's oil fires contributed more than 2% of global fossil fuel CO2 emissions that year, with distant and long-lasting consequences.**

The indirect emissions from active conflicts are the hardest to quantify, but perhaps the most significant given that they extend across many sectors, and into the future. **In the early phases of fighting, the main emissions will arise from damaged infrastructure, the loss of vegetation, and delivering humanitarian aid.**

Significant resources are required to deliver food, water and shelter to civilians affected by conflict, and the humanitarian sector has a large carbon footprint. Fuel use is particularly high – in 2017 costing an estimated \$1.2 billion, or 5% of aid expenditure – mainly for logistics and to power the generators delivering vital electricity. **Displaced persons camps can also release carbon following landscape changes, for example the deforestation near the Rohingya camps in Bangladesh, something donors and agencies have sought to address through Nature-based Solutions.**

As a conflict becomes protracted or frozen, some significant sources of anthropogenic emissions can become locked in. Under-development, **a lack of external investment and weak governance can result in old polluting technologies remaining in use, where they might otherwise have been replaced.**

The use of explosive weapons in populated areas can create staggering levels of destruction. This often creates a substantial environmental legacy, including the carbon costs of debris management, the remediation of contaminated areas and reconstruction. **It is estimated that clearing the debris from Aleppo and Homs alone would require more than 1 million truck journeys.**

Beyond the cities, the post-conflict period can see significant changes in land use. This can be as a result of economic development, populations returning to previously insecure areas, or agricultural expansion or conversion. This typically takes place in a weak institutional context with limited rule of law, often leading to harmful environmental change.

Debate Track: Evidence Packet (Abolish P5 Status) - Climate Change Impacts

Resolved: The United Nations should abolish permanent membership on its Security Council.

Link Blocks

AT Obama Policy

The Obama administration's Clean Power Plan imposed higher energy costs without significant environmental benefits.

Loris 17 - [Loris, Nicolas. "Four Big Problems with the Obama Administration's Climate Change Regulations." The Heritage Foundation. October 10, 2017. <https://www.heritage.org/environment/report/four-big-problems-the-obama-administrations-climate-change-regulations>.]

[Nicolas Loris is an economist who focused on energy, environmental, and regulatory issues as the Deputy Director of the Thomas A. Roe Institute for Economic Policy Studies and Herbert and Joyce Morgan fellow at The Heritage Foundation.]

The Trump administration is dismantling President Barack Obama's climate legacy piece by piece, and this week it's taking an axe to arguably the biggest piece.

Under section 111(d) of the Clean Air Act, the Obama EPA formalized regulations to reduce carbon dioxide from existing power plants.

Using a name that surely message-tested well, the **Clean Power Plan had nothing to do with eradicating hazardous pollutants from power generation.** The U.S. already has laws on the books to protect Americans' health from emissions that have adverse environmental impacts.

Instead, the Clean Power Plan regulated carbon dioxide, a colorless, odorless, nontoxic gas, because of its alleged contribution to climate change.

From Day One, Obama's Clean Power Plan was fraught with problems—economically, environmentally, and legally.

For starters, families and businesses would have been hit with more expensive energy bills. The EPA's idea of flexibility would not have softened the economic blow. It merely meant that Americans would have incurred higher costs through different mechanisms.

Environmentally, the climate impact of the Clean Power Plan would have been pointless. According to climatologist Paul Knappenberger:

Even if we implement the Clean Power Plan to perfection, the amount of climate change averted over the course of this century amounts to about 0.02 C. This is so small as to be scientifically undetectable and environmentally insignificant.

Take it from Laurence Tribe, Harvard University professor of constitutional law and a "liberal legal icon" who served in Obama's Justice Department.

Tribe stated in testimony before Congress that the "EPA is attempting an unconstitutional trifecta: usurping the prerogatives of the states, Congress, and the federal courts—all at once. Burning the Constitution should not become part of our national energy policy."

The Clean Air Act was never intended to regulate carbon dioxide and other greenhouse gas emissions.

AT Volcanoes

While volcanic eruptions do contribute to atmospheric CO₂ levels, human activities surpass their impact.

NASA 19 - [NASA. "What Do Volcanoes Have to Do with Climate Change? – Climate Change: Vital Signs of the Planet." Climate Change: Vital Signs of the Planet. 2019. <https://climate.nasa.gov/faq/42/what-do-volcanoes-have-to-do-with-climate-change/>.]

[NASA is a U.S. government agency that is responsible for science and technology related to air and space. The Space Age started in 1957 with the launch of the Soviet satellite Sputnik. NASA opened for business on Oct. 1, 1958.]

Volcanic eruptions are often discussed in the context of climate change because they release CO₂ and other gases into our atmosphere. However, the impact of human activities on the carbon cycle far exceeds that of all the world's volcanoes combined, by more than 100 times.

To put it in perspective, **while volcanic eruptions do contribute to an increase in atmospheric CO₂, human activities release an amount of CO₂ equivalent to what a Mount St. Helens-sized eruption produces every 2.5 hours and a Mount Pinatubo-sized eruption twice daily.**

The most significant eruptions come from super volcanoes like Yellowstone or Mount Toba, which erupt very rarely, about every 100,000 to 200,000 years or more. **Yet, the total annual CO₂ emissions from human activities are akin to one or more Yellowstone-sized super eruptions occurring every year.**

Climate scientists mention volcanic eruptions to help us understand and explain short periods of cooling in Earth's history. Approximately every few decades, a volcanic eruption, such as Mount Pinatubo or El Chichón, releases a substantial number of particles and gases. **Some of these particles and gases temporarily block enough sunlight to induce a brief global cooling period. While these effects typically dissipate after 1 to 2 years, their impact is felt across the globe.**

In comparison, the warming caused by greenhouse gases resulting from human activities, primarily from burning fossil fuels, will persist for millennia.

Impacts

Health

Climate change threatens human health by impacting air and water quality, exacerbating respiratory illnesses, food safety concerns, and mental health issues.

United States Environmental Protection Agency – [United States Environmental Protection Agency. “Climate Impacts on Human Health | Climate Change Impacts | US EPA.” Climatechange.chicago.gov. <https://climatechange.chicago.gov/climate-impacts/climate-impacts-human-health>.]

[The U.S. Environmental Protection Agency (EPA) is responsible for the protection of human health and the environment. EPA: Provides technical assistance to support recovery planning of public health and infrastructure, such as waste water treatment plants.]

The impacts of climate change include warming temperatures, changes in precipitation, increases in the frequency or intensity of some extreme weather events, and rising sea levels. **These impacts threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience.**

The severity of these health risks will depend on the ability of public health and safety systems to address or prepare for these changing threats, as well as factors such as an individual's behavior, age, gender, and economic status. **Impacts will vary based on a where a person lives, how sensitive they are to health threats, how much they are exposed to climate change impacts, and how well they and their community are able to adapt to change.**

People in developing countries may be the most vulnerable to health risks globally, but climate change poses significant threats to health even in wealthy nations such as the United States. Certain populations, such as children, pregnant women, older adults, and people with low incomes, face increased risks; see the section below on Populations of Concern.

Changes in the climate affect the air we breathe both indoors and outdoors. **Warmer temperatures and shifting weather patterns can worsen air quality, which can lead to asthma attacks and other respiratory and cardiovascular health effects.** Wildfires, which are expected to continue to increase in number and severity as the climate changes, create smoke and other unhealthy air pollutants. Rising carbon dioxide levels and warmer temperatures also affect airborne allergens, such as ragweed pollen. **Climate change increases the risk of illness through increasing temperature, more frequent heavy rains and runoff, and the effects of storms.** Health impacts may include gastrointestinal illness like diarrhea, effects on the body's nervous and respiratory systems, or liver and kidney damage.

Climate change and the direct impacts of higher concentrations of carbon dioxide in the atmosphere are expected to affect food safety and nutrition. Extreme weather events can also disrupt or slow the distribution of food.

Any changes in a person's physical health or surrounding environment can also have serious impacts on their mental health. In particular, experiencing an extreme weather event can cause stress and other mental health consequences, particularly when a person loses loved ones or their home.

Individuals with mental illness are especially vulnerable to extreme heat; studies have found that having a pre-existing mental illness tripled the risk of death during heat waves. People taking

medication for mental illness that makes it difficult to regulate their body temperature are particularly at risk.

Tourism

Climate change poses a significant threat to the tourism sector, impacting coastal, winter, and wildlife tourism industries, as well as increasing the risk of forest fires due to heat waves.

Leal Filho 22 – [Leal Filho, Walter. "Will climate change disrupt the tourism sector?", *International Journal of Climate Change Strategies and Management*, Vol. 14 No. 2, pp. 212-217. February 11, 2022. <https://doi.org/10.1108/IJCCSM-08-2021-0088>]

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The pandemic is not the only element, which has been negatively affecting the tourism sector. Climate change, which has been leading to several adverse effects including:

- increases in temperature;
- changes in humidity;
- flooding;
- droughts; and
- unpredictable weather conditions.

as well as extreme events, has been leading to significant impacts to tourism and, inter alia, affecting the national and global economy.

A worrying trend is that **climate conditions are considered to be a key resource to tourism**. More specifically, tourism relies on suitable weather conditions in an area (e.g. sunshine, mild temperatures), for tourists to have an enjoyable experience.

The coastal or seaside vacation industry is a popular sector within the tourism sector. **This particular modality is largely dependent on the aesthetic of the coasts and daily weather, which may attract tourists. However, the rises in sea-level, caused by increased global temperatures, poses a threat to coastal tourism. Additionally, changes in precipitation affect the available times for tourists to enjoy seaside holidays.** This has been observed in Sub-Saharan Africa where, for instance, South African beaches are being affected by climate change. Extreme events such as typhoons and cyclones on the one hand, and heavy rainfall on the other, may endanger the infra-structure that coastal tourism depends on.

Apart from the fact that it has influences on seasonal aspects of land coverage, **the reduction in availability of snow is particularly detrimental to winter tourism, which involves various snow-dependent activities such as skiing or Nordic walking**, very popular among tourists. Some studies have indicated that the **winter tourism industry will see an approximate 64% drop in demand if**

global temperatures continue to rise throughout skiing seasons. If snowfall is reduced only at the beginning and end of skiing seasons, then an 18% decline in demand may be observed. These figures were generated following assessment from 53 ski resorts in Austria which is a country popular for ski/snow tourism.

Areas that rely on flora and fauna for tourism are also being impacted. This is due to extreme temperatures resulting in drought and thus decreased biodiversity and health of animals. More specifically, this is seen in areas such as Africa where wildlife parks are experiencing adverse outcomes due to extreme weather. **Furthermore, tourism infrastructure has been damaged due to severity of weather conditions.** Researchers have suggested rethinking land use planning, redesigning and reinforcing existing parks and infrastructure and conservation techniques to build climate resilience.

Apart from the issues so far described, a special climate-related problem seems to be becoming more present, and which has the potential to significantly interfere with the tourism sector: heat waves. The year of 2021 has been characterized by very long dry periods in various parts of the world, which have led to various forest fires. Forest fires were not only recorded in tropical countries, but also in the northern hemisphere, both in Europe and North America.

Economy

Climate change poses economic risks, such as decreased agricultural yields and costly infrastructure repairs, also potential declines in GDP.

Irwin 19 – [Irwin, Neil. “Climate Change’s Giant Impact on the Economy: 4 Key Issues.” *The New York Times*, January 17, 2019. <https://www.nytimes.com/2019/01/17/upshot/how-to-think-about-the-costs-of-climate-change.html>.]

[Neil Irwin is a senior economics correspondent for The Upshot. He is the author of “How to Win in a Winner-Take-All-World,” a guide to navigating a career in the modern economy.]

By now, it’s clear that climate change poses environmental risks beyond anything seen in the modern age. But we’re only starting to come to grips with the potential economic effects.

Researchers are calculating how each tenth of a degree of global warming is likely to play out in economic terms.

A government report in November raised the prospect that a **warmer planet could mean a big hit to G.D.P. in the coming decades.**

And on Thursday, some of the world’s most influential economists called for a tax on carbon emissions in the United States, saying climate change demands “immediate national action.”

Consider three possible ways that climate change could exact an economic cost:

- **A once-fertile agricultural area experiences hotter weather and drought, causing its crop yields to decrease.**
- **A road destroyed by flooding because of rising seas and more frequent hurricanes must be rebuilt.**

- An electrical utility spends hundreds of millions of dollars to build a more efficient power grid because the old one could not withstand extreme weather.

The farmland's yield decline is a permanent loss of the economy's productive capacity — society is that much poorer, for the indefinite future. It's worse than what happens in a typical economic downturn. Usually when factories sit idle during a recession, there is a reasonable expectation that they will start cranking again once the economy returns to health.

The road rebuilding might be expensive, but at least that money is going to pay people and businesses to do their work. The cost for society over all is that the resources that go to rebuilding the road are not available for something else that might be more valuable. That's a setback, but it's not a permanent reduction in economic potential like the less fertile farmland. And in a recession, it might even be a net positive, under the same logic that fiscal stimulus can be beneficial in a downturn.

By contrast, new investment in the power grid could yield long-term benefits in energy efficiency and greater reliability.

Certain types of efforts to reduce carbon emissions or adapt to climate impacts are likely to generate similar benefits, says Nicholas Stern, chair of the Grantham Research Institute on Climate Change and the Environment at the London School of Economics.

When a government report raises the possibility of a 10 percent hit to G.D.P. as a result of a warming climate, it can be easy to picture everyone's incomes being reduced by a tenth.

In reality there is likely to be enormous variance in the economic impact, depending on where people live and what kind of jobs they have.

Low-lying, flood-prone areas are at particularly high risk of becoming unlivable — or at least uninsurable. Certain industries in certain places will be dealt a huge blow, or cease to exist; many ski slopes will turn out to be too warm for regular snow, and the map of global agriculture will shift.

Adaptation will probably be easier for the affluent than for the poor. Those who can afford to move to an area with more favorable impacts from a warmer climate presumably will.

So the economic implications of climate change include huge shifts in geography, demographics and technology, with each affecting the other.

Human Rights

Climate change threatens fundamental human rights, including the right to life, health, adequate housing, and safe water, necessitating urgent action from world leaders to curb its devastating impacts.

Amnesty International 19 - [Amnesty International. "Climate Change." Amnesty.org. 2019. <https://www.amnesty.org/en/what-we-do/climate-change/>.]

[Amnesty International is a global movement of more than 10 million people in over 150 countries and territories who campaign to end abuses of human rights.]

Climate change is intimately linked with human rights because of its effect on not just the environment but our own well-being – and ultimately our survival.

World leaders – especially from higher income countries with the greatest historical responsibility for greenhouse gas emissions – are failing in their legal obligation to curb climate change and help us adapt to the change that has already occurred. If they don't act quickly, the effects of a warming planet will continue to grow and worsen over time, creating ruin for current and future generations.

We all have the right to life, and to live in freedom and safety. **But climate change threatens the life and safety of billions of people on this planet. The most obvious example is extreme weather-related events, such as storms, floods and wildfires.** The World Health Organization predicts that climate change will cause 250,000 deaths per year between 2030 and 2050.

We all have the right to enjoy the highest attainable standard of physical and mental health.

According to the Intergovernmental Panel on Climate Change (IPCC), major health impacts of human-induced climate change will include;

- Greater risk of injury
- disease and death due to things like more intense heat waves and fires
- increased risk of undernutrition as a result of diminished food production
- increased risks of diseases from food water and vector-borne diseases

People, and particularly children, exposed to traumatic events such as natural disasters – exacerbated by climate change – can suffer from post-traumatic stress disorders.

We all have a right to an adequate standard of living for ourselves and our families, including adequate housing. But unless governments do more to help stop further climate change, **extreme weather events such as floods and wildfires will continue to destroy people's homes and leave them displaced.** Drought can also lead to significant adverse changes in the environment while sea-level rises threaten the homes of millions of people around the world in low-lying territories.

We all have the right to safe water and to sanitation that ensures we stay healthy. But continued inaction by governments and corporations has brought us to the point where **melting snow and ice, reduced rainfall, higher temperatures and rising sea-levels threaten the quality and quantity of water resources.** Already 785 million people do not have access to a source of water or sanitation that is likely to be safe. Climate change will make this worse.

Diseases, Rice Yields

The warming climate could lead to the spread of mosquito-borne diseases like Dengue fever and malaria to new regions, increasing the risk of infections globally. It could also impact rice yields worldwide, affecting over 1 billion people who rely on rice as their primary food.

Gaille 17 - [Gaille, Louise. "10 Global Warming Pros and Cons." Vittana.org. November 19, 2017. <https://vittana.org/10-global-warming-pros-and-cons>.]

[Louise Gaille has received her B.A. in Economics from the University of Washington. In addition to being a seasoned writer, Louise has almost a decade of experience in Banking and Finance.]

Warmer temperatures won't just affect daytime climates. It will also create warmer temperatures at night. **Because global warming would create a warmer minimum temperature during the night, this would affect rice yields from around the planet.** This would impact the more than 1 billion people who use rice as their primary staple food. At the same time, grasslands and shrubs would encroach on fields, further reducing the yield potential for this essential crop.

Although global warming could improve the number of available shipping lanes, it would also create more obstacles that could negatively impact shipping. **Because ice would be less compacted, there would be more floes and mobile icebergs that could move into common shipping lanes.** At the same time, the ice melting in arctic and Antarctic regions would release more methane, which would further enhance the problems associated with global warming.

Global warming would encourage a higher rate of production for mosquitoes. This deadly insect would be able to populate larger areas of the planet for longer periods of time as well. **That means there would be a likely spread of Dengue fever and malaria around the world.** Places like the United States, which rarely sees localized infections of these diseases, would begin to face the same problems that other nations already face because of the mosquito.

Transportation

Climate change affects transportation in two main ways: it contributes to emissions from road and air travel, while also making infrastructure more vulnerable to extreme weather, which can disrupt services and increase costs for repairs and upgrades.

Levinson & Merkert 19 - [Levinson, David. Merkert, Rico. How climate change impacts infrastructure: experts explain Interview by Low Luisa. November 27, 2019. <https://www.sydney.edu.au/news-opinion/news/2019/11/27/how-climate-change-impacts-infrastructure--experts-explain.html>.]

[School of Civil Engineering academic, Professor David Levinson is a transport engineering expert who says transport infrastructure both contributes to climate change, but can also be affected by it.

Professor Rico Merkert is an academic from the University of Sydney's Business School who is an expert in transport and logistics.]

"The issue goes two ways in transport. Typically, road and air transport are considered major contributors to climate change, making up 23 percent of CO2 emissions," said Professor Levinson.

"But transport is also vulnerable, particularly due to so many facilities like roads and bus terminals being in flood zones, for instance New Jersey Transit lost \$US120 million in damage to buses after Hurricane Sandy.

“Extreme weather increases the variability of weather, and roads designed for a particular climate range may fail more quickly. All of these add costs to design and retrofit, as well as decreasing reliability for users.”

Professor Rico Merkert is an academic from the University of Sydney’s Business School who is an expert in transport and logistics.

"For a start, no one likes to be on a turbulent flight and climate change increases unstable weather. What is more, large airports are typically built where there are favourable wind conditions and that is generally near coastal areas. With hail storms, floods and damaging winds all increasing with climate change, airports are extremely exposed and are already experiencing severe disruptions.

"What’s worse, with temperatures also on the rise, at some airports large aircraft can no longer take off. The industry is of course aware of this and has not only started to reduce its carbon footprint but is beginning to implement countermeasures such as new airports being built well above current sea levels, and airlines, such as Qantas, recently announcing initiatives to cut net CO2 emissions.

Refugees

Climate change-induced extreme weather is displacing millions and exacerbating conflicts over resources.

The UN Refugee Agency 24 – [The UN Refugee Agency. “How Climate Change Impacts Refugees and Displaced Communities.” [Www.unrefugees.org](https://www.unrefugees.org/news/how-climate-change-impacts-refugees-and-displaced-communities/). January 26, 2024.]

[The United Nations High Commissioner for Refugees is a United Nations agency mandated to aid and protect refugees, forcibly displaced communities, and stateless people, and to assist in their voluntary repatriation, local integration or resettlement to a third country.]

Nearly 32 million people were internally displaced by extreme weather events in 2022. In 2023, global temperatures reached new record highs and the year was marked by dozens of fires, floods and intense storms across the world.

Climate change increases the risks of extreme weather events – like storms, floods, wildfires, heatwaves and droughts – making them more unpredictable, frequent and intense. **At the same time, rising sea levels, droughts and drastic changes in rainfall patterns as a result of warmer temperatures can destroy crops and kill livestock, threatening livelihoods and exacerbating food insecurity - all of which can lead to massive displacement.**

Climate change and natural disasters can also be a source of potential conflict between refugees and their host communities if there is competition over natural resources, food, water and land rights.

UNHCR has identified 22 countries where the effects of climate change will be most severe between now and 2030. These countries include regions heavily impacted by both conflict and climate change, including countries in the Eastern Horn of Africa, Afghanistan, Bangladesh, Ecuador, Honduras and

more. Collectively, these countries host 52 percent of all internally displaced people, 24 percent of all stateless people and 28 percent of all refugees.

Climate change can clearly be seen in the increasing intensity and frequency of extreme weather events, such as abnormally heavy rainfall, prolonged drought, heatwaves and cyclones. Such hazards are already inducing some 23 million displacements of people from their homes each year, as an average based on data from the past decade. Most are internally displaced within their home countries, while some may also be impelled to cross borders in search of safety and protection.

According to the latest research, without dramatic action to mitigate climate change and significantly reduce the risk of climate disasters, by 2050, 200 million people will be in need of humanitarian assistance annually due to the effects of climate change.

Regional Impact

Climate change is forecasted to lead to various regional impacts, including biodiversity loss in Latin America, increased flooding in Europe, decreased agricultural productivity in Africa etc.

United States Geological Survey 22 - [United States Geological Survey. "What Are the Long-Term Effects of Climate Change? | U.S. Geological Survey." Www.usgs.gov. 2022. <https://www.usgs.gov/faqs/what-are-long-term-effects-climate-change>.]

[For over 60 years, USGS scientists have worked across many fields in planetary science, the study of planets, moons, comets, and asteroids. The USGS has partnered with NASA to help plan and complete missions by studying how geologic processes work across the solar system, participating in rover missions, and training astronauts to return to the Moon.]

Scientists have predicted that long-term effects of climate change will include a decrease in sea ice and an increase in permafrost thawing, an increase in heat waves and heavy precipitation, and decreased water resources in semi-arid regions.

Below are some of the regional impacts of global change forecast by the Intergovernmental Panel on Climate Change:

- North America: Decreasing snowpack in the western mountains; 5-20 percent **increase in yields of rain-fed agriculture in some regions**; increased frequency, intensity and duration of heat waves in cities that currently experience them.
- Latin America: **Gradual replacement of tropical forest by savannah in eastern Amazonia; risk of significant biodiversity loss through species extinction in many tropical areas**; significant changes in water availability for human consumption, agriculture and energy generation.
- Europe: **Increased risk of inland flash floods**; more frequent coastal flooding and **increased erosion from storms and sea level rise; glacial retreat in mountainous areas**; reduced snow cover and winter tourism; extensive species losses; reductions of crop productivity in southern Europe.
- Africa: Between 75 and 250 million people are projected to be exposed to increased water stress; yields from rain-fed agriculture could be reduced by up to 50 percent in some regions; **agricultural production, including access to food, may be severely compromised.**

- Asia: **Freshwater availability projected to decrease in Central, South, East and Southeast Asia by the 2050s**; coastal areas will be at risk due to increased flooding; death rate from disease associated with floods and droughts expected to rise in some regions.

Harvard Experts

Harvard experts believe that human activities disrupting Earth's climate pose significant threats to essential environmental conditions and processes.

Holdren 20 - [Holdren, John. What scares you most about climate change? Interview by Liz Mineo. Accessed April 22, 2020. <https://news.harvard.edu/gazette/story/2020/04/harvard-experts-discuss-climate-change-fears/>.]

[John Holdren is Research Professor in Harvard University's Kennedy School of Government and Co-Director of the Science, Technology, and Public Policy Program in the School's Belfer Center for Science and International Affairs.]

The disruption of Earth's climate by human activities scares me for many reasons. Here are three. **First, climate is the envelope within which all other environmental conditions and processes important to human well-being must function. Those conditions and processes include those that govern the quality of air, the quality and quantity of fresh water, the fertility of soil, the productivity of the ocean, and natural controls on pests and pathogens.** As our activities increasingly alter the climate — with direct impacts including hotter heat waves, stronger storms, bigger floods, larger wildfires, and inexorably rising sea level — we imperil all the essential environmental conditions and processes that function within the climatic envelope.

Second, **the human activities driving the disruption of global climate are so deeply embedded in the economies of developed and developing countries alike that it is impossible to change the drivers rapidly.** The biggest driver is the combustion of coal, oil, and natural gas — the fossil fuels — using technologies that discharge all of the resulting carbon dioxide into the atmosphere. In 2020, about 80 percent of the energy used by civilization worldwide still comes from these fossil fuels. It will take decades to free ourselves from them. The next biggest driver is land use and land-use change, including deforestation and many agricultural practices. These, too, in turn, are on such a large scale and driven by such fundamental forces in the world's economies that they are very difficult to change quickly.

Third, impacts of global climate change are already causing serious damage to human health and safety, property, infrastructure, and terrestrial and marine ecosystems, even though the increase in the annually and globally averaged surface temperature has been “only” about 2 degrees Fahrenheit. At this point, because of the intractable nature of the drivers described above, it seems almost impossible to avoid an increase twice as large, which will result in a much more than proportional increase in the damages now being experienced.

The only good news is that public awareness of the ongoing harm and increasing danger is growing to the point that countries may finally undertake the remedial actions needed to avoid even bigger changes in our future climate, along with adaptation measures that can reduce the harm from the changes we cannot avoid.

Sea Level Rise

Sea level rise poses serious risks to coastal regions worldwide, threatening infrastructure, livelihoods, and ecosystems.

Grantham Institute, Imperial College London n.d. - [Grantham Institute, Imperial College London n.d. "What Are the Impacts of Climate Change?" Imperial College London. <https://www.imperial.ac.uk/grantham/publications/climate-change-faqs/what-are-the-impacts-of-climate-change/>.]

[The Grantham Institute is Imperial College London's hub for climate change and the environment, and one of Imperial's seven Global Institutes established to promote interdisciplinary working and to meet some of the greatest challenges faced by society.]

The impacts of climate change will disrupt the natural, economic and social systems we depend on. **This disruption will impact global food security, damage infrastructure and jobs, and harm human health.** These impacts are unevenly distributed around the world, with some countries facing far greater risks than others.

As the world warms, ice sheets and glaciers on land melt and flow into the ocean. The ocean itself also warms and expands, as it absorbs significant amounts of the heat trapped by the greenhouse gas effect. These changes cause the sea level to rise.

Sea level rise continues to speed up as human-induced global warming increases. **Sea levels were rising at a rate of around 8cm per 100 years in the late nineteenth century, 21cm per 100 years in the mid-twentieth century, and now up to around 32cm per 100 years.** Future sea level rise depends on how quickly we reduce global greenhouse gas emissions.

In a scenario where emissions are reduced rapidly and the rise in global temperatures stay below 2°C, sea level rise will still reach 29–59 cm in the next hundred years with respect to 1986-2005 levels. This is because the effect of CO₂ already in the atmosphere has a time lag; it heats the atmosphere slowly.

This would bring serious risks for coastal regions around the world, including low-lying islands and major cities like Shanghai, Alexandria and Miami. More than half of the world's largest cities lie along the coast, and just over 1 billion people live in coastal areas within 10 metres of sea level.

The largest threat of future sea level rise comes from the possibility that the massive ice sheets in the Antarctic and Greenland could melt. In particular, the West Antarctic ice sheet is thought to be vulnerable to collapse. It rests on a bed more than 2 km below sea level and contains enough ice to raise global sea levels by around 3.5 m. In total, there is enough ice on the planet to raise sea levels by 70 m. It is difficult to predict at what level of warming this kind of dangerous change could occur, however the risk grows as global temperatures increase.

Biden-Harris Administration Report

The Fifth National Climate Assessment shows how weather extremes, made worse by climate change, affect every part of the United States, and how it worsens social inequalities.

National Oceanic and Atmospheric Administration 23 - [National Oceanic and Atmospheric Administration. "Climate Change Impacts Are Increasing for Americans." Noaa.gov. November 14, 2023. <https://www.noaa.gov/news-release/climate-change-impacts-are-increasing-for-americans>]

Debate Track: Evidence Packet (Abolish P5 Status) - Climate Change Impacts

Resolved: The United Nations should abolish permanent membership on its Security Council.

[National Oceanic and Atmospheric Administration is a US governmental agency established in 1970. NOAA holds key leadership roles in shaping international ocean, fisheries, climate, space and weather policies.]

A new national report finds that the impacts of weather extremes — exacerbated by climate change — are far-reaching across every region of the United States. However, the report also finds that rapidly reducing greenhouse gas emissions and accelerating adaptation can limit further warming and protect lives and property from many climate risks.

The Fifth National Climate Assessment (NCA5), released today by the Biden-Harris Administration and the U.S. Global Change Research Program (USGCRP), also notes that across the country, efforts to adapt to climate change and reduce greenhouse gas emissions have expanded since the last National Climate Assessment in 2018, and U.S. emissions have fallen since peaking in 2007. But without deeper cuts in global and U.S. net greenhouse gas emissions and accelerated adaptation efforts, climate risks to the U.S. will continue to grow.

Some of the key findings from the report are:

- **Climate change exacerbates long-standing social inequities experienced by underserved and overburdened communities, contributing to persistent disparities in the resources needed to prepare for, respond to, and recover from climate impacts. Low-income and communities of color face higher risks of illness and death from extreme heat, climate-driven floods and air pollution compared with White people, and often lack access to adequate flood infrastructure, green spaces, safe housing and often lack protective resources.**
- **Climate change is harming physical, mental, spiritual and community health and well-being.**
- Climate action can result in near-term benefits that outweigh the costs, with the potential to improve well-being, strengthen resilience, benefit the economy and redress legacies of racism and injustice.
- By 2050 and by 2100, **sea level rise under the Intermediate Sea Level Scenario, is projected to be higher along the Atlantic (about 1.25 and 4 feet, respectively) versus Pacific coast (0.75 and 3 feet), and greatest along the western Gulf coast (2 and 5 feet).**
- **Hurricanes have been intensifying more rapidly since the 1980s and causing heavier rainfall and higher storm surges due to climate change.** There is no long-term trend in the frequency of landfalling hurricanes in the U.S. since the late 19th century, but there has been an increase in hurricane activity in the North Atlantic since the early 1970s.
- **Climate change has impacted commercial marine fisheries in every region of the U.S. by altering the availability and quality of harvested species, destabilizing fisheries-related revenue and employment, and causing new management challenges.**
- Over the next century, **climate change is expected to reduce fish and shellfish catch** in all U.S. regions, including some of the highest-valued fisheries.

Heatwaves

Climate change has made most extreme heat events worse, showing how human activities affect these occurrences.

Debate Track: Evidence Packet (Abolish P5 Status) - Climate Change Impacts

Resolved: The United Nations should abolish permanent membership on its Security Council.

Pidcock & McSweeney 22 – [Pidcock, Roz. & McSweeney, Robert. “Mapped: How Climate Change Affects Extreme Weather around the World.” Carbon Brief. August 4, 2022. <https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world/>.]

[Dr Roz Pidcock has a PhD in physical oceanography from the University of Southampton and previously worked in the science communication unit at the University of the West of England, Bristol.

Robert McSweeney is senior science editor. He holds an MEng in mechanical engineering from the University of Warwick and an MSc in climate change from the University of East Anglia. He previously spent eight years working on climate change projects at the consultancy firm Atkins.]

The attribution map includes studies of 152 extreme heat events, of which 142 (93%) have been made more likely or more severe because of climate change. No studies have found a heatwave that has been made less severe by climate change, while studies of two events (1%) identified no influence and a further eight (5%) were inconclusive.

In recent years, **studies have shown that several heat extremes would have been impossible or virtually impossible without human influence on the climate.** These include Siberia’s heatwave of 2020, the Pacific north-west “heat dome” event of 2021 and Europe’s record-breaking summer of 2021.

While heatwaves are the most-studied extreme event in attribution literature, they are becoming “**less and less interesting for researchers**”, notes a Bloomberg article from 2020. Dr Friederike Otto is a senior lecturer at the Grantham Institute for Climate Change and the Environment at Imperial College London and co-leader of World Weather Attribution, a consortium of scientific organisations founded in 2014 to deliver “timely and scientifically reliable information on how extreme weather may be affected by climate change”. She told Bloomberg that **the consortium chose not to investigate California’s record-breaking summer 2020 heatwave as “the evidence is so strong already”.**

A particularly well-studied region for heatwaves in the literature is Australia, which accounts for 10% of the heat-related events included here. And climate change was found to play a role in all but one of the 15 Australian heat events studied. It is worth noting for that one event, however, that although the study was inconclusive for the city of Melbourne in south-east Australia, **the authors did detect a human influence on extreme heat up the coast in Adelaide.**

Another important point is that in cases where attribution science finds that climate change is making a given type of extreme weather more likely, it does not necessarily follow that the chance of experiencing that kind of weather gets incrementally higher each year. Natural variability means that there will still be ups and downs in the strength and frequency of extreme events.

Drought and Loss of Species

Droughts, worsened by climate change, pose serious threats to agriculture, ecosystems, and human communities. Climate change also exacerbates the risk of species extinction.

Debate Track: Evidence Packet (Abolish P5 Status) - Climate Change Impacts

Resolved: The United Nations should abolish permanent membership on its Security Council.

United Nations 24 – [United Nations. “Causes and Effects of Climate Change.” United Nations. 2024. <https://www.un.org/en/climatechange/science/causes-effects-climate-change>.]

[The United Nations is an international organization founded in 1945. Currently made up of 193 Member States, the UN and its work are guided by the purposes and principles contained in its founding Charter. The UN has evolved over the years to keep pace with a rapidly changing world.]

Climate change is changing water availability, making it scarcer in more regions. **Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems.** Droughts can also stir destructive sand and dust storms that can move billions of tons of sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.

Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures climb. Exacerbated by climate change, **the world is losing species at a rate 1,000 times greater than at any other time in recorded human history.** One million species are at risk of becoming extinct within the next few decades. Forest fires, extreme weather, and invasive pests and diseases are among many threats related to climate change. Some species will be able to relocate and survive, but others will not.

Climate change increases the factors that put and keep people in poverty. **Floods may sweep away urban slums, destroying homes and livelihoods.** Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops. **Over the past decade (2010–2019), weather-related events displaced an estimated 23.1 million people on average each year,** leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change.

Inequality

Climate change exacerbates economic inequality, disproportionately affecting vulnerable communities, particularly in poorer nations.

Colmer 21 – [Colmer, Jonathan. “How Does Climate Change Shape Inequality, Poverty and Economic Opportunity?” Economics Observatory. October 5, 2021. <https://www.economicsobservatory.com/how-does-climate-change-shape-inequality-poverty-and-economic-opportunity>.]

[Jonathan Colmer is an Assistant Professor in the Department of Economics at the University of Virginia, and the Co-Founder and Director of the Environmental Inequality Lab. Jonathan is an environmental economist, who also works in the area of growth and development economics.]

Climate change and economic inequality are often considered independently of one another. **But it is not possible to address either of these challenges without engaging with the other: they are inextricably linked.**

Unabated climate change will have dramatic effects on inequality, poverty and economic opportunity.

We are already being harmed by climate change. In June 2021, temperatures in the Pacific Northwest hit a record high of 46.6°C during a four-day heatwave, killing more than 200 people. Scientists from World Weather Attribution analysed that this heatwave would have been virtually impossible without climate change. The heavy rainfall events that led to severe flooding in Western Europe at the same time were also found to be made more likely by climate change.

To date, much of the emphasis has been on inequality across countries. **Evidence suggests that total damages from natural disasters and higher temperatures are larger in developing countries.** Research shows that the relationship between economic activity and temperature is non-linear, with productivity peaking at 13°C and declining strongly at higher temperatures.

As poor countries tend to be exposed to higher temperatures, they currently suffer and will continue to suffer the most from higher temperatures. Because of larger temperature-driven reductions in GDP per capita in the poorest countries, it is estimated that the ratio between the top and bottom income deciles is likely to be 25% larger today than it would have been in the absence of experienced global warming.

In developed countries, growth effects seem less likely because growth is shaped by new innovations and technological progress. In developing and emerging economies, growth effects are more of a possibility because growth is shaped to a greater extent by events and institutional change.

Higher temperatures may affect investments if climate-induced scarcity reduces savings and investments at low income levels, or if climate events affect institutions through civil unrest and conflict. It is also possible that climate shocks such as natural disasters, droughts and other extreme weather could result in persistent level effects if they cause people to become trapped in poverty.

The most vulnerable groups in society have neither the means to protect themselves against climate events nor to recover from them when they strike.

This is likely to exacerbate existing inequalities: when higher temperatures reduce productivity, earnings and health, and hurricanes destroy homes and employment opportunities, the economic situation of those most in need is made more precarious still, and further worsens their economic standing.

For example, the economic effects of higher temperatures are not restricted to agriculture. Higher temperatures have been shown to affect productivity and injuries in non-agricultural settings in both developed and developing countries.

If inequality and climate change are not addressed together, it is unclear whether either can be addressed at all.

Insurance Costs, Outdoor work

Insurance costs are rising because of climate change damages, making it harder for homeowners in vulnerable areas to afford coverage.

Cho 19 – [Cho, Renee. “10 Climate Change Impacts That Will Affect Us All.” State of the Planet. Columbia Climate School. December 27, 2019. <https://news.climate.columbia.edu/2019/12/27/climate-change-impacts-everyone/>.]

[Renee Cho has written over 200 articles for State of the Planet on a broad range of topics. She was previously published by www.insideclimatenews.com, and other environmental magazines. Renee was Communications Coordinator for Riverkeeper, the Hudson River environmental organization. She received the Executive Education Certificate in Conservation and Sustainability from the Earth Institute Center for Environmental Sustainability.]

As insurance companies pay out huge amounts to homeowners whose houses have been damaged by climate change impacts, many are raising premiums to offset their costs. Home insurance rates increased more than 50 percent between 2005 and 2015.

In high-risk areas, premiums and deductibles may rise, coverage may be more limited, and **insurance could ultimately become unaffordable or unavailable for some, especially in climate-vulnerable areas.** For Connecticut homeowners, insurance rates have gone up 35 percent in the last 10 years; for homeowners with property along the coast, rates have gone up by over 50 percent. In 2016, California insurance companies would not renew over 10,000 policies for homes in high-risk areas.

Moreover, standard homeowners' insurance does not cover flooding, so homeowners must buy private insurance or sign up for the National Flood Insurance Program run by FEMA. Due to billions of dollars in payouts for Hurricanes Katrina, Harvey, Irma, Maria and Sandy, however, NFIP is \$20.5 billion in debt. In October, FEMA announced that rates would rise 11.3 percent in April 2020, and will be further restructured in October 2021.

With continued global warming, heat waves are expected to increase in frequency, duration and intensity. Jane Baldwin, a postdoctoral research scientist at Lamont-Doherty Earth Observatory, found that **compound heat waves—heat waves that occur in sequence, one after the other—will also increase, making recovery from heat waves more difficult.**

People who work outdoors, such as construction workers, miners, firefighters and agricultural workers, will be most affected by increasing temperatures. Florida, for example, has one of the highest rates of heat-related hospitalizations in the U.S. This summer during a heat wave, the majority of heat-related visits to emergency rooms in Virginia were made by people aged 29-40, 70 percent of whom were men. Indoor workers in warehouses and steel plants can also be affected by excessive heat.

One study suggested that outdoor workers should begin their shifts earlier in the day, but if global warming continues at the current pace, by 2100, they would have to start working four to six hours before dawn. Currently, there are no federal laws that protect workers from heat stress, but in July, a bill was introduced into the House of Representatives that would require the Occupational Safety and Health Administration to establish standards to protect those working in the heat.

Ecosystem

Climate change disrupts ecosystems by driving species to extinction, spreading pests and diseases.

Rosenberg 20 - [Rosenberg, Matt. "Could There Be Any Advantages of Global Warming?" ThoughtCo. February 18, 2020. <https://www.thoughtco.com/advantages-and-disadvantages-of-global-warming-1434937/>.]

[Matt Rosenberg is an award-winning geographer and the author of "The Handy Geography Answer Book" and "The Geography Bee Complete Preparation Handbook." He was director of emergency services for the American Red Cross and served on more than two dozen major disaster relief operations around the United States.]

The environment around us is affected by climate change in a multitude of ways. The component parts of any ecosystem normally must maintain a delicate balance but climate change is throwing nature is out of whack—in some places more than others. Effects include:

- Increase in the number of species of animals and plants heading toward extinction.
- **Loss of animal and plant habitats causes animals to move into other territories, disrupting ecosystems that are already established.**
- Because the behaviors of many plants, insects, and animals are dependent on temperature, **a change in climate can cause an imbalance in the ecosystem itself.** For example, say the availability of food for a particular insect no longer coincides with the time when the offspring of the natural predator for that insect is born. **Uncontrolled by predation, the insect population booms, resulting in an overabundance of that pest.** This, in turn, leads to increased stress on the foliage the insects eat, which ultimately results in a loss of food for larger animals in the food chain that also depend on those plants for sustenance.
- Pests such as viruses, fungi, or parasites that usually perish at a certain low temperature no longer die off, **which may lead to an increase in disease among plants, animals, and humans.**
- Melting of permafrost leads to flooding and greatly increases the release of carbon dioxide and methane into the atmosphere which only serves to exacerbate climate change. In addition, ancient viruses long held in stasis by the permafrost are allowed to escape into the environment.
- Rainfall increases in acidity.

Earlier seasonal drying of forests leads to forest fires of increased frequency, size, and intensity. **Loss of plants and trees on hillsides leaves them more vulnerable to erosion and landslides and may lead to an increased probability of property damage and loss of life.**

Hurricanes

While the total number of hurricanes globally is not expected to increase, the warming climate significantly enhances the likelihood of more intense hurricanes with higher wind speeds.

Poynting 23 - [Poynting, Mark. "How Is Climate Change Affecting Hurricanes, Typhoons and Cyclones?" BBC News. September 26, 2023. <https://www.bbc.co.uk/news/world-us-canada-42251921#>.]

[Mark Poynting is a Climate and Environment Researcher at BBC News. Previously he was working at Scott Polar Research Institute and Selwyn College, Cambridge.]

In August, the US science body NOAA forecasted an "above normal" Atlantic hurricane season, which runs until the end of November.

Globally, the frequency of tropical cyclones has not increased, and in fact the number may have fallen - although long-term data is limited in some regions. **But it is "likely" that a higher proportion of tropical cyclones across the globe are reaching category three, meaning they reach the highest wind speeds,** according to the UN's climate body, the IPCC.

Assessing the precise influence of climate change on individual tropical cyclones is challenging. The storms are relatively localised and short-lived, and can vary significantly in any case. **But rising temperatures do affect these storms in several measurable ways.**

Firstly, **warmer ocean waters mean storms can pick up more energy, leading to higher wind speeds.** The forecast for the 2023 Atlantic hurricane season was upgraded to "above normal" in August, partly because of record high Atlantic sea surface temperatures.

Secondly, **a warmer atmosphere can hold more moisture, leading to more intense rainfall.** Climate change made the extreme rainfall from Hurricane Harvey in 2017 around three times more likely, according to one estimate.

Finally, sea-levels are rising, mainly due to a combination of melting glaciers and ice sheets, and the fact that warmer water takes up more space. Local factors also play a part. **This means storm surges happen on top of already elevated sea levels, worsening coastal flooding.**

For example, it is estimated that flood heights from Hurricane Katrina in 2005 - one of America's deadliest storms - were 15-60% higher than they would have been in the climate conditions of 1900.

Overall, the IPCC concludes that there is "high confidence" that humans have contributed to increases in precipitation associated with tropical cyclones, and "medium confidence" that humans have contributed to the higher probability of a tropical cyclone being more intense.

The number of tropical cyclones globally is unlikely to increase, according to the IPCC. But as the world warms, it says it is "very likely" they will have higher rates of rainfall and reach higher top wind speeds. **This means a higher proportion would reach the most intense categories, four and five.**

The more global temperatures rise, the more extreme these changes will tend to be. **The proportion of tropical cyclones reaching category four and five may increase by around 10% if global temperature rises are limited to 1.5C, increasing to 13% at 2C and 20% at 4C, the IPCC says - although the exact numbers are uncertain.**

High Cost of Living

In California, the climate crisis causes higher living costs, utility bills, insurance packages, and food prices, which particularly affects low-income families who are already struggling.

Singh 23 – [Singh, Maanvi. "‘We Can’t Escape’: Climate Crisis Is Driving up Cost of Living in the US West." *The Guardian*, July 21, 2023. <https://www.theguardian.com/us-news/2023/jul/21/climate-crisis-cost-of-living-energy-water-california>.]

[Maanvi Singh is a west coast reporter for Guardian US based in Oakland, with a focus on health, climate and environmental justice issues.]

Recently, after a series of extreme heatwaves in California forced her family to run the AC, her monthly electricity costs rose to about \$500. Her water bill averages around \$100, but because the water is contaminated with pesticides from nearby agricultural fields, her family spends an additional \$140 each month to purchase jugs of drinking water. Her grocery bills have gone up as well, after a spate of winter storms disrupted harvests across the state.

Here, in what is already one of the most expensive states in the US, **the climate emergency is driving up the cost of living. Extreme weather, drought and drastic swings in temperature, all fueled by**

global heating, are affecting utility costs and insurance premiums, exacerbating housing shortages and causing food prices to go up.

These issues are echoed throughout the US and the globe, as relentless heat and smoke pollution from wildfires push communities across the southern US, Europe and Asia to their limits. The health and economic impacts of the spate of extreme weather will become clearer in the months to come.

But in California, the cost imposed by the disquieting recurrence of climate-related disasters that more and more countries are faced with have already become untenable for many. **Nearly half of the state's residents say they struggle to save money or pay for unexpected expenses, according to a recent poll by a consortium of local non-profits. Many families are just one fire or flood away from financial ruin.**

One major reason is that electricity companies have faced increasing wildfire mitigation expenses like clearing vegetation around power lines and higher wildfire insurance costs and they have passed the charge on to consumers. Meanwhile, utility companies such as PG&E have also been allowed to pass on the liability costs of sparking some of the state's most destructive wildfires.

For many households, the price increases mean dire choices, said Michael Méndez, assistant professor of environmental planning and policy at the University of California, Irvine. **A survey by researchers at Columbia University found that nearly 30% of households in California kept their homes at a temperature that was unhealthy or unsafe to save on energy costs.** "When you overlay existing social, economic and health disparities with climate change and extreme weather, that exacerbates inequalities," Méndez said.

In fact, many poor and middle-class families are being forced to move to areas that are feeling the impact of climate crisis more intensely. "The housing affordability crisis in California is pushing people out of cities and increasingly out, into locales with a higher risk for extreme heat, higher risk for drought and wildfires," said Méndez.

Agricultural workers in the central coast and Central valley, who harvest the bulk of produce grown in the state and in the country, were out of work for weeks. Planted fields of summer fruit were wiped out and shortages drove up already inflated grocery prices this year.

In Lamont, where daily highs are predicted to remain above 100F (37.7C) through the end of the month, the Contreras family has resigned to another year of debt. Because it is unsafe to work in the fields after 11am on most days, Contreras's husband has had his work hours cut. Normally he would pick up extra work in the tangerine or grape fields, but the weather has disrupted those harvests as well.

Polar Bears

The melting Arctic sea ice is causing polar bears to face starvation as they cannot adapt their diets to living on land. That increases mortality rates among the unique species.

McGrath 24 – [McGrath, Matt. "Climate Change: Polar Bears Face Starvation Threat as Ice Melts." BBC News. February 13, 2024. <https://www.bbc.co.uk/news/science-environment-68253819#>.]

[Matt McGrath is an award winning environment correspondent. He has a broad, detailed knowledge of environmental issues, especially climate change. Matt is a first international winner of the BBVA Biophilia Award, also former Science Journalism Fellow at MIT.]

Some polar bears face starvation as the Arctic sea ice melts because they are unable to adapt their diets to living on land, scientists have found.

The iconic Arctic species normally feed on ringed seals that they catch on ice floes offshore. But as the ice disappears in a warming world, **many bears are spending greater amounts of time on shore, eating bird's eggs, berries and grass. However the animals rapidly lose weight on land, increasing the risk of death.**

To understand how the animals survive as the ice disappears, researchers followed the activities of 20 polar bears during the summer months over a three-year period.

As well as taking blood samples, and weighing the bears, the animals were fitted with GPS-equipped video camera collars. This allowed the scientists to record the animals movements, their activities and what they ate.

In the ice-free summer months, the bears adopted different strategies to survive, with some essentially resting and conserving their energy. **The majority tried to forage for vegetation or berries or swam to see if they could find food.**

Both approaches failed, with 19 of the 20 bears in the study losing body mass, by up to 11% in some cases. On average they lost one kilogramme per day.

Two of the three bears that took to the water found carcasses of dead animals but spent only a short time eating, as they were too tired from their exertions.

"It really suggests to us that that these bears can't eat and swim at the same time."

- There are about 26,000 polar bears left in the world, with the majority in Canada. Populations are also found in the US, Russia, Greenland and Norway.
- Polar bears are listed as vulnerable to extinction by the International Union for Conservation of Nature (IUCN), with climate change a key factor in their decline.

However other researchers say the impacts of climate change on polar bears would differ, depending on location.

Impact Turns

500 Scientists

500 scientists question the climate emergency narrative. They argue that warming is slower than predicted, CO2 is beneficial for plant growth and global warming hasn't led to an increase in natural disasters.

Perry 19 - [Perry, Mark. "There Is No Climate Emergency, Say 500 Experts in Letter to the United Nations | American Enterprise Institute - AEI %." American Enterprise Institute - AEI. October 1, 2019. <https://www.aei.org/carpe-diem/there-is-no-climate-emergency-say-500-experts-in-letter-to-the-united-nations/>.]

[Mark Joseph Perry is an American economist, a professor of economics and finance in the School of Management at University of Michigan–Flint, and scholar at The American Enterprise Institute. He is also a member of the Board of Scholars for the Mackinac Center for Public Policy.]

On the same day last week that Greta Thunberg made an impassioned speech to the United Nations about her fears of a climate emergency, **a group of 500 prominent scientists and professionals, led by the CLINTEL co-founder Guus Berkhout, sent this registered letter to the United Nations Secretary-General stating that there is no climate emergency** and climate policies should be designed to benefit the lives of people. Here's the press release, here' the list of 500 signees, and here's the opening of the letter:

A global network of more than 500 knowledgeable and experienced scientists and professionals in climate and related fields have the honor to address to Your Excellencies the attached European Climate Declaration, for which the signatories to this letter are the national ambassadors. The general-circulation models of climate on which international policy is at present founded are unfit for their purpose.

Therefore, it is cruel as well as imprudent to advocate the squandering of trillions of dollars on the basis of results from such immature models. **Current climate policies pointlessly and grievously undermine the economic system, putting lives at risk in countries denied access to affordable, reliable electrical energy.** We urge you to follow a climate policy based on sound science, realistic economics and genuine concern for those harmed by costly but unnecessary attempts at mitigation

Here are the specific points about climate change highlighted in the letter:

1. Natural as well as anthropogenic factors cause warming.
- 2. Warming is far slower than predicted.**
3. Climate policy relies on inadequate models.
- 4. CO2 is not a pollutant. It is a plant food that is essential to all life on Earth. Photosynthesis is a blessing. More CO2 is beneficial for nature, greening the Earth: additional CO2 in the air has promoted growth in global plant biomass. It is also good for agriculture, increasing the yields of crops worldwide.**
- 5. Global warming has not increased natural disasters.**
6. Climate policy must respect scientific and economic realities.
- 7. There is no climate emergency. Therefore, there is no cause for panic.**

MP: What about that "consensus" and "settled science" about climate change we always hear about? How can there be a consensus when there's a global network of more than 500 knowledgeable and experienced scientists and professionals in climate and related fields who challenge the "settled science"?

Accessibility to Oil and Gas Reserves

The potential benefits of climate change include increased plant growth in frozen regions, longer growing seasons for agriculture, and the possible accessibility of previously untapped oil and gas reserves.

Rosenberg 20 - [Rosenberg, Matt. "Could There Be Any Advantages of Global Warming?" ThoughtCo. February 18, 2020. <https://www.thoughtco.com/advantages-and-disadvantages-of-global-warming-1434937/>.]

[Matt Rosenberg is an award-winning geographer and the author of "The Handy Geography Answer Book" and "The Geography Bee Complete Preparation Handbook." He was director of emergency services for the American Red Cross and served on more than two dozen major disaster relief operations around the United States.]

The United Nations has been studying climate change and working to combat its effects since the first Earth Summit in 1992. The UN Intergovernmental panel's fifth report, published in late 2014, reiterates that global warming—more precisely called climate change—is happening and will likely not abate for centuries. The report also states with 95% certainty that the activity of humans has been the primary cause of increasing temperatures over the previous few decades, up from 90% in a previous report. We've heard the dire warnings—even if we have yet to heed them—but could there possibly be any advantages to climate change, and if so, could these upsides possibly outweigh the downsides?

Advantages of Global Warming? It's a Bit of a Stretch.

The so-called advantages of climate are out there—if you're really looking but do they compensate for the disruption and destruction wrought by the disadvantages? Again, the answer is no but for die-hard fans of the global warming trend, advantages might include the following suspect scenarios:

- **The Arctic, Antarctic, Siberia, and other frozen regions of the earth might experience more plant growth and milder climates.**
- **The next ice age could possibly be prevented.**
- **The Northwest Passage through the formerly icy Canadian Arctic Archipelago could arguably open up to transportation.**
- Fewer deaths or injuries would occur due to arctic conditions.
- **Longer growing seasons could mean increased agricultural production in some areas.**
- **Previously untapped oil and gas reserves might become available.**

Agriculture

Recent research indicates that changes in temperature could benefit agriculture and enhance yields and profitability.

Benjamin 07 - [Benjamin, Daniel. "The Benefits of Climate Change." PERC. September 1, 2007. <https://www.perc.org/2007/09/01/the-benefits-of-climate-change/>.]

[Benjamin is the author of numerous scholarly articles and books. He has also served as the associate editor of the journal Economic Inquiry. In 1994, he joined PERC as a senior fellow and the director of the PERC Fellowship Program for graduate and law students with an interest in natural resources and the environment. He graduated Phi Beta Kappa from the University of Virginia and completed his Ph.D. in economics in 1975 at the University of California at Los Angeles.]

Many people believe that human-caused emissions of greenhouse gases will lead to higher temperatures and increased precipitation during the 21st century. Similarly, it is thought that these changes may have an impact on economic well-being. The question remains: If such changes occur, will their economic effects be positive or negative? A definitive answer to this question is likely to be a long time coming, but recent research has shed new light on one important aspect. **Olivier Deschênes and Michael Greenstone (2007) show that the changes in temperatures and precipitation forecast by the standard models of climate change will actually benefit agriculture in America.**

They find that the lengthened growing seasons and added precipitation implied by the most widely cited global climate change models will modestly increase agricultural yields and thereby enhance the profitability of American agriculture.

At one extreme, it has been estimated that climate change might reduce agricultural productivity so much as to cut the value of agricultural land by almost 20 percent. **At the other extreme, the outcome might be increased productivity that pushes the value of agricultural land up by almost 30 percent.**

Deschênes and Greenstone show that these widely differing numbers from past research are not the result of uncertainty about the climate and its effects on agriculture. Instead, they are the result of the statistical methods used by researchers. **In particular, these methods turn out to be highly sensitive to small changes in the data samples, and to small changes in the way the data are used.** To avoid this sensitivity, the authors employ a method in which the observed productivity impacts of past changes in temperatures and precipitation are used to infer the likely impacts of future changes in temperature and precipitation.

Perhaps most importantly, the authors find that, over any plausible range, the impacts of climate change are largely invariant to the size of the climate change. That is, if temperatures rise by more than 50F or precipitation increases by more than eight inches, productivity will rise even more—but not much more. Similarly, even if precipitation or temperatures fall over the next century, agricultural productivity will barely drop.

The second key finding of the present study lies in its striking demonstration of the robustness of agriculture productivity to climate change. **Even if precipitation and temperature change far more than any climate models now suggest they might, the likely effects on agricultural productivity in America appear to be de minimis.** For those who have observed the resilience of Mother Nature and the adaptiveness of human beings, this may come as little surprise. But given the current state of climate research it surely comes as good news.

Health

Experts indicate that climate change has had more positive effects than negative ones so far, including reduced winter mortality, improved agricultural yields, and enhanced biodiversity.

Ridley 13 - [Ridley., Matt.. "Why Climate Change Is Good for the World." The Spectator. October 17, 2013. <https://www.spectator.co.uk/article/why-climate-change-is-good-for-the-world/>.]

[Matthew Ridley is a British science writer, journalist and businessman. He is known for his writings on science, the environment, and economics and has been a regular contributor to The Times newspaper. Matt Ridley is the author of How Innovation Works: And Why It Flourishes in Freedom (2020), and co-author of Viral: The Search for the Origin of Covid-19 (2021)]

Climate change has done more good than harm so far and is likely to continue doing so for most of this century. It is the consensus of expert opinion. Yet almost nobody seems to know this.

There are many likely effects of climate change: positive and negative, economic and ecological, humanitarian and financial. **And if you aggregate them all, the overall effect is positive today — and likely to stay positive until around 2080. That was the conclusion of Professor Richard Tol of Sussex University after he reviewed 14 different studies of the effects of future climate trends.** To be precise, Prof Tol calculated that climate change would be beneficial up to 2.2°C of warming from 2009 (when he wrote his paper). This means approximately 3°C from pre-industrial levels, since about 0.8°C of warming has happened in the last 150 years. The latest estimates of climate sensitivity suggest that such temperatures may not be reached till the end of the century — if at all.

Overall, Prof Tol finds that climate change in the past century improved human welfare. By how much? He calculates by 1.4 per cent of global economic output, rising to 1.5 per cent by 2025. For some people, this means the difference between survival and starvation.

It will still be 1.2 per cent around 2050 and will not turn negative until around 2080. In short, my children will be very old before global warming stops benefiting the world. **Note that if the world continues to grow at 3 per cent a year, then the average person will be about nine times as rich in 2080 as she is today. So low-lying Bangladesh will be able to afford the same kind of flood defences that the Dutch have today.**

The chief benefits of global warming include: **fewer winter deaths; lower energy costs; better agricultural yields; probably fewer droughts; maybe richer biodiversity. It is a little-known fact that winter deaths exceed summer deaths — not just in countries like Britain but also those with very warm summers, including Greece.** Both Britain and Greece see mortality rates rise by 18 per cent each winter. Especially cold winters cause a rise in heart failures far greater than the rise in deaths during heatwaves.

Cold, not the heat, is the biggest killer. **For the last decade, Brits have been dying from the cold at the average rate of 29,000 excess deaths each winter. Compare this to the heatwave ten years ago, which claimed 15,000 lives in France and just 2,000 in Britain.** In the ten years since, there has been no summer death spike at all. **Excess winter deaths hit the poor harder than the rich for the obvious reason: they cannot afford heating.** And it is not just those at risk who benefit from moderate warming. **Global warming has so far cut heating bills more than it has raised cooling bills.** If it resumes after its current 17-year hiatus, and if the energy efficiency of our homes improves, then at

Debate Track: Evidence Packet (Abolish P5 Status) - Climate Change Impacts

Resolved: The United Nations should abolish permanent membership on its Security Council.

some point the cost of cooling probably will exceed the cost of heating — probably from about 2035, Prof Tol estimates.

The greatest benefit from climate change comes not from temperature change but from carbon dioxide itself. It is not pollution, but the raw material from which plants make carbohydrates and thence proteins and fats. As it is an extremely rare trace gas in the air — less than 0.04 per cent of the air on average — plants struggle to absorb enough of it. On a windless, sunny day, a field of corn can suck half the carbon dioxide out of the air. Commercial greenhouse operators therefore pump carbon dioxide into their greenhouses to raise plant growth rates.

It is often argued that global warming will hurt the world's poorest hardest. What is seldom heard is that the decline of famines in the Sahel in recent years is partly due to more rainfall caused by moderate warming and partly due to more carbon dioxide itself: **more greenery for goats to eat means more greenery left over for gazelles, so entire ecosystems have benefited.**

Short-Term Benefits

In the short term, there may be some benefits from global warming, like fewer deaths from cold waves and improved crop growth in certain regions due to longer warm seasons and higher carbon dioxide levels.

Herring 20 - [Herring, David. "Are There Positive Benefits from Global Warming? | NOAA Climate.gov." Www.climate.gov. October 29, 2020. <https://www.climate.gov/news-features/climate-qa/are-there-positive-benefits-global-warming#:~:text=For%20example%2C%20the%20flip%20side.>]

[David Herring was a senior political, policy, and communications adviser to the Commerce-Justice-Science Appropriations Subcommittee Chairman. He was a chief speechwriter and special counsel on issues related to energy and the environment.]

Yes, there will probably be some short-term and long-term benefits from global warming. For example, **the flip side of increased mortality from heat waves may be decreased mortality from cold waves.**

In the short term, **farmers in some regions may benefit from the earlier onset of spring and from a longer warm season that is suitable for growing crops.** Also, studies show that, up to a certain point, **crops and other plants grow better in the presence of higher carbon dioxide levels and seem to be more drought-tolerant.** But this benefit is a two-edged sword: weeds, many invasive plant species, and insect pests will also thrive in a warmer world. Water availability will be impacted in drier agricultural areas that need irrigation. At some point, the benefits to crops of increased carbon dioxide will likely be overwhelmed by the negative impacts of heat stress and drought.

In the long term, **shipping commerce will benefit from the opening of the Northwest Passage for longer periods of the year due to the loss of Arctic sea ice.** However, in the long run, if a "business as usual" approach to emitting heat-trapping gases is maintained at the present rate, or faster, then the negative costs and impacts of global warming are very likely to far outweigh the benefits over the course of this century, with increased potential for catastrophic impacts from more extreme events. In part, this is because any substantial change, whether warmer or colder, would challenge the societal infrastructure that has developed under the current climate.