Climate Change Frequently Asked Questions

Information Source: EPA Climate Change FAQ

1. How serious is a warming of a few degrees?

2. Will a warming climate have more positive or negative effects?

3. How will climate change affect ecosystems?

4. How will climate change affect human health?

5. How will climate change affect agriculture?

6. How will climate change affect Polar regions?

7. How will a warming climate affect precipitation?

8. How will a warming climate affect hurricanes?

9. How will climate change affect water resources?

10. How will climate change affect energy?

11. How are the terms climate change, global warming, and global change different?

12. What is the greenhouse effect?

13. Are human activities responsible for the warming climate?

14. How do scientists predict future climate change?

15. How much will the Earth warm if emissions of greenhouse gases continue to rise?

16. Is our planet warming?

17. How much carbon dioxide do humans contribute through breathing?

18. How are individuals contributing to the build-up of greenhouse gases?

19. What are the most important greenhouse gases? Where are they coming from and how have they changed?

20. Since 1990, how have greenhouse gas emissions in the U.S. changed?

21. What are the largest sources of greenhouse gas emissions in the U.S.?

Ans. In the U.S., our energy-related activities account for over three-quarters of our human-generated greenhouse gas emissions, mostly in the form of carbon dioxide emissions from burning fossil fuels. More than half the energy-related emissions come from large sources such as power plants and factories, while about a third comes from transportation. Industrial processes (such as the production of cement, steel, and aluminum), agriculture, other land use, and waste management are also important sources of greenhouse gas emissions in the United States. Forestry is also an important sector — in the U.S., after accounting for tree growth and harvesting, there is a net accumulation of carbon from the atmosphere and into biomass. This net accumulation partially offsets some of the emissions from other sources.

Source: EPA US GHG Inventory Reports

Ans. The Earth's climate is very complex and involves the influences of air, land, and oceans on one another. Scientists use computer models to study these interactions. The models project future climate changes based on expected changes to the atmosphere. Though the models are not exact, they are able to simulate many aspects of the climate. Scientists reason that if the models can mimic currently observed features of the climate, then they are also most likely able to project future changes.

Source: IPCC "AR4 WG1 FAQs" 2007 (PDF)

Ans. Longer, more intense and frequent heat waves may cause more heat-related death and illness. There is virtual certainty of declining air quality in cities since greater heat can also worsen air pollution such as ozone or smog. Insect-borne illnesses are also likely to increase as many insect ranges expand. Climate change health effects are especially serious for the very young, very old, or for those with heart and respiratory problems. Conversely, warmer winter temperatures may reduce the negative health impacts from cold weather. For more information, visit the Health page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Health

Ans. Because warm sea surface temperatures energize hurricanes, a warming climate is likely to make hurricanes more intense. Hurricanes in the future will probably have stronger peak winds and increased rainfall. The relationship between sea surface temperatures and the frequency of hurricanes is less clear. There is currently no scientific consensus on how a warming climate is likely to affect the frequency of hurricanes, but research continues. For more information, visit the Extreme Events page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Extreme Events
http://epa.gov/climatechange/fq/effects.html - content

Ans. The Intergovernmental Panel on Climate Change (IPCC) estimates it has warmed 1.2 to 1.4°F (0.7 to 0.8ºC) over the past century and projects a further 3 to 7°F (2 to 4ºC) over the 21st century. The increases may appear minor compared to short-term weather changes from night to day and winter to summer. In global climate terms, however, warming at this rate would be much larger and faster than any of the climate changes over at least the past 10,000 years.

Source: IPCC Climate Change 2007: The Physical Science Basis.

Ans. Overall, total U.S. emissions have risen by 17 percent from 1990 to 2007. This trend is projected to continue at about 1 percent per year assuming current trends in economic growth and fuel consumption continue. The increase is driven principally by population and economic growth, and the rate of change is affected by energy price fluctuations, technological changes, seasonal temperatures, and other factors. On an annual basis, the overall consumption of fossil fuels in the United States generally fluctuates in response to changes in general economic conditions, energy prices, weather, and the availability of non-fossil alternatives. Future trends will be driven by changes that affect the scale of consumption (e.g., population, number of cars, and size of houses), the efficiency with which energy is used in equipment (e.g., cars, power plants, steel mills, and light bulbs), and consumer behavior (e.g., walking, bicycling, or telecommuting to work instead of driving).

Source: EPA US GHG Trends (PDF) (40 pp, 975KB, About PDF)
Source: Energy Information Agency (EIA) International Energy Outlook (IEO) Table A10. World Carbon Dioxide Emissions by Region, Reference Case, 1990-2030: International Energy Outlook 2007 (PDF)

Ans. Many greenhouse gases, like water vapor and carbon dioxide (CO2), occur naturally. Fuel burning and other human activities are adding large amounts of carbon dioxide and other gases to the natural mix at a faster rate than at any other time on record. Other important greenhouse gases produced by human activity include methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).
Since 1750, atmospheric concentrations of CO2, CH4 and N20 have increased by over 36 percent, 148 percent and 18 percent, respectively. Scientists have concluded that this is due primarily to human activity.

Source: EPA Greenhouse Gas Emissions

Ans. Rising temperatures will intensify the Earth's water cycle. Increased evaporation will make more water available in the air for storms, but contribute to drying over some land areas. As a result, storm-affected areas are likely to experience increases in precipitation and increased risk of flooding. But areas located far away from storm tracks are likely to experience less precipitation and increased risk of drought. In the U.S., warming is expected to cause a northward shift in storm tracks, resulting in decreases in precipitation in areas such as the Southwest U.S. but increases in many areas to the north and east. However, these changes will vary by season and depend on weather fluctuations. For more information, visit the Future Precipitation and Storm Changes page on EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Science, Future Precipitation and Storm Changes

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Ans. A warming climate will have both positive and negative impacts. Local impacts are the most difficult to predict, making it a challenge to know exactly who or what will be harmed or benefit. Generally, the risk of negative impacts from climate change increases the faster it warms. More rapid climate change makes adapting to change more difficult and costly. This is especially true for vulnerable groups (such as the poor, the very young, and older adults) and fragile ecosystems which may struggle to adapt to even small changes. The Intergovernmental Panel on Climate Change (IPCC) suggests that temperature increases above the range of 3.5 to 5.5°F (2 to 3ºC) over the next 100 years would dramatically increase the negative impacts of climate change. So a major aim of climate action is to reduce the risk and likelihood of large, rapid warming. For more information, visit the Health and Environmental Effects page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability

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Ans. The Earth's greenhouse effect is a natural occurrence that helps regulate the temperature of our planet. When the Sun heats the Earth, some of this heat escapes back to space. The rest of the heat, also known as infrared radiation, is trapped in the atmosphere by clouds and greenhouse gases, such as water vapor and carbon dioxide. If all of these greenhouse gases were to suddenly disappear, our planet would be 60ºF (33ºC) colder and would not support life as we know it. Human activities have enhanced the natural greenhouse effect by adding greenhouse gases to the atmosphere, very likely (greater than 90 percent chance) causing the Earth's average temperature to rise. These additional greenhouse gases come from burning fossil fuels such as coal, natural gas, and oil to power our cars, factories, power plants, homes, offices, and schools. Cutting down trees, generating waste and farming also produce greenhouse gases.

Source: IPCC "AR4 WG1 FAQs" 2007 (PDF)
Source: EPA Climate Change Basic Information

Ans. Warmer temperatures may result in higher energy bills for air conditioning in summer, and lower bills for heating in winter. Energy usage is also connected to water needs. Energy is needed for irrigation, which will most likely increase due to climate change. Also, energy is generated by hydropower in some regions, which will also be impacted by changing precipitation patterns. For more information, visit the Energy Production and Use page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Energy Production and Use

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Ans. In a warming climate, extreme events like floods and droughts are likely to become more frequent. More frequent floods and droughts will affect water quality and availability. For example, increases in drought in some areas may increase the frequency of water shortages and lead to more restrictions on water usage. An overall increase in precipitation may increase water availability in some regions, but also create greater flood potential. For more information, visit the Water Resources page of EPA's Climate Change site.
Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Water Resources
http://epa.gov/climatechange/fq/effects.html - content
If you live along the coast, your home may be impacted by sea level rise and an increase in storm intensity. Rising seas may contribute to enhanced coastal erosion, coastal flooding, loss of coastal wetlands, and increased risk of property loss from storm surges. For more information, visit Coastal Zones and Sea Level Rise page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Coastal Zones and Sea Level Rise
http://epa.gov/climatechange/fq/effects.html - content

Ans. The average person, through the natural process of breathing, produces approximately 2.3 pounds (1 kg) of carbon dioxide per day. The actual amount depends strongly on the person's activity level. However, this carbon dioxide is part of a natural closed-loop cycle and does not contribute to the greenhouse gas concentrations in the atmosphere. Natural processes of photosynthesis (in plants) and respiration (in plants and animals) maintain a balance of oxygen and carbon dioxide in the atmosphere. Thus, the carbon dioxide from natural process is not included in greenhouse gas inventories.
In contrast, the burning of fossil fuels upsets this natural equilibrium by adding a surplus of carbon dioxide into the system. The carbon in fossil fuels has been stored underground for millions of years and thus is not part of the current natural carbon cycle. When those fuels are burned, the carbon dioxide generated is over and above the amount circulating from natural sources. Land use changes such as deforestation also upset the natural equilibrium by reducing the amount of carbon dioxide removed from the atmosphere by forests. Thus, both fossil fuel burning and deforestation are accounted for by scientists who develop greenhouse gas inventories to study how greenhouse gases contribute to climate change.

Source: Carbon Dioxide Information Analysis Center FAQs

Ans. Intergovernmental Panel on Climate Change (IPCC) scientists believe that it is very likely (greater than 90 percent chance) that most of the warming we have experienced since the 1950s is due to the increase in greenhouse gas emissions from human activities.

Source: IPCC "AR4 WG1 FAQs" 2007 (PDF)
Source: IPCC Climate Change 2007: WGI Summary for Policy Makers (PDF) (18 pp, 3.7MB)

Ans. Many daily activities produce greenhouse gas emissions. Individuals can produce greenhouse gas emissions directly by driving a car or burning oil or gas for home heating. Individuals can also produce greenhouse gas emissions indirectly by using electricity generated from fossil fuels. In the United States, emissions per person vary depending on location, habits, and personal choices. For example, the types of fuel used to generate the electricity a person uses can lead to different levels of emissions. A power plant that burns coal emits more greenhouse gases per unit of electricity than a power plant that uses natural gas. How much a person drives, the vehicle's fuel efficiency, and the proportion of driving time spent idling in traffic also affect the level of emissions. In addition, a household's reuse and recycling of materials can affect emissions by reducing the amount of methane-generating waste sent to landfills. EPA's household greenhouse gas emissions calculator provides a good estimate of emissions generated by individuals.

Source: EPA Individual Emissions

Ans. The supply and cost of food may change as farmers and the food industry adapt to new climate patterns. A small amount of warming coupled with increasing CO2 may benefit certain crops, plants, and forests, although the impacts of vegetation depend also on the availability of water and nutrients. For warming of more than a few degrees, the effects are expected to become increasingly negative, especially for vegetation near the warm end of its suitable range. For more information, visit the Agriculture and Food Supply page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Agriculture and Food Supply

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Ans. If humans continue to emit greenhouse gases at or above the current pace, we will probably see an average global temperature increase of 3 to 7°F (2 to 4ºC) by 2100, and greater warming after that. Temperatures in some parts of the globe (e.g., over land and in the polar regions) are expected to rise even more.
Even if we drastically reduce greenhouse gas emissions, returning them to year 2000 levels and holding them constant, the Earth would still warm about 1°F (0.6ºC) over the next 100 years. This is due to the long lifetime of many greenhouse gases and the slow cycling of heat from the ocean to the atmosphere.

Source: IPCC Climate Change 2007: The Physical Science Basis.

Ans. Polar regions are expected to warm more than any other parts of the world. In part, this is because ice has greater reflectivity (also known as albedo) than ocean or land. Melting of highly reflective snow and ice reveals darker land and ocean surfaces, which increases absorption of the sun's heat and further warms the planet, especially in those regions. Polar ice sheets (such as those on Greenland and Antarctica) are some of the largest surface features on our planet. Any changes to them, however small, could have far-reaching effects. Polar ice sheets potentially will accumulate more snow and ice because of an increase in precipitation. However, overall melting due to global warming is expected to reduce the size and extent of the polar ice sheets. Melting of polar ice and land-based glaciers is expected to contribute to sea level rise. In addition to the ice sheets, sea ice is also melting. Though the melting of floating sea ice that covers part of the Arctic Ocean does not affect sea level, sea ice is important for wildlife and for keeping the region cool by reflecting sunlight back to space. If the Arctic loses the reflective surface of ice and then the dark Arctic Ocean absorbs more heat, the northern regions may warm even more rapidly. For more information, visit the Polar Regions page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Polar Regions

Ans. The term climate change is often used as if it means the same thing as the term global warming. According to the National Academy of Sciences, however, "the phrase 'climate change' is growing in preferred use to 'global warming' because it helps convey that there are [other] changes in addition to rising temperatures." Climate change refers to any distinct change in measures of climate lasting for a long period of time. In other words, "climate change" means major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from:

- natural factors, such as changes in the Sun's energy or slow changes in the Earth's orbit around the Sun;
- natural processes within the climate system (e.g., changes in ocean circulation);
- human activities that change the atmosphere's makeup (e.g, burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.).

Global warming is an average increase in temperatures near the Earth's surface and in the lowest layer of the atmosphere. Increases in temperatures in our Earth's atmosphere can contribute to changes in global climate patterns. Global warming is probably the most talked about climate change we are experiencing, but is just one of many changes along with precipitation levels, storm intensity, etc. Global warming can be considered part of climate change along with changes in precipitation, sea level, etc.
Global change is a broad term that refers to changes in the global environment, including climate change, ozone depletion, and land-use change.

Source: EPA Climate Change Basic Information

Ans. Yes. The global temperature record shows an average warming of about 1.3°F (0.74ºC) over the past century. According to the National Oceanic and Atmospheric Administration (NOAA), seven of the eight warmest years on record have occurred since 2001. Within the past 30 years, the rate of warming across the globe has been approximately three times greater than the rate over the last 100 years. Past climate information suggests the warmth of the last half century is unusual in at least the previous 1,300 years in the Northern Hemisphere. The Intergovernmental Panel on Climate Change (IPCC) concluded that warming of the Earth's climate system is now "unequivocal" (i.e., "definite"). The IPCC bases this conclusion on observations of increases in average air and ocean temperatures, melting of snow and ice, and average sea level across the globe.

Source: IPCC "AR4 WG1 FAQs" 2007 (PDF)

Ans. Some ecosystems have already been affected by changes in climate. As the climate continues to warm, major changes may occur in ecosystem structure and function, species' ecological interactions, and species' geographic ranges, with predominantly negative consequences for biodiversity. Warmer temperatures and precipitation changes will likely affect the habitats and migratory patterns of many types of wildlife. The range and distribution of many species will change, and some species that cannot move or adapt may face extinction. In addition, climate changes such as increased floods and droughts are predicted to increase the risk of extinction for some plant and animal species, many of which are already at-risk due to other non-climate related factors. For more information, visit the Ecosystems and Biodiversity page of EPA's Climate Change site.

Source: IPCC Climate Change 2007: Impacts, Adaptation and Vulnerability
Source: EPA Climate Change Effects, Ecosystems and Biodiversity