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Summary

The global climate is changing and our Earth is warming. Many people are already aware of the existence of climate change, but fewer are aware of the impacts of climate change on our water supplies, agriculture, power and transportation systems, the natural environment, and even our own health and safety. Also fewer people are aware of the efforts that we can make to overcome climate change by changing policies, practices and behaviors. In this project, the latest data and information are collected, summarized and synthesized from UN Intergovernmental Panel on Climate Change (IPCC), UN Food and Agriculture Organization (FAO), U.S. Environmental Protection Agency (EPA), U.S. Climate Change Science Program (CCSP), and U.S. National Research Council (NRC). The results are presented through a series of posters. The purpose of the project is to increase our GSU community's awareness of climate change science and enhance the intellectual pursuits for understanding of interrelation and interaction between human activities and the environments. The specific objectives of the project are: (1) to present up-to-date evidence on climate change; (2) to explain the main causes of the climate change; (3) to show the potential consequences of climate change on human being, the environment, society, and specific in the Midwest; and (4) to demonstrate what we can/should do to overcome climate change.

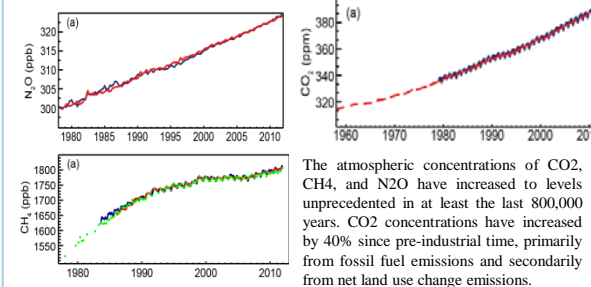
What is greenhouse gas?

Any gas that absorbs heat (infrared radiation) in the atmosphere are called greenhouse gases (GHG). Four most important GHGs are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases.

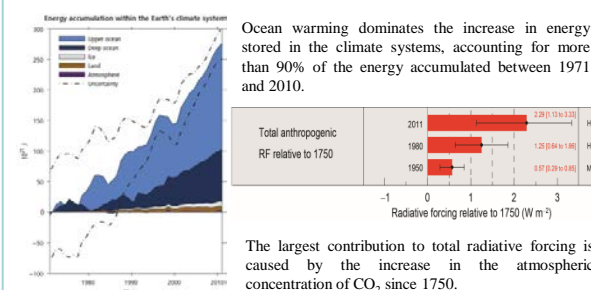
What is greenhouse effect?

Trapping and build-up of heat in the atmosphere near the Earth's surface. Some of the heat flowing back toward space from the Earth's surface is absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the Earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase

Increase of GHGs



Total radiative forcing is positive and has led to uptake of energy by the climate system



Acknowledgement

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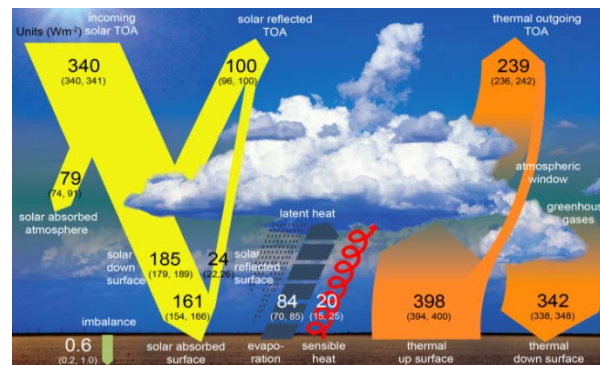
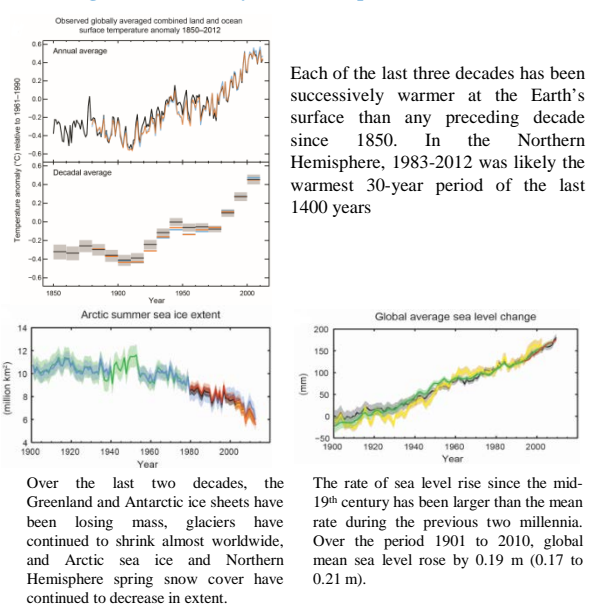
What is climate change?

Climate change refers to any significant change in the measures of climate (such as temperature and precipitation) lasting for an extended period of time (decades or longer). Climate change may result from natural factors and processes or from human activities.

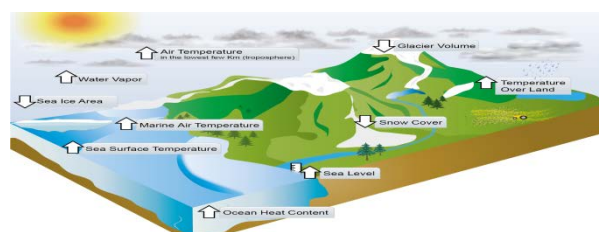
What is global warming?

Global warming refers to an average increase in temperature of the atmosphere near the Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere. Global warming is causing climate patterns to change. However, global warming is just one aspect of global climate change, though a very important one.

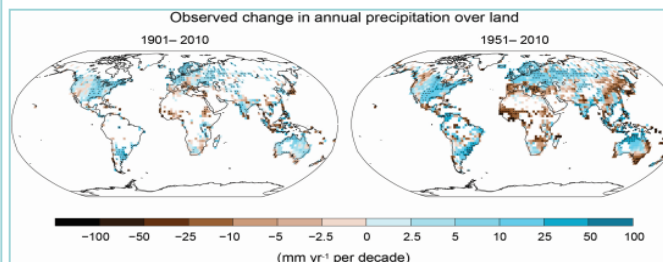
Warming of the climate system is unequivocal



Global mean energy budget under present-day climate conditions. Numbers state magnitudes of the individual energy fluxes in W m⁻², adjusted within their uncertainty ranges to close the energy budgets. Numbers in parentheses attached to the energy fluxes cover the range of values in line with observational constraints.



Independent analyses of many components of the climate system that would be expected to change in a warming world exhibit trends consistent with warming (arrow direction denotes the sign of the change).





Climate change: Causes, Impacts and Adaptation



----- Causes of Climate Change

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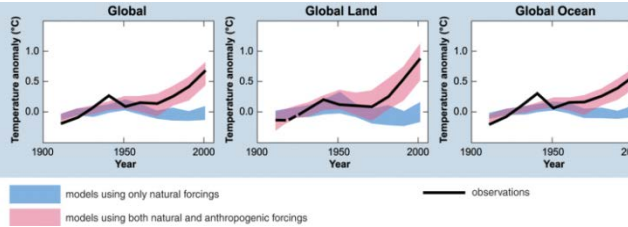
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Human influence on the climate system is clear

Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system

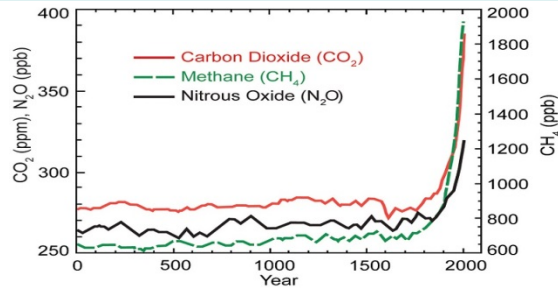


Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes

The main GHGs

The most important GHGs directly emitted by humans include CO₂, CH₄, N₂O and fluorinated gases.

- CO₂ is the primary greenhouse gas that is contributing to recent climate change. Human activities, such as the burning of fossil fuels and changes in land use, release large amounts of carbon to the atmosphere, causing CO₂ concentrations in the atmosphere to rise.
- CH₄ is produced through both natural and human activities. Natural wetlands, agricultural activities, and fossil fuel extraction and transport all emit CH₄.
- N₂O is produced through natural and human activities, mainly through agricultural activities, fuel burning and natural biological processes.

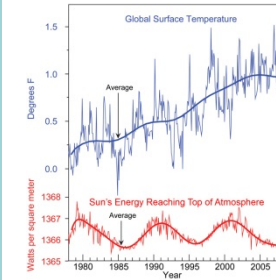


Increase in greenhouse gas (GHG) concentrations in the atmosphere over the last 2,000 years.

- CO₂ concentrations have increased by almost 40% since pre-industrial times, from approximately 280 ppmv in the 18th century to 390 ppmv in 2010.
- CH₄ concentrations increased sharply during most of the 20th century and are now more than two-and-a-half times pre-industrial levels.
- N₂O have risen approximately 18% since the start of the Industrial Revolution

Key points

- Both natural and human factors change Earth's climate.
- Before humans, changes in climate resulted entirely from natural causes such as changes in Earth's orbit, changes in solar activity, or volcanic eruptions.
- Since the Industrial Era began, humans have had an increasing effect on climate, particularly by adding billions of tons of heat-trapping greenhouse gases to the atmosphere.
- Most of the observed warming since the mid-20th century is due to human-caused greenhouse gas emission



The sun's energy received at the top of Earth's atmosphere has been measured by satellites since 1978. It has followed its natural 11-year cycle of small ups and downs, but with no net increase (bottom). Over the same period, global temperature has risen markedly (top).

Changes in the sun's energy affect how much energy reaches Earth's system

- Climate is influenced by natural changes that affect how much solar energy reaches Earth. These changes include changes within the sun and changes in Earth's orbit.
- Changes in solar energy continue to affect climate. But, solar activity has been relatively constant, therefore does not explain the recent warming of Earth. Changes in the shape of Earth's orbit as well as the tilt and position of Earth's axis affect temperature on relatively long timescales, and therefore cannot explain the recent warming.

Changes in reflectivity affect how much energy enters Earth's system

When sunlight reaches Earth, it can be reflected or absorbed. The amount that is reflected or absorbed depends on Earth's surface and atmosphere. Human changes in land use and land cover have changed Earth's reflectivity. Processes such as deforestation, reforestation, desertification, and urbanization often contribute to changes in climate in the places they occur. These effects may be significant regionally, but are smaller when averaged over the entire globe.

In addition, human activities have generally increased the number of aerosol particles in the atmosphere. Overall, human-generated aerosols have a net cooling effect offsetting about one-third of the total warming effect associated with human greenhouse gas emissions. Reductions in overall aerosol emissions can therefore lead to more warming.

Human activities currently release over 30 billion tons of CO₂ into the atmosphere every year. This build-up in the atmosphere is like a tub filling with water, where more water flows from the faucet than the drain can take away.

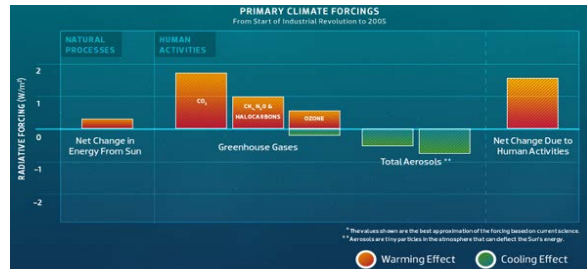
Earth's temperature is a balancing act

Earth's temperature depends on the balance between energy entering and leaving the planet's system. When incoming energy from the sun is absorbed by the Earth system, Earth warms. When the sun's energy is reflected back into space, Earth avoids warming. When energy is released back into space, Earth cools. Many factors, both natural and human, can cause changes in Earth's energy balance, including:

- Changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere
- Variations in the sun's energy reaching Earth
- Changes in the reflectivity of Earth's atmosphere and surface

The historical record shows that the climate system varies naturally over a wide range of time scales. In general, climate changes prior to the Industrial Revolution in the 1700s can be explained by natural causes, such as changes in solar energy, volcanic eruptions, and natural changes in greenhouse gas (GHG) concentrations

Recent climate changes, however, cannot be explained by natural causes alone. Research indicates that natural causes are very unlikely to explain most observed warming, especially warming since the mid-20th century. Rather, human activities can very likely explain most of that warming



Radiative forcing is a measure of the influence of a particular factor (e.g. GHGs, aerosols, or land use changes) on the net change in Earth's energy balance. On average, a positive radiative forcing tends to warm the surface of the planet, while a negative forcing tends to cool the surface.

Greenhouse effect causes the atmosphere to retain heat

When sunlight reaches Earth's surface, it can either be reflected back into space or absorbed by Earth. Once absorbed, the planet releases some of the energy back into the atmosphere as heat (also called infrared radiation). GHGs like water vapor (H₂O), carbon dioxide (CO₂), and methane (CH₄) absorb energy, slowing or preventing the loss of heat to space. In this way, GHGs act like a blanket, making Earth warmer than it would otherwise be. This process is commonly known as the "greenhouse effect".

Recent role of the greenhouse effect

Since the Industrial Revolution began around 1750, human activities have contributed substantially to climate change by adding CO₂ and other heat-trapping gases to the atmosphere. These greenhouse gas emissions have increased the greenhouse effect and caused Earth's surface temperature to rise. The primary human activity affecting the amount and rate of climate change is greenhouse gas emissions from the burning of fossil fuels



----- Climate change indicators

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Greenhouse Gases

- **U.S. GHG Emissions.** In U.S., GHG emissions caused by human activities increased by 5 percent from 1990 to 2012. However, since 2005, total U.S. GHG emissions have decreased by 10 percent. CO₂ accounts for most of the nation's emissions and most of the increase since 1990. Electricity generation is the largest source of GHG emissions in U.S., followed by transportation
- **Global GHG Emissions.** Worldwide, net emissions of GHGs from human activities increased by 35 percent from 1990 to 2010. Emissions of CO₂, which account for about three-fourths of total emissions, increased by 42 percent over this period. As with the U.S., the majority of the world's emissions result from electricity generation, transportation, and other forms of energy production and use
- **Atmospheric Concentrations of GHGs.** Concentrations of CO₂ and other GHGs in the atmosphere have increased since the beginning of the industrial era. Almost all of this increase is attributable to human activities. Historical measurements show that current levels of many GHGs are higher than any levels recorded for hundreds of thousands of years, even after accounting for natural fluctuations
- **Climate Forcing.** Climate forcing refers to a change in the Earth's energy balance, leading to either a warming or cooling effect. An increase in the atmospheric concentrations of GHGs produces a positive climate forcing, or warming effect. From 1990 to 2013, the total warming effect from GHGs added by humans to the Earth's atmosphere increased by 34 percent. The warming effect associated with CO₂ alone increased by 27 percent

Weather & Climate

- **U.S. and Global Temperature.** Average temperatures have risen across the contiguous 48 states in U.S. since 1901, with an increased rate of warming over the past 30 years. Seven of the top 10 warmest years on record have occurred since 1998. Average global temperatures show a similar trend, and the top 10 warmest years on record worldwide have all occurred since 1998
- **High and Low Temperature.** Many extreme temperature conditions are becoming more common. Since the 1970s, unusually hot summer temperatures have become more common in U.S., and heat waves have become more frequent. Record-setting daily high temperatures have become more common than record lows. The decade from 2000 to 2009 had twice as many record highs as record lows
- **U.S. and Global Precipitation.** Total annual precipitation has increased in U.S. and over land areas worldwide. Since 1901, precipitation has increased at an average rate of 0.5 percent per decade in the contiguous 48 states and 0.2 percent per decade over land areas worldwide
- **Heavy Precipitation.** In recent years, a higher percentage of precipitation in the U.S. has come in the form of intense single-day events. Nationwide, nine of the top 10 years for extreme one-day precipitation events have occurred since 1990
- **Drought.** Average drought conditions across the nation have varied since records began in 1895. The 1930s and 1950s saw the most widespread droughts, while the last 50 years have generally been wetter than average.
- **Tropical Cyclone Activity.** Tropical storm activity in the Atlantic Ocean, the Caribbean, and the Gulf of Mexico has increased during the past 20 years. Increased storm intensity is closely related to variations in sea surface temperature in the tropical Atlantic

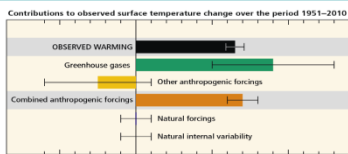
Background

The Earth's climate is changing. Temperatures are rising, snow and rainfall patterns are shifting, and more extreme climate events—like heavy rainstorms and record high temperatures—are already taking place. Scientists are highly confident that many of these observed changes can be linked to the climbing levels of carbon dioxide (CO₂) and other greenhouse gases (GHGs) in our atmosphere, which are caused by human activities

The U.S. Environmental Protection Agency use indicators to help readers understand observed long-term trends related to the causes and effects of climate change. An indicator represents the state or trend of certain environmental or societal conditions over a given area and a specified period of time

Oceans

- **Ocean Heat.** Three separate analyses show that the amount of heat stored in the ocean has increased substantially since the 1950s. Ocean heat content not only determines sea surface temperature, but also affects sea level and currents
- **Sea Surface Temperature.** Ocean surface temperatures increased around the world over the 20th century. The sea surface temperatures have been higher during the past three decades than at any other time since reliable observations began in the late 1800s
- **Sea Level.** When averaged over all the world's oceans, sea level has increased at a rate of roughly six-tenths of an inch per decade since 1880. The rate of increase has accelerated in recent years to more than an inch per decade
- **Ocean Acidity.** The ocean has become more acidic over the past few centuries because of increased levels of atmospheric carbon dioxide, which dissolves in the water



It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations and other anthropogenic forcing together.

Snow & Ice

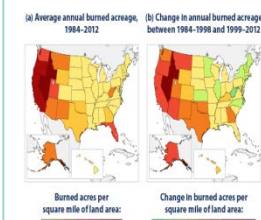
- **Arctic Sea Ice.** The minimum extent of Arctic sea ice has decreased over time, and in September 2012 it was the smallest on record. Arctic ice has also become thinner, which makes it more vulnerable to additional melting
- **Glaciers.** Glaciers in the U.S. and around the world have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level
- **Lake Ice.** Most lakes in the northern U.S. are freezing later and thawing earlier compared with the 1800s and early 1900s. Freeze dates have shifted later at a rate of roughly half a day to one day per decade, while thaw dates for most of the lakes studied have shifted earlier at a rate of half a day to two days per decade
- **Snowfall.** Total snowfall has decreased in most parts of the country since widespread records began in 1930
- **Snow Cover.** Between 1972 and 2013, the average portion of North America covered by snow decreased at a rate of about 3,500 square miles per year

Health & Society

- **Heating and Cooling Degree Days.** Heating and cooling degree days measure the difference between outdoor temperatures and the temperatures that people find comfortable indoors. As the U.S. climate has warmed in recent years, heating degree days have decreased and cooling degree days have increased overall, suggesting that Americans need to use less energy for heating and more energy for air conditioning.
- **Heat-Related Deaths.** Over the past three decades, nearly 8,000 Americans were reported to have died as a direct result of heat-related illnesses such as heat stroke
- **Lyme Disease.** Lyme disease is a bacterial illness spread by ticks that bite humans. Nationwide, the rate of reported cases of Lyme disease has approximately doubled since 1991
- **Length of Growing Season.** The average length of the growing season in the contiguous 48 states has increased by nearly two weeks since the beginning of the 20th century. A particularly large and steady increase has occurred over the last 30 years
- **Ragweed Pollen Season.** Warmer temperatures and later fall frosts allow ragweed plants to produce pollen later into the year, potentially prolonging the allergy season for millions of people

Ecosystems

- **Wildfires.** Since 1983, the United States has had an average of 72,000 recorded wildfires per year. Of the 10 years with the largest acreage burned, nine have occurred since 2000
- **Streamflow.** Changes in temperature, precipitation, snowpack, and glaciers can affect the rate of streamflow and the timing of peak flow. Nearly half of the rivers and streams measured in U.S. show peak winter-spring runoff happening at least five days earlier than it did in the mid-20th century
- **Great Lakes Water Levels and Temperatures.** Water levels in most of the Great Lakes have declined in the last few decades. Since 1995, average surface water temperatures have increased by a few degrees for Lakes Superior, Michigan, Huron, and Ontario
- **Bird Wintering Ranges.** Some birds shift their range or alter their migration habits to adapt to changes in temperature or other environmental conditions
- **Leaf and Bloom Dates.** Leaf growth and flower blooms are examples of natural events whose timing can be influenced by climate change



The number of acres burned in each state as a proportion of that state's total land area. For reference, there are 640 acres in a square mile; therefore, an average burned area of 6.4 acres per square mile would mean that fires burned 1 percent of a state's total land area. (a) The average extent of fires per year from 1984 to 2012. Darker-shaded states have the largest proportion of acreage burned. (b) How burned acreage has changed over time, based on a simple comparison between the first half of the available years (1984-1998) and the second half (1999-2012).



Climate change: Causes, Impacts and Adaptation

----- Climate Change Science Overview



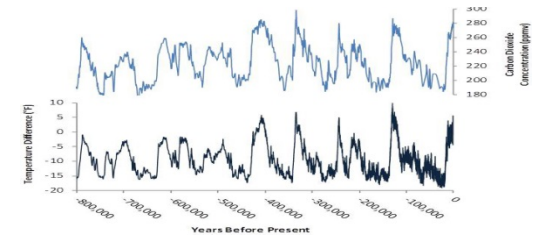
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The Role of the Greenhouse Effect in the Past



Estimates of the Earth's changing CO₂ concentration (top) and Antarctic temperature (bottom), based on analysis of ice core data extending back 800,000 years. Until the past century, natural factors caused atmospheric CO₂ concentrations to vary within a range of about 180 to 300 parts per million by volume (ppmv). Warmer periods coincide with periods of relatively high CO₂ concentrations.

Climate change impacts our health, environment, and economy

Climate change affects our environment and natural resources, and impacts our way of life in many ways. For example:

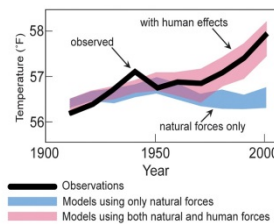
- Warmer temperatures increase the frequency, intensity, and duration of heat waves, which can pose health risks, particularly for young children and the elderly.
- Rising sea levels threaten coastal communities and ecosystems.
- Changes in the patterns and amount of rainfall, as well as changes in the timing and amount of stream flow, can affect water supplies and water quality and the production of hydroelectricity.
- Changing ecosystems influence geographic ranges of many plant and animal species and the timing of their lifecycle events, such as migration and reproduction.
- Increases in the frequency and intensity of extreme weather events, such as heat waves, droughts, and floods, can increase losses to property, cause costly disruptions to society, and reduce the availability and affordability of insurance.

We can prepare for some of the likely climate change impacts to reduce their effect on ecosystem and human well-being. Making such preparations is known as adaptation. Examples of adaptation include strengthening water conservation programs, upgrading stormwater systems, developing early warning systems for extreme heat events, and preparing for stronger storms through better emergency preparation and response strategies.

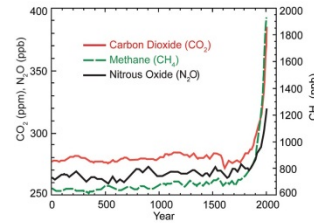


Background

- Earth's climate is changing in ways that affect our weather, oceans, snow, ice, ecosystems, and society.
- Natural causes alone cannot explain all of these changes. Human activities are contributing to climate change, primarily by releasing billions of tons of carbon dioxide (CO₂) and other heat-trapping gases, known as greenhouse gases (GHGs), into the atmosphere every year.
- Climate changes will continue into the future. The more GHGs we emit, the larger future climate changes will be.
- Changes in the climate system affect our health, environment, and economy. We can prepare for some of the impacts of climate change to reduce their effects on our well-being.



Models that account only for the effects of natural processes are not able to explain the warming over the past century. Models that also account for the GHGs emitted by humans are able to explain this warming



The increase in GHG concentrations in the atmosphere over the last 2,000 years. Increases in concentrations of these gases since 1750 are due to human activities in the industrial era.

The Carbon 'Bathtub' and its Components

SOURCES OF CARBON = "FAUCET"
 • Fossil fuel combustion
 • Deforestation

Right now, size of "faucet" is much larger than "drain."



As global temperature increases, size of "drain" decreases.

SINKS OF CARBON = "DRAIN"
 • Land uptake
 • Ocean uptake

If the amount of water flowing into a bathtub is greater than the amount of water leaving through the drain, the water level will rise. Carbon dioxide (CO₂) emissions are like the flow of water into the world's carbon bathtub. "Sources" of CO₂ emissions such as fossil fuel burning, cement manufacture, and land use are like the bathtub's faucet. "Sinks" of CO₂ in the ocean and on land (such as plants) that take up CO₂ are like the drain. Today, human activities have turned up the flow from the CO₂ "faucet," which is much larger than the "drain" can cope with, and the level of CO₂ in the atmosphere (like the level of water in a bathtub) is rising.

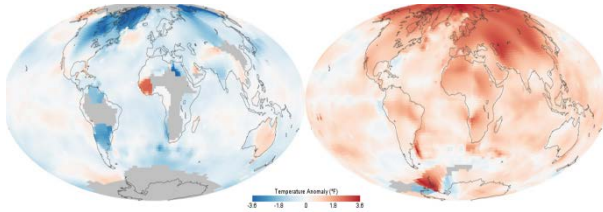
Climate will continue to change unless we reduce our emissions

During the 21st century, global warming is projected to continue and climate changes are likely to intensify. Scientists have used climate models to project different aspects of future climate, including temperature, precipitation, snow and ice, ocean level, and ocean acidity. Depending on future emissions of GHGs and how the climate responds, average global temperatures are projected to increase worldwide by 2° F to 11.5° F by 2100.

Earth's climate is changing

The global average temperature increased by more than 1.3° F over the last century. The average temperature in the Arctic rose by almost twice as much. The buildup of greenhouse gases in our atmosphere and the warming of the planet are responsible for other changes, such as:

- Changing precipitation patterns
- Increases in ocean temperatures, sea level, and acidity
- Melting of glaciers and sea ice



These maps show temperatures across the world in the 1880s (left) and the 1980s (right), as compared to average temperatures from 1951 to 1980. This difference from average is called an anomaly. The map on the left shows that it was colder in the 1880's in most places. The map on the right shows it was warmer in the 1980s in most places. Earth's average surface temperature has increased almost 1.5° F during the 20th century. Two-thirds of the warming has occurred since 1975, at a rate of roughly 0.3° F-0.4° F per decade.

Natural causes alone cannot explain recent changes

Natural processes such as changes in the sun's energy, shifts in ocean currents, and others affect Earth's climate. However, they do not explain the warming that we have observed over the last half-century.

Human causes can explain these changes

- Most of the warming of the past half century has been caused by human emissions of GHGs.
- GHGs come from a variety of human activities, including: burning fossil fuels for heat and energy, clearing forests, fertilizing crops, storing waste in landfills, raising livestock, and producing some kinds of industrial products.
- GHGs emissions are not the only way that people can change the climate. Activities such as agriculture or road construction can change the reflectivity of Earth's surface, leading to local warming or cooling. This effect is observed in urban centers, which are often warmer than surrounding, less populated areas. Emissions of small particles, known as aerosols, into the air can also lead to reflection or absorption of the sun's energy.





Climate change: Causes, Impacts and Adaptation

Climate Change Impacts on Agriculture and Food Supply



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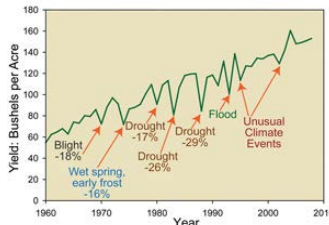
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Impacts on Crops

- Crops grown in U.S. are critical for the food supply here and around the world. U.S. exports supply more than 30% of all wheat, corn, and rice on the global market. Changes in temperature, amount of CO₂, and the frequency and intensity of extreme weather could have significant impacts on crop yields.
- Warmer temperatures may make many crops grow more quickly, but warmer temperatures could also reduce yields. Crops tend to grow faster in warmer conditions. However, for some crops (such as grains), faster growth reduces the amount of time that seeds have to grow and mature. This can reduce yields (i.e., the amount of crop produced from a given amount of land).



Increased carbon dioxide levels may accelerate the growth of some crops.

Despite technological improvements that increase corn yields, extreme weather events have caused significant yield reductions in some years.

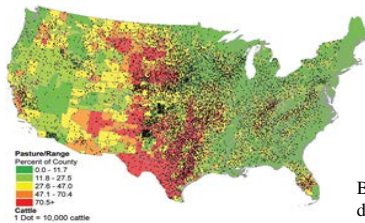
- For any particular crop, the effect of increased temperature will depend on the crop's optimal temperature for growth and reproduction. In some areas, warming may benefit the types of crops that are typically planted there. However, if warming exceeds a crop's optimum temperature, yields can decline.
- Higher CO₂ levels can increase yields. The yields for some crops, like wheat and soybeans, could increase by 30% or more under a doubling of CO₂ concentrations. The yields for other crops, such as corn, exhibit a much smaller response (less than 10% increase). However, some factors may counteract these potential increases in yield. For example, if temperature exceeds a crop's optimal level or if sufficient water and nutrients are not available, yield increases may be reduced or reversed.
- More extreme temperature and precipitation can prevent crops from growing. Extreme events, especially floods and droughts, can harm crops and reduce yields. For example, in 2008, the Mississippi River flooded just before the harvest period for many crops, causing an estimated loss of \$8 billion for farmers.
- Dealing with drought could become a challenge in areas where summer temperatures are projected to increase and precipitation is projected to decrease. As water supplies are reduced, it may be more difficult to meet water demands.
- Many weeds, pests and fungi thrive under warmer temperatures, wetter climates, and increased CO₂ levels. Currently, farmers spend more than \$11 billion per year to fight weeds in U.S.. The ranges of weeds and pests are likely to expand northward. This would cause new problems for farmers' crops previously unexposed to these species. Moreover, increased use of pesticides and fungicides may negatively affect human health.

Background

Agriculture is an important sector of the U.S. economy. In addition to providing us with much of our food, the crops, livestock, and seafood that are grown, raised, and caught in U.S. contribute at least \$200 billion to the economy each year.

Agriculture and fisheries are highly dependent on specific climate conditions.. Increases in temperature and CO₂ can be beneficial for some crops in some places. But to realize these benefits, nutrient levels, soil moisture, water availability, and other conditions must also be met. Changes in the frequency and severity of droughts and floods could pose challenges for farmers and ranchers. Meanwhile, warmer water temperatures are likely to cause the habitat ranges of many fish and shellfish species to shift, which could disrupt ecosystems. Overall, climate change could make it more difficult to grow crops, raise animals, and catch fish in the same ways and same places as we have done in the past. The effects of climate change also need to be considered along with other evolving factors that affect agricultural production, such as changes in farming practices and technology.

Impacts on Livestock



Beef cattle and pasture/rangeland distribution in the continental U.S.

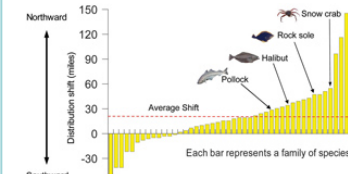
- Americans consume more than 37 million tons of meat annually. The U.S. livestock industry produced \$100 billion worth of goods in 2002. Changes in climate could affect animals both directly and indirectly.
- Heat waves, which are projected to increase under climate change, could directly threaten livestock. A number of states have each reported losses of more than 5,000 animals from just one heat wave. Heat stress affects animals both directly and indirectly. Over time, heat stress can increase vulnerability to disease, reduce fertility, and reduce milk production.
- Drought may threaten pasture and feed supplies. Drought reduces the amount of quality forage available to grazing livestock. Some areas could experience longer, more intense droughts, resulting from higher summer temperatures and reduced precipitation. For animals that rely on grain, changes in crop production due to drought could also become a problem.
- Climate change may increase the prevalence of parasites and diseases that affect livestock. The earlier onset of spring and warmer winters could allow some parasites and pathogens to survive more easily. In areas with increased rainfall, moisture-reliant pathogens could thrive.
- Increases in CO₂ may increase the productivity of pastures, but may also decrease their quality. Increases in atmospheric CO₂ can increase the productivity of plants on which livestock feed. However, studies indicate that the quality of some of the forage found in pasturelands decreases with higher CO₂. As a result, cattle would need to eat more to get the same nutritional benefits.

Key Points

- Moderate warming and more carbon dioxide in the atmosphere may help plants to grow faster. However, more severe warming, floods, and drought may reduce yields.
- Livestock may be at risk, both directly from heat stress and indirectly from reduced quality of their food supply.
- Fisheries will be affected by changes in water temperature that shift species ranges, make waters more hospitable to invasive species, and change lifecycle timing

Impacts on Fisheries

American fisheries catch or harvest five million metric tons of fish and shellfish each year. These fisheries contribute more than \$1.4 billion to the economy annually (as of 2007). Many fisheries already face multiple stresses, including overfishing and water pollution. Climate change may worsen these stresses. In particular, temperature changes could lead to significant impacts.



The ranges of marine species have shifted northward as waters have warmed

- The ranges of many fish and shellfish species may change. Many marine species have certain temperature ranges at which they can survive. For example, cod in the North Atlantic require water temperatures below 54° F. Even sea-bottom temperatures above 47° F can reduce their ability to reproduce and for young cod to survive. In this century, temperatures in the region will likely exceed both thresholds.
- Many aquatic species can find colder areas of streams and lakes or move northward along the coast or in the ocean. However, moving into new areas may put these species into competition with other species over food and other resources, as explained on the Ecosystems Impacts page.
- Some diseases that affect aquatic life may become more prevalent in warm water. For example, in southern New England, lobster catches have declined dramatically. A temperature-sensitive bacterial shell disease likely caused the large die-off events that led to the decline.
- Changes in temperature and seasons could affect the timing of reproduction and migration. Many steps within an aquatic animal's lifecycle are controlled by temperature and the changing of the seasons. For example, in the Northwest warmer water temperatures may affect the lifecycle of salmon and increase the likelihood of disease. Combined with other climate impacts, these effects are projected to lead to large declines in salmon populations.
- In addition to warming, the world's oceans are gradually becoming more acidic due to increases in atmospheric CO₂. Increasing acidity could harm shellfish by weakening their shells, which are created from calcium and are vulnerable to increasing acidity. Acidification may also threaten the structures of sensitive ecosystems upon which some fish and shellfish rely.

International Impacts

Internationally, the effects of climate change on agriculture and food supply are likely to be similar to those seen in U.S. However, other stressors such as population growth may magnify their effects.



----- Climate Change Impacts on Human Health

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Key Points

- A warmer climate is expected to both increase the risk of heat-related illnesses and death and worsen conditions for air quality.
- Climate change will likely increase the frequency and strength of extreme events (such as floods and droughts) that threaten human safety and health.
- Climate changes may allow some diseases to spread more easily.

Impacts from Climate-Sensitive Diseases

Changes in climate may enhance the spread of some diseases. Disease-causing agents, called pathogens, can be transmitted through food, water, and animals such as deer, birds, mice, and insects. Climate change could affect all of these transmitters.



Mosquitoes favor warm, wet climates and can spread diseases such as West Nile virus

Food-borne Diseases

- Higher air temperatures can increase cases of salmonella and other bacteria-related food poisoning because bacteria grow more rapidly in warm environments. These diseases can cause gastrointestinal distress and death.
- Flooding and heavy rainfall can cause overflows from sewage treatment plants into fresh water sources. Overflows could contaminate certain food crops with pathogen-containing feces.

Water-borne Diseases

- Heavy rainfall or flooding can increase water-borne parasites such as *Cryptosporidium* and *Giardia* that are sometimes found in drinking water. These parasites can cause gastrointestinal distress and in severe cases, death.
- Heavy rainfall events cause stormwater runoff that may contaminate water bodies used for recreation (such as lakes and beaches) with other bacteria. The most common illness contracted from contamination at beaches is gastroenteritis, an inflammation of the stomach and the intestines that can cause symptoms such as vomiting, headaches, and fever.

Animal-borne Diseases

- Mosquitoes favor warm, wet climates and can spread diseases such as West Nile virus.
- The geographic range of ticks that carry Lyme disease is limited by temperature. As air temperatures rise, the range of these ticks is likely to continue to expand northward. Typical symptoms of Lyme disease include fever, headache, fatigue, and a characteristic skin rash.
- In 2002, a new strain of West Nile virus, which can cause serious, life-altering disease, emerged in the United States. Higher temperatures are favorable to the survival of this new strain.

Other Health Linkages

Other linkages exist between climate change and human health. For example, changes in temperature and precipitation, as well as droughts and floods, will likely affect agricultural yields and production. In some regions of the world, these impacts may compromise food security and threaten human health through malnutrition, the spread of infectious diseases, and food poisoning. The worst of these effects are projected to occur in developing countries, among vulnerable populations

Background

- Weather and climate play a significant role in people's health. Changes in climate affect the average weather conditions that we are accustomed to. Warmer average temperatures will likely lead to hotter days and more frequent and longer heat waves. This could increase the number of heat-related illnesses and deaths. Increases in the frequency or severity of extreme weather events such as storms could increase the risk of dangerous flooding, high winds, and other direct threats to people and property. Warmer temperatures could increase the concentrations of unhealthy air and water pollutants. Changes in temperature, precipitation patterns, and extreme events could enhance the spread of some diseases.
- The impacts of climate change on health will depend on many factors. These factors include the effectiveness of a community's public health and safety systems to address or prepare for the risk and the behavior, age, gender, and economic status of individuals affected. Impacts will likely vary by region, the sensitivity of populations, the extent and length of exposure to climate change impacts, and society's ability to adapt to change.
- Although the United States has well-developed public health systems (compared with those of many developing countries), climate change will still likely affect many Americans. In addition, the impacts of climate change on public health around the globe could have important consequences for the United States. For example, more frequent and intense storms may require more disaster relief and declines in agriculture may increase food shortages.



Smog in Los Angeles decreases visibility and can be harmful to human health.



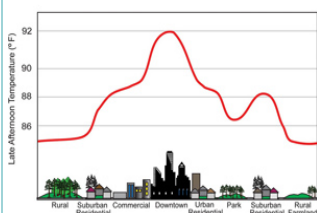
Ozone chemistry

Impacts from Reduced Air Quality

- Despite significant improvements in U.S. air quality since the 1970s, as of 2008 more than 126 million Americans lived in counties that did not meet national air quality standards.
- Scientists project that warmer temperatures from climate change will increase the frequency of days with unhealthy levels of ground-level ozone, a harmful air pollutant, and a component in smog.
- Ground-level ozone can damage lung tissue and can reduce lung function.
- Climate change will also affect particulates through changes in wildfires, which are expected to become more frequent and intense in a warmer climate.
- Climate change may affect allergies and respiratory health. The spring pollen season is already occurring earlier in U.S. due to climate change. The length of the season may also have increased. In addition, climate change may facilitate the spread of ragweed, an invasive plant with very allergenic pollen. Tests on ragweed show that increasing CO₂ concentrations and temperatures would increase the amount and timing of ragweed pollen production

Impacts from Heat Waves

- Heat waves can lead to heat stroke and dehydration, and are the most common cause of weather-related deaths. Excessive heat is more likely to impact populations in northern latitudes where people are less prepared to cope with excessive temperatures. Young children, older adults, people with medical conditions, and the poor are more vulnerable than others to heat-related illness. The share of the U.S. population composed of adults over age 65 is currently 12%, but is projected to grow to 21% by 2050, leading to a larger vulnerable population.
- Climate change will likely lead to more frequent, more severe, and longer heat waves in the summer, as well as less severe cold spells in the winter. A recent assessment of the science suggests that increases in heat-related deaths due to climate change would outweigh decreases in deaths from cold-snaps.
- Urban areas are typically warmer than their rural surroundings. Climate change could lead to even warmer temperatures in cities. This would increase the demand for electricity in the summer to run air conditioning, which in turn would increase air pollution and greenhouse gas emissions from power plants. The impacts of future heat waves could be especially severe in large metropolitan areas. Heat waves are also often accompanied by periods of stagnant air, leading to increases in air pollution and the associated health effects.



Flooded streets in New Orleans after Hurricane Katrina in 2005.

The "urban heat island" refers to the fact that the local temperature in urban areas is a few degrees higher than the surrounding area.

Impacts from Extreme Weather Events

- The frequency and intensity of extreme precipitation events is projected to increase in some locations, as is the severity of tropical storms. These extreme weather events could cause injuries and, in some cases, death. As with heat waves, the people most at risk include young children, older adults, people with medical conditions, and the poor. Extreme events can also indirectly threaten human health in a number of ways. Extreme events can:
- Reduce the availability of fresh food and water.
 - Interrupt communication, utility, and health care services.
 - Contribute to carbon monoxide poisoning from portable electric generators used during and after storms.
 - Increase stomach and intestinal illness among evacuees.
 - Contribute to mental health impacts such as depression and post-traumatic stress disorder



----- Adaptation for Climate Change

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Introduction

- “Adaptation” refers to efforts by society or ecosystems to prepare for or adjust to future climate change. These adjustments can be protective (i.e., guarding against negative impacts of climate change), or opportunistic (i.e., taking advantage of any beneficial effects of climate change).
- Adaptation to changes in climate is nothing new. Throughout history, human societies have repeatedly demonstrated a strong capacity for adapting to different climates and environmental changes--whether by migration to new areas, changing the crops we cultivate, or building different types of shelter. However, the current rate of global climate change is unusually high compared to past changes that society has experienced. In an increasingly interdependent world, negative effects of climate change on one population or economic sector can have repercussions around the world.
- Ecosystems will also be faced with adaptation challenges. Some species will be able to migrate or change their behavior to accommodate changes in climate. Other species may go extinct. Society's ability to anticipate some of the impacts of climate change on ecosystems can help us develop management programs that help ecosystems adapt.
- Even if current climate changes seem readily absorbed today, governments and communities are beginning adaptation planning. Many greenhouse gases remain in the atmosphere for 100 years or more after they are emitted. Because of the long-lasting effects of greenhouse gases, those already emitted into the atmosphere will continue to warm Earth in the 21st century, even if we were to stop emitting additional greenhouse gases today. Earth is committed to some amount of future climate change, no matter what. Therefore, steps can be taken now to prepare for, and respond to, the impacts of climate change that are already occurring, and those that are projected to occur in the decades ahead.
- There are limits to the ability to adapt, so actions to mitigate climate change must continue. For example, the relocation of communities or infrastructure may not be feasible in many locations, especially in the short term. Over the long term, adaptation alone may not be sufficient to cope with all the projected impacts of climate change. Adaptation will need to be continuously coupled with actions to lower greenhouse gas emissions.

Examples of Adaptation

Adaptation can consist of a wide variety of actions by an individual, community, or organization to prepare for, or respond to, climate change impacts. Many of these measures are things we are already doing but could be stepped up or modified to prepare for climate change. Some examples include:

Agriculture and Food Supply

- Breed crop varieties that are more tolerant of heat, drought, and water logging from heavy rainfall or flooding
- Protect livestock from higher summer temperatures by providing more shade and improving air flow in barns

Coasts

- Promote shore protection techniques and open space preserves that allow beaches and coastal wetlands to gradually move inland as sea level rises.
- Identify and improve evacuation routes and evacuation plans for low-lying areas, to prepare for increased storm surge and flooding.

Ecosystems

- Protect and increase migration corridors to allow species to migrate as the climate changes.
- Promote land and wildlife management practices that enhance ecosystem resilience

Energy

- Increase energy efficiency to help offset increases in energy consumption.
- Harden energy production facilities to withstand increased flood, wind, lightning, and other storm-related stresses

Human health

- Implement early warning systems and emergency response plans to prepare for changes in the frequency, duration, and intensity of extreme weather events.
- Plant trees and expand green spaces in urban settings to moderate heat increases

Water resources

- Improve water use efficiency and build additional water storage capacity.
- Protect and restore stream and river banks to ensure good water quality and safe guard water quantity.

Ongoing Efforts

Efforts by organizations and governments to prepare for climate change impacts have increased significantly across the United States, and the world, in recent years. For example:

- EPA has instituted programs to help communities adapt, including Climate Ready Estuaries and Climate Ready Water Utilities.
- The U.S. Interagency Climate Change Adaptation Task Force is coordinating the efforts for adaptation across government agencies.
- A growing number of states (e.g., California) and cities (e.g., Chicago) have begun preparing to protect people and infrastructure from climate change impacts.
- Many other countries around the world are beginning to adapt.
- Additionally, a number of corporations have begun preparing for climate change impacts.

Key Points

- Adaptation is the adjustments that society or ecosystems make to limit negative effects of climate change. It can also include taking advantage of opportunities that a changing climate provides.
- Adaptation can include actions by individuals and communities, from a farmer planting more drought-resistant crops to a city ensuring that new coastal infrastructure can accommodate future sea level rise.
- Many governments and organizations across the United States and the world have already begun taking action to adapt to climate change.
- Together, adaptation coupled with actions to reduce greenhouse gas emissions, are needed to address projected climate change



Forest and freshwater lake

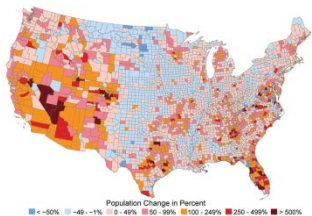


Irrigation canal in the desert

Society Adaptation

Certain areas of the U.S. benefit from being located close to natural resources that support the local economy. Climate change could threaten these resources, as well as the goods and services they produce and the jobs and livelihoods of those who depend upon them. For example, climate change will likely affect farming communities, tourism and recreation, and the insurance industry.

- Communities that developed around the production of different agricultural crops, depend on the climate to support their way of life. Climate change will likely cause the ideal climate for these crops to shift northward. Combined with decreasing rural populations, as in the Great Plains, a changing climate may fundamentally change many of these communities. Certain agricultural products may disappear entirely from the U.S.
- Climate change will also likely affect tourism and recreational activities. A warming climate and changes in precipitation patterns will likely decrease the number of days when recreational snow activities such as skiing and snowmobiling can take place. Beaches could suffer erosion due to sea level rise and storm surge. Changes in the migration patterns of fish and animals would affect fishing and hunting. Communities that support themselves through these recreational activities would feel economic impacts as tourism patterns begin to change.
- Climate change may make it harder and more expensive for many people to insure their homes, businesses, or other valuable assets in risk-prone areas.. We rely on insurance to protect investments in real estate, agriculture, transportation, and utility infrastructure by distributing costs across society. Climate change is projected to increase the frequency and intensity of extreme weather events. These changes are likely to increase losses to property and cause costly disruptions to society. Escalating losses have already affected the availability and affordability of insurance.



The percentage change in population across U.S. from 1970 to 2008

As a society, we have structured our day-to-day lives around historical and current climate conditions. We are accustomed to a normal range of conditions and may be sensitive to extremes that fall outside of this range. Climate change could affect our society through impacts on a number of different social, cultural, and natural resources.

- Climate change will affect certain groups more than others, particularly groups located in vulnerable areas and the poor, young, old, or sick.
- Cities are sensitive to many impacts, especially extreme weather impacts.
- Climate change may threaten people's jobs and livelihoods



Climate change: Causes, Impacts and Adaptation



Climate Change Impacts in the Midwest

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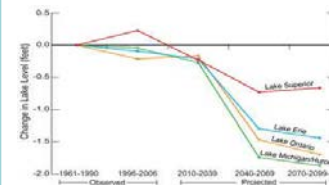
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Impacts on Agriculture, Forests, and other Ecosystems

In the short term, climate change could help or harm agriculture, forests, and other ecosystems in the Midwest. On one hand, where sufficient water and other nutrients are available, crops and forests may benefit from a longer growing season and increased levels of carbon dioxide. On the other hand, climate change may negatively impact the health of crops, trees, and animals in the region.

- Wetter conditions in the spring may make it difficult for farmers to plant their crops
- More frequent heat waves, floods, and droughts, as well as larger populations of harmful insects, will likely place additional stress on the region's agriculture
- Higher temperatures may stress livestock animals. This will likely make livestock production more costly during the summer as livestock productivity decreases and ventilation and cooling costs increase
- Climate change may threaten forests in the Midwest. Threats include more frequent droughts, wildfires, and larger populations of harmful insects such as gypsy moths
- Climate change is likely to alter fish populations in the Midwest. Cold-water fish such as brook trout, lake trout, and whitefish are projected to decline. Cool-water fish such as muskies, smallmouth bass, and bluegill are projected to replace these declining populations



Projected changes in the level of the Great lakes by end of the century.

Climate Change Impacts on the Great Lakes

• The Great Lakes are a key feature of Midwestern geography and society. The lakes contain 78% of North America's surface freshwater¹ and support transportation, agriculture, commerce, and recreation in the area. Each year, millions of tons of iron ore, coal, and grain are shipped over the lakes. In addition, fish are harvested from the Lakes, providing support to the local economy. One third of all registered boaters in the United States reside in the greater Great Lakes region, including Lake Ontario.

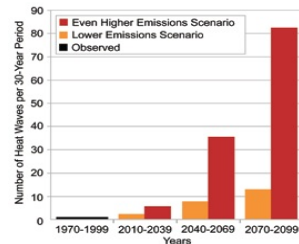
- Climate change is likely to upset these economic activities in the Great Lakes. For instance, in a warmer climate, evaporation from the lakes is projected to increase. Increased evaporation could cause water levels to drop by one to two feet by the end of the century. Although such a drop in water levels could benefit public beach access, it could adversely affect coastal ecosystems. Lower water levels would also make some key shipping channels too shallow for fully loaded ocean-going ships.
- Warmer temperatures may, however, have a positive impact on shipping, as ice-free seasons on waterways lengthen. The net impact of these changes is likely to impose costs on the Midwest through increased shipping, maintenance, and repair costs, as well as lost recreation and tourism. The Great Lakes Restoration Initiative, an interagency task force working to restore the Great Lakes ecosystem, is addressing climate change impacts and increasing the resiliency of the Lakes to future changes.

Background

- The Midwest is home to roughly 66 million Americans and includes the cities of Chicago, Indianapolis, Detroit, Milwaukee, Kansas City, Cleveland, Minneapolis, and St. Paul, among others. Most of the region consists of flat prairie that is farmed for corn, soybean, and wheat, or is used for grazing livestock. Summers in the Midwest are hot and humid, and winters are cold, since the region is far from the temperature-moderating effect of the oceans.
- Number of 1995-like Chicago Heat Waves. Under the lower emissions scenarios, 1995-like heat waves are projected to occur approximately once every three years. Under the higher scenarios, heat waves are projected to occur on average, three times per year.
- In the Midwest, average annual temperatures increased over the last several decades. Heat waves are becoming more frequent and cold periods are becoming rarer. Snow and ice are arriving later in the fall and starting to melt earlier in the spring. Heavy downpours now occur twice as frequently as they did a century ago. These trends are likely to continue under future climate change: average summer temperatures are projected to increase by 3° F over the next few decades and could increase by over 10° F by the end of this century.

Key Points

- The Midwest will likely experience hotter summers with longer dry periods and milder, wetter winters.
- In Midwest urban areas, climate change will likely make it more difficult to maintain current summer air quality.
- Climate change will likely place additional stress on infrastructure and the economy, particularly on shipping routes on the Great Lakes.
- In the short-term, Midwest crop yields may benefit from less snow cover and a longer growing season.



Number of 1995-like Chicago Heat Waves. Under the lower emissions scenarios, 1995-like heat waves are projected to occur approximately once every three years. Under the higher scenarios, heat waves are projected to occur on average, three times per year.

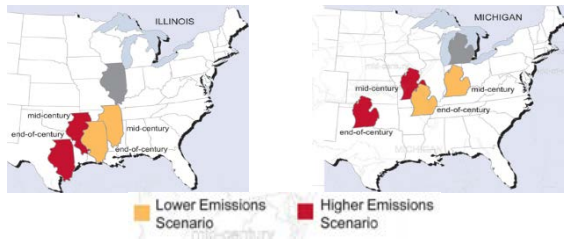
Source



Damage caused by the Great Flood of 1993 along the Mississippi and Missouri river systems. The damage caused to Highway 54 just north of Jefferson City, Missouri. Although an individual flood event such as this cannot be linked specifically to climate change, climate change will increase the likelihood of flooding in the Midwest

Impacts on Human Health

- Climate change will likely affect the health of Americans living in the Midwest. For example, climate change could increase heat-related deaths, increase the risks of spreading certain diseases, and worsen air quality.
- In 1995, Chicago endured a heat wave from July 12th to July 16th that caused over 700 heat-related deaths. Similar heat waves could occur up to three times per year by 2100. If greenhouse gas emissions increase at a higher rate, the average annual number of heat-related deaths in Chicago is projected to quadruple by the middle of the century. In general, heat waves are projected to increase in frequency, duration, and severity as climate changes.
- Ticks and mosquitoes are already a nuisance in the Midwest, but will survive in greater numbers as winters become milder. This will increase the risks of spreading diseases such as Lyme disease and West Nile virus.
- Some areas close to Chicago and St. Louis do not currently meet air quality standards for ground-level ozone, an air pollutant that can damage lung tissue when inhaled. Ozone forms in hot, sunny, and stagnant conditions. More frequent and intense heat waves are likely to increase ozone formation. This will make it more challenging to meet air quality standards and will increase the risks of health effects in these areas.



Projected change in summer temperatures under different warming scenarios. Summers in Illinois and Michigan might feel like current summers in Texas or Oklahoma by the end of the century

Impacts on Water Resources

- Throughout the year, precipitation in the Midwest is likely to become more intense, likely leading to increased flood damage, strained drainage systems, and reduced summer water availability.
- Precipitation in the Midwest is likely to fall more frequently in heavy downpours, which will increase the likelihood of flooding, property damage, travel delays, and disruption in services. The last three decades have been the wettest in a century for the Midwest. In the first half of 2008, severe floods swept the region, causing fatalities, evacuations, and damage to roads and infrastructure.
- More frequent heavy downpours will strain drainage and wastewater systems unless they are rebuilt during the next century. Chicago's combined water and sewer systems overflowed into Lake Michigan due to heavy rainfall an average of two and a half times each decade from 1960 to 1990. This level of heavy rainfall is projected to occur two to three times as often by 2100.
- Between heavy rainfall events, there will likely be longer periods without precipitation. Increased evaporation during warmer summers could increase the likelihood of water shortages or drought in the Midwest.

Climate change: Causes, Impacts and Adaptation



----- What You Can Do

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Background

Driving a car, using electricity to light and heat your home, and throwing away garbage all lead to greenhouse gas (GHG) emissions. You can reduce emissions through simple actions like changing a light bulb, powering down electronics, using less water, and recycling. This poster provides easy steps you can take at Home, School, the Office, and On the Road to protect the climate, reduce air pollution, and save money. Take action today! Small steps add up, if we all do our part.



At office

Business and home offices use a significant amount of electricity for heating and cooling, lighting, and operating equipment. Here are four easy ways to reduce GHG emissions and help make the air

Manage your office equipment energy use better

Save energy and reduce GHG emissions at work by setting your computer, monitor and other office equipment to power down when not in use. Activate the power management features on your computer and monitor, unplug laptop power cords when not in use and turn off equipment and lights at the end of the day.

Look for High Efficiency Energy products for the office

Office products that have earned the feature special energy-efficient designs, which enable them to use less energy while performing regular tasks.

Ask your office building manager if your building is special energy-efficient designs

High efficiency energy labeled buildings provide safe, healthy, and productive environments that use about 35% less energy than average buildings.

Use less energy for your commute

Switching to public transportation, carpooling, biking, or telecommuting, can save energy and reduce GHG emissions on your way to and from work.

Reduce, reuse, recycle

Reducing, reusing, and recycling at the office helps conserve energy, and reduces pollution and GHG emissions. Reduce, reuse, and recycle at the office by using two-sided printing and copying; only printing what you need; buying supplies made with recycled content; and recycling paper products, batteries, and used printer cartridges.

Use Green Power

Emissions from electricity generated from fossil fuels can be one of the most significant environmental impacts associated with your organization's operations.

Encourage your organization to develop a GHG inventory

Developing a GHG inventory is a critical first step toward measuring and managing your organization's climate change impact.

On the road

Driving your vehicle releases GHGs into the atmosphere and contributes to climate change—but you can take simple, easy steps to cut your emissions, reduce our nation's dependence on oil, and save money.

Buy smart: Purchase a fuel-efficient, low-greenhouse gas vehicle

When shopping for a new or used vehicle, choose the cleanest, most fuel-efficient vehicle that meets your needs

Drive smart

To improve your fuel economy and reduce GHG emissions, go easy on the brakes and gas pedal, avoid hard accelerations, reduce your time spent idling and unload unnecessary items in your trunk to reduce weight.

Remember maintenance

Get regular tune-ups, follow the manufacturer's maintenance schedule, and use the recommended grade of motor oil

Do not forget your tires

Check your tire pressure regularly

Give your car a break

Use public transportation, carpool, or walk or bike whenever possible to avoid using your car

Use renewable fuels

Give E85 and biodiesel a try. Both are renewable fuels that can reduce GHG emissions from your vehicle



At school

Students, faculties, staffs and administrators can all play a key role in reducing GHGs emissions.

Students

Students can reduce their emissions from energy they use in dorm rooms and can also work with faculty, staff and administrator to develop an inventory, increase energy efficiency on campus, and reduce their university's GHGs by using green power.

Faculty and Staff

Teach students about climate change and ecosystems

Engage students in estimating emissions

Learn from other educators

Administrators

Track and rate the energy performance of your portfolio of university buildings and make them to become energy efficient, reduce GHG emissions, and save money.

Developing an inventory of their university's emissions in order to reduce their university's GHG emissions

Reducing, reusing, and recycling at university and in the classroom helps conserve energy, and reduce pollution and GHGs from resource extraction, manufacturing, and disposal.

At home

Making a few small changes in your home and yard can reduce greenhouse gases (GHGs) and save you money

Change five lights

Replace your five most frequently used light fixtures or the lightbulbs in them with energy efficiency products

Look for High Efficiency Energy Products

When buying new products for your home, look for high efficiency energy label to help you make the most energy-efficient decision

Heat and cool smartly

Simple steps like changing air filters regularly, properly using a programmable thermostat, and having your heating and cooling equipment maintained annually by a licensed contractor can save energy and increase comfort, while helping to protect the environment

Seal and insulate your home

Reduce air leaks and stop drafts by using caulk, weather stripping, and insulation to seal your home's envelope and add more insulation to your attic to block out heat and cold

Reduce, reuse, recycle

Reducing, reusing, and recycling in your home helps conserve energy and reduces pollution and GHG emissions from resource extraction, manufacturing, and disposal

Use water efficiently

It takes lots of energy to pump, treat, and heat water, so saving water reduces GHG emissions. Saving water around the home is simple

Be green in your yard

Composting your food and yard waste reduces the amount of garbage that you send to landfills and reduces GHG emissions

Purchase green power

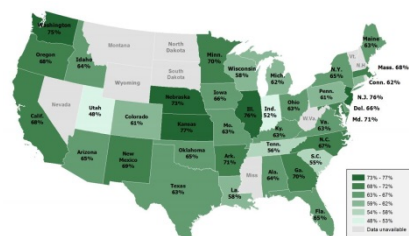
Power your home by purchasing green power

Calculate your household's carbon footprint

Use EPA's Household GHG Emissions Calculator to estimate your household GHG emissions resulting from energy use, transportation, and waste disposal. This tool helps you understand where your emissions come from and identify ways to reduce them

Spread the word

Tell family and friends that energy efficiency is good for their homes and good for the environment because it lowers GHG emissions and air pollution. Tell five people and together we can help our homes help us all



Percentage of Americans who believe the U.S. should take action on global warming regardless of the actions of other countries