

Climate Impact Projections

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Increasing temperatures

SCIENTIFIC MODELS SUGGEST the global average temperature is likely to rise between 1.8 and 4.0°C (3.2-7.2°F) over the 21st century. Temperatures will not rise equally everywhere, however. Land will warm more than oceans. The centers of continents will warm more rapidly than land near the oceans. Landmasses in higher latitudes are also predicted to warm more than in lower latitudes (tropics). For example, the Arctic is projected to warm much faster than tropical regions during the 21st century. In the past 100 years, average Arctic temperatures have increased at nearly twice the average rate of global temperature change.

The warming trend is not expected to be consistent across seasons. Winters are likely to warm more than summers. Consequently, the increased temperatures may change some precipitation from snow to rain.

Consequences of higher temperatures may include the following:

- more heat-related deaths, especially in urban areas and among poor people
- fewer cold-related deaths in cooler climates
- decreased use of energy for heat (in cooler climates) and increased use of energy for air conditioning
- melting glaciers and thawing permafrost (permanently frozen ground)
- later frosts, earlier spring plantings, and longer growing seasons in cooler climates
- reduced growing season and increased heat damage to crops in warmer and drier climates
- poleward shift of plant and animal species
- earlier spring migrations of birds and fish
- increased heat stress to wildlife and livestock

- increased risk of drought and forest wildfires
- increased susceptibility of trees and crops to pests
- shifts in tourist destinations

Changes in precipitation

WARMER TEMPERATURES ARE EXPECTED to lead to changes in the water cycle, and global mean precipitation is expected to increase. However, it is difficult to predict how much the amount of precipitation will change in any given area. Climate models predict an increase in the frequency of heavy precipitation events in the 21st century, particularly in tropical regions (near the equator) and high latitudes (near the poles). Conversely, it is likely that precipitation will decrease in sub-tropical and mid-latitude regions.

A warmer climate increases the likelihood of precipitation extremes, including both droughts and floods. Consequences of these extreme events may include increased stress on flood insurance systems and government disaster relief systems, increased damage to plants and crops, and increased risk of forest fires.

Shifting freshwater supplies

CLIMATE CHANGE HAS THE POTENTIAL to affect both surface waters and groundwater storage. Climate change is expected to affect groundwater recharge rates. The recharge (water that moves from Earth's surface down into the ground) that used to happen in spring will move to winter, and the summer recharge will decrease. This may affect the quantity of groundwater stored in aquifers, which are used for municipal drinking water and for irrigation.

Higher temperatures will increase glacial melt, leading to higher river flows in the short term. That glacial melt is expected to decrease in the future, as there is less glacial mass remaining. Reduced snowpack, another anticipated result of

climate change, will affect communities that depend on snowmelt for drinking water. A warmer climate may also adversely impact water quality; heat promotes growth of algal blooms, bacteria, and fungi.

Changes to ocean chemistry

GLOBAL OCEAN HEAT CONTENT is expected to continue to increase. Most of the increase will happen near the surface of the ocean. The Atlantic Ocean accounts for about half of the global increase in ocean heat content.

Globally, the world's oceans are becoming less saline, although this is not the case in all places (salinity has actually increased in subtropical waters). This may be due to increased precipitation, higher runoff from land, and melting ice. The Pacific Ocean is overall warming and "freshening."

The increased carbon dioxide in Earth's atmosphere affects the amount of carbon dioxide in oceans. The world's oceans are becoming more acidic. Algae are particularly sensitive to acidification; they may die as a result. Coral reefs, which are often brightly colored by the algae that live within them, appear bleached when the algae die. Coastal communities that rely on fish and other marine animals living around these coral reefs will be affected.

Rising sea levels

SEA LEVEL WILL CONTINUE TO RISE as a result of global warming. Part of this rise is due to thermal expansion of the oceans (as water gets warmer, it becomes less dense and takes up more space), and part is due to melting glaciers and icecaps. Thawing permafrost is also expected to contribute up to 5 millimeters to ocean levels in the 21st century.

Scientists have so far been unable to predict precisely how much and how quickly the oceans will rise because there are so many variables, including how much glaciers will melt, how much sea water will expand, and how ocean circulation patterns will change. Rising sea levels will make low-lying coastal areas, deltas, and small islands at

risk for flooding and erosion. Some very low-lying islands and other areas may need to be evacuated.

Shorter and milder winters

IN AREAS WITH TRADITIONALLY COLD WINTERS, the hard frosts kill off insect pests, and the accumulated snow melts slowly during the spring to recharge groundwater and feed streams. Often these areas rely on snow and ice to draw winter tourists for activities like skiing, snowmobiling, dogsledding, and ice climbing.

Warmer winters would enable more insect pests to survive. This could threaten local communities of living things. Also, less snowpack that melts earlier means that less water might be available in the spring and summer, when plants need it most. Areas with winter tourism would also suffer from reduced ice and snowpack.

Spreading disease vectors

AS THE CLIMATE WARMS, disease vectors (things that carry disease) like mosquitoes and ticks will be able to extend their ranges into places that were previously too cold. At the same time, climate change may increase waterborne pathogens (microorganisms that cause disease), decrease water and air quality, and decrease the amount and quality of available food in some regions. These effects will be most severe in developing countries and among the poor.

References:

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Climate Prediction Sheet

GROUP MEMBERS _____

COUNTRY NAME _____

INSTRUCTIONS: Based on the information you have about the climate in your country and the Climate Impact Projections reading, answer the questions below to predict how global climate change might affect your country.

Remember that these are just your predictions, and not right/wrong answers!

1. At what time of year might precipitation come? In what form? How much?
2. Might part of your region be affected by droughts? Floods?
3. Might the area be affected by storms? What kinds of storms, and where?
4. Would shorter and milder winters affect the area? If so, how?
5. Might the area be affected by rising sea levels? If so, how?
6. How would the production of food or other crops be affected?
7. What concerns might the area have related to diseases? Agricultural pests?