# Climate Change

On-going scientific research has identified the potential impacts of "greenhouse gas" (GHG) emissions (including carbon dioxide (CO2); methane; nitrous oxide; water vapor; and several trace gasses) on global climate. The Intergovernmental Panel on Climate Change (IPCC 2007) recently stated that most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) GHG concentrations. Through complex interactions on a regional and global scale, these GHG emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO2 concentrations to increase dramatically, and are likely to contribute to overall climatic changes, typically referred to as global warming. Increasing CO2 concentrations also lead to preferential fertilization and growth of specific plant species.

Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies 2007). In the past decades, the Pacific Northwest regional climate has become warmer and wetter with reduced snowpack (Scientific Consensus Statement 2004). The IPCC has suggested that the average global surface temperature could rise 1 to 4.5 degrees Fahrenheit (°F) in the next 50 years, with significant regional variation. The National Academy of Sciences (2006) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Computer models indicate that such increases in temperature will not be equally distributed globally, but are likely to be accentuated at higher latitudes. Also, warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Vulnerabilities to climate change depend considerably on specific geographic and social contexts.

Although changes to the amount and timing of precipitation are too uncertain to predict, the consensus concerning temperature changes has much greater certainty. Even if precipitation regimes do not change, increasing temperature will result in greater evapo-transpiration demand in summer, leading to drier soils and dead fuels and earlier curing of herbaceous vegetation. These effects can thereby extend the fire season, reduce base flows in streams, and increase water temperatures. More precipitation in winter will likely fall as rain instead of snow, changing the timing of high flows and increasing the risk of freeze damage to vegetation that is adapted to being snow covered most of the winter. These changes are already documented in areas outside the JDB.

Potential impacts to air quality resulting from climate change are likely to be varied. If global climate change results in a warmer and drier climate, increased particulate matter could occur as a result of increased windblown dust from drier and less stable soils.

Exactly how diverse plant and animal species will respond to climate change and at what rate is unclear, particularly since the planning area lies largely at mid- and lower elevations. Changes in timing of bird migration and nesting, insect hatching and development, green-up and other

spring events are also well documented both in the U.S. and globally. Cool season plant species' ranges could potentially move north due to the potential loss of habitat, or from competition from other species whose ranges shift northward, and the population of some animal species could change. It would be difficult to apply the results of existing climate change models to a finer scale than the entire Pacific Northwest; it is unknown how these changes in climate will specifically alter fundamental ecological processes at the scale of the John Day River Basin (JDB).

Many of the models needed to make effective decisions at the local and regional levels have not been developed. When further information on the impacts to climate change is known, such information would be considered in the implementation of this plan, as appropriate.

**NEW CITATIONS**

Goddard Institute for Space Studies. 2007. Annual Mean Temperature Change for Three Latitude Bands. Datasets and Images. GISS Surface Temperature Analysis, Analysis Graphs and Plots. New York, New York.
Available on the Internet: http://data.giss.nasa.gov/gistemp/graphs/Fig.B.lrg.gif.

National Academy of Sciences. 2006. Understanding and Responding to Climate Change: Highlights of National Academies Reports. Division on Earth and Life Studies. National Academy of Sciences. Washington, D.C.
Available on the Internet: http://dels.nas.edu/basc/Climate-HIGH.pdf.

Make sure GHG is listed in the acronym list.