



Knowledge Building Series

Climate Change 101

March 2008

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 8

What is Climate Change?

Climate change refers to any significant change in measures of climate, such as temperature, precipitation or wind, lasting for an extended period (decades or longer). Climate change can result from:

- natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- natural processes within the climate system, such as changes in ocean circulation;
- human activities, such as burning fossil fuels, that change the atmosphere's composition and the land surface, such as deforestation, urbanization, desertification.

Global warming is an average increase in the temperature of the Earth's atmosphere near the surface and in the troposphere. The term climate change is often used interchangeably with the term global warming, but according to the National Academy of Sciences, "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."

Since the start of the industrial era in the late 18th century, the overall effect of human activities on climate has been a warming influence, according to the Intergovernmental Panel on Climate Change. The human impact on climate during this era greatly exceeds impacts due to known changes in natural processes, such as solar changes and volcanic eruptions.

What the Data Tells Us

Climate scientists contributing to the Intergovernmental Panel on Climate Change are working to understand the impacts of climate change, the vulnerability of natural and human environments and the potential for response through adaptation.

These scientists use various tools and techniques in a wide range of scientific disciplines ranging from ecology, biology, hydrology, atmospheric science, meteorology, oceanography, glaciology, pathology, agronomy, forestry, economics, social science and natural resource management.

In addition to increasing air and ocean temperatures, scientists are observing and measuring: retreating glaciers, decreased thickness and extent of sea ice in the Arctic, a lengthening of the warm season over much of the Northern Hemisphere, rising sea levels, species extinctions, poleward and upward shifts in plant and animal ranges, increasing acidification of the oceans due to higher carbon dioxide levels and the spread of vector-borne diseases.

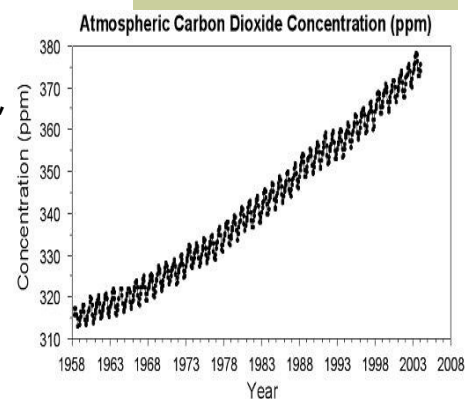
Physical and biological systems on all continents and in most oceans are already being affected by recent climate changes, particularly regional temperature increases. Further, it is likely that human-caused, or anthropogenic, warming over the last three decades has had a discernible influence.



Greenhouse Gases

Carbon dioxide (CO₂), methane, nitrous oxide and three groups of fluorinated gases—sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons, are the major greenhouse gases associated with human activity.

All of these gases have a high global warming potential, and remain in the atmosphere for long periods of time. They are also increasing in the atmosphere. In 2005, concentrations of CO₂ and methane exceed by far the natural range over the last 650,000 years, according to the Intergovernmental Panel on Climate Change. Climate change is predicted to warm the Earth by 3 to 10° F between 1990 and 2100.



Monthly record of atmospheric carbon dioxide concentration as measured from Mauna Loa, 1958-2003. [World Climate Report, 2004]

Less snowfall and warmer temperatures may increase drought, wildfires and habitat loss in the Mountain West.



Alpine habitat is expected to be lost and fragmented as warming occurs. The American pika is among the species at risk.



Future Climate Predictions in the Region

In the coming decades, scientists project that climate change will lead to significant changes in the Mountain West and Great Plains. The mid-range of the Intergovernmental Panel on Climate Change estimates a 5.4° F increase is enough to make Aspen as warm as Flagstaff is now, and Missoula as warm as Denver is now.

- The region will experience warmer temperatures overall, with less snowfall.
- Temperatures are expected to increase more in winter than in summer, more at night than in the day, and more in the mountains than at lower elevations – all leading to less snow.
- Earlier snowmelt means peak streamflows will be earlier, weeks before the peak needs of farmers, ranchers, rafters and others. In late summer, rivers, lakes and reservoirs will be drier.
- More frequent, more severe, and possibly longer-lasting droughts will occur.
- Crop and livestock production patterns could shift northward; less soil moisture due to increased evaporation may increase irrigation needs.
- Drier conditions will reduce the range and health of ponderosa and lodge pole forests, and increase susceptibility to fire. Grasslands and rangeland could expand into previously forested areas.
- Ecosystems will be stressed and wildlife such as the mountain lion, black bear, longnose sucker, fringetailed myotis, marten, and bald eagle could be further stressed.

Taking Action

There are many “no-regrets” actions we can take to reduce climate change and its impacts – actions that make sense for us to be doing anyway.

Tools and technologies exist to substantially cut greenhouse gases now, while actually improving local economies and saving money. What it will take is a decision to act—by all of us.

Also, since greenhouse gases already in the atmosphere will remain and affect the climate for decades, we will need to plan for and adapt to changes in climate that are coming.

Many states, municipalities and businesses in the region are showing leadership in this area. They have completed greenhouse gas inventories, established climate action plans, passed beneficial legislation and joined voluntary programs such as EPA’s Energy Star , Climate Leaders and the Green Power Partnership.

What EPA Region 8 is Doing

EPA Region 8 has designated climate change as a priority, and has developed a Strategic Plan to address this growing threat to human health and the environment. The vision of this Plan is to implement a comprehensive set of activities that reduce greenhouse gas emissions, sequester carbon, and facilitate adaptation to the negative effects of climate change. The region has identified ways in which it can make significant progress toward this vision through our statutory and voluntary programs, as well as our partnerships with States and Tribes.

The Plan includes activities in our core programs, including air, water, waste, ecosystems and enforcement.



EPA Region 8’s facility in Denver includes many design features and systems that dramatically reduce energy use and greenhouse gas emissions.

CLIMATE CHANGE IS PREDICTED TO WARM THE EARTH BY 3 TO 10° F BETWEEN 1990 AND 2100.

Climate Change 101



What You Can Do at Home

1. Change five lights to energy-efficient bulbs

Change a light, and you help change the world.

2. Look for the ENERGY STAR

Look for Energy Star-qualified products in more than 50 product categories, including lighting, home electronics, heating and cooling, and appliances.

3. Heat and cool smartly

Simple steps like cleaning air filters regularly, installing adequate insulation, and having your heating and cooling equipment tuned annually by a licensed contractor can save energy, increase comfort at home and reduce greenhouse gas emissions.

4. Use green power

Green power is electricity that is generated from renewable energy sources, such as wind and the sun, that don't contribute to climate change

5. Reduce, reuse and recycle

Reduce the amount of waste you generate and water you consume.

Pursue simple water saving actions such as not letting the water run while shaving or brushing teeth. Recycle your newspapers, beverage containers, paper and other goods. Reducing, reusing and recycling in your home helps conserve energy and reduces pollution and greenhouse gases from resource extraction, manufacturing and disposal.

6. Be green in your yard

Composting your food and yard waste reduces the amount of garbage that you send to landfills and reduces greenhouse gas emissions. EPA's GreenScapes program provides tips on how to improve your lawn or garden while also benefiting the environment.

What You Can Do at Work

1. Manage office equipment energy use better

Office equipment and electronics use energy even when idle or on stand-by. Always 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. Consider using a power strip that can be turned off when you're done using your computers, printers, wireless routers and other electronics.

2. Use less energy for your commute

Switch to public transportation, carpooling, biking, telecommuting and other innovative ways to save energy and reduce greenhouse gas emissions on your way to and from work.

Encourage your employer to offer commuter benefits that address limited or expensive parking, reduce traffic congestion, improve employee recruiting and retention, and minimize the environmental impacts associated with drive-alone commuting. If you do drive, find out the fuel efficiency of your vehicle using EPA's and the Department of Energy's Fuel Economy Web site, and make more environmentally informed choices when purchasing your next vehicle by using EPA's Green Vehicle Guide.

3. Reduce, reuse and recycle

Recycle office paper, newspapers, beverage containers, electronic equipment and batteries. Use two-sided printing and copying, buy supplies made with recycled content and recycle used printer cartridges. For your old electronics, investigate leasing programs to ensure reuse and recycling or donate used equipment to schools or other organizations.

What You Can Do on the Road

1. Buy smart

Before buying a new or used vehicle (or even renting), check out EPA's Green Vehicle Guide and the EPA/DOE Fuel Economy Guide.

2. Drive smart

To improve fuel economy and reduce greenhouse gas emissions, go easy on the brakes and gas pedal, avoid hard accelerations, reduce time spent idling, and unload unnecessary items in your trunk to reduce weight. If you have a removable roof rack and you are not using it, take it off to improve your fuel economy by as much as 5 percent. Use overdrive and cruise control on your car.

3. Tune your ride

A well-maintained car is more fuel-efficient, produces lower greenhouse gas emissions, is more reliable and is safer! Keep your car well-tuned, follow the manu-

facturer's maintenance schedule and use the recommended grade of motor oil. Also check and replace your vehicle's air filter regularly.

4. Check your tires

Check your tire pressure regularly. Under-inflation increases tire wear, reduces your fuel economy by up to 3 percent and leads to increased emissions of greenhouse gases and air pollutants.

5. Give your car a break

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

6. Use renewable fuels

Look for the ever-increasing number of alternative-fueled and hybrid vehicles available.

CLIMATE
CHANGE IS A
REAL
PROBLEM, BUT
IT ALSO HAS
REAL
SOLUTIONS



Wind energy production is increasing rapidly throughout the Mountain West and Great Plains. Look for opportunities to purchase clean energy from your local utility.



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EPA Climate Change Information

Regional Climate Change Coordinator

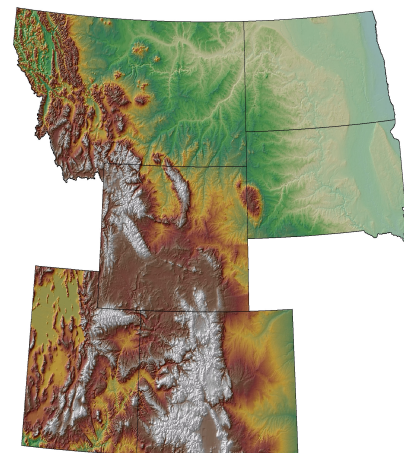
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Region 8 Climate Change Website

<http://www.epa.gov/region8/climatechange/>

EPA National Climate Change Website

<http://www.epa.gov/climatechange/>



Sources of Scientific Information

Intergovernmental Panel on Climate Change
<http://www.ipcc.ch/>

National Center for Atmospheric Research
<http://www.ncar.ucar.edu/research/climate/>

Rocky Mountain Climate Organization
<http://www.rockymountainclimate.org/index.htm>

National Oceanic and Atmospheric Administration
<http://www.esrl.noaa.gov/gmd/ccgg/trends/>

Earth Institute
<http://www.earthinstitute.columbia.edu/sections/view/9>

State Actions to Address Climate Change

Center for Climate Strategies
<http://www.climatestrategies.us/>

Pew Center on Global Climate Change
http://www.pewclimate.org/what_s_being_done/in_the_states/state_action_maps.cfm

