

## Health and Environmental Effects

Many elements of human society and the environment are sensitive to climate variability and change. Human health, agriculture, natural ecosystems, coastal areas, and heating and cooling requirements are examples of climate-sensitive systems.

Rising average temperatures are already affecting the environment. Some observed changes include shrinking of glaciers, thawing of permafrost, later freezing and earlier break-up of ice on rivers and lakes, lengthening of growing seasons, shifts in plant and animal ranges and earlier flowering of trees ([IPCC, 2001](#)).

Global temperatures are expected to continue to rise as human activities continue to add carbon dioxide, methane, nitrous oxide, and other greenhouse (or heat-trapping) [gases to the atmosphere](#). Most of the United States is expected to experience an increase in average temperature ([IPCC, 2001](#)). Precipitation changes, which are also very important to consider when assessing climate change effects, are more difficult to predict. Whether or not rainfall will increase or decrease remains difficult to project for specific regions.

The extent of climate change effects, and whether these effects prove harmful or beneficial, will vary by region, over time, and with the ability of different societal and environmental systems to adapt to or cope with the change.

A 2001 report from the National Research Council, entitled "Climate Change Science: An Analysis of Some Key Questions" ([NRC, 2001](#)), concluded:

The impacts of these climate changes will be significant, but their nature and intensity will depend strongly on the region and timing of occurrence. At a national level, the direct economic impacts are likely to be modest. However, on a regional basis the level and extent of both beneficial and harmful impacts will grow. Some economic sectors may be transformed substantially and there may be significant regional transitions associated with shifts in agriculture and forestry. Increasingly, climate change impacts will have to be placed in the context of other stresses associated with land use and a wide variety of pollutants. The possibility of abrupt or unexpected changes could pose greater challenges for adaptation.

Even the mid-range scenarios considered in the IPCC result in temperatures that continue to increase well beyond the end of this century, suggesting that assessments that examine only the next 100 years may well underestimate the magnitude of the eventual impacts.

The amount and speed of future climate change will ultimately depend on:

- Whether greenhouse gases and aerosol concentrations increase, stay the same or decrease.
- How strongly features of the climate (e.g. temperature, precipitation and sea level) respond to changes in greenhouse gas and aerosol concentrations.
- How much the climate varies as a result of natural influences (e.g. from volcanic activity and changes in the sun's intensity) and its internal variability (referring to random changes in the circulation of the atmosphere and oceans).