

OUR WARMING WORLD

1928



MELTING GLACIERS

The continent's best-studied example of glacial wasting over the last half-century has been the South Cascade Glacier, about 25 miles northeast of Darrington, outside North Cascades National Park.

1960



1986



2000



The toe of the glacier, frozen solid in 1928, has melted into a lake.

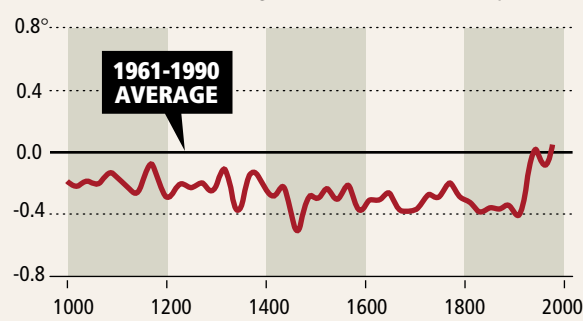
A warmer, wetter Northwest

"It is likely that the rate and duration of the warming of the 20th century is larger than any other time during the last 1,000 years."

- Intergovernmental Panel on Climate Change 2001 Report

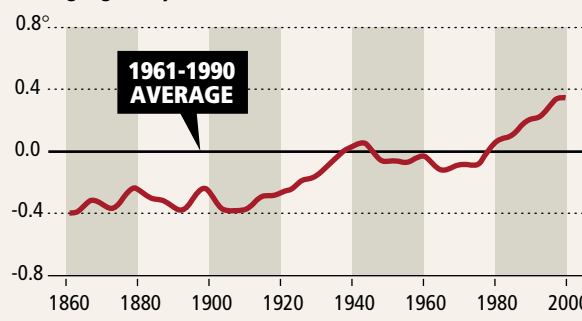
THE LONG-TERM TREND

Departures in temperature (Celsius) for the last 1,000 years from the 1961-1990 average for the Northern Hemisphere



THE PAST 140 YEARS

Departures in temperature (Celsius) from the 1961-1990 average, globally 1860-2000

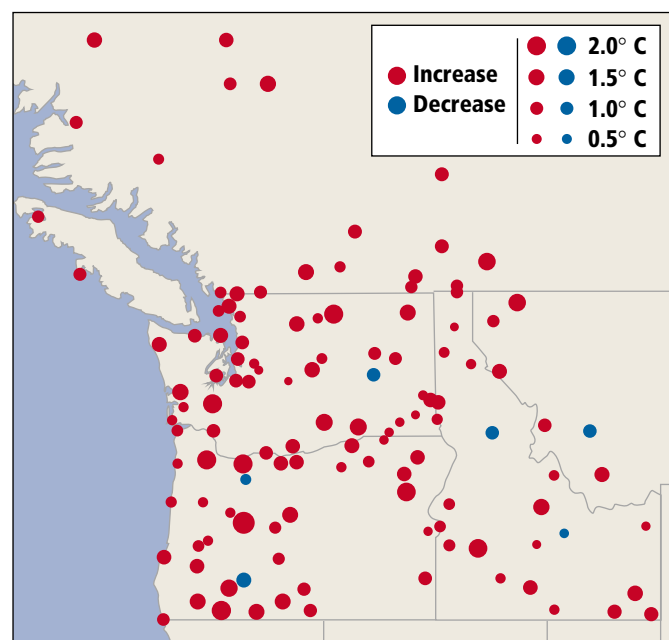


"Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities. . . . Temperatures are, in fact, rising."

- National Academy of Sciences 2001 report to President Bush

REGIONAL TEMPERATURE TRENDS

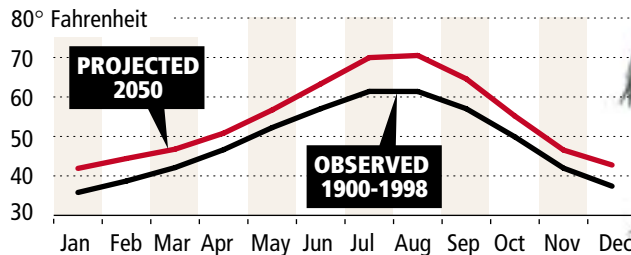
Dots indicate areas where readings were taken from 1930 to 1995



Average Northwest temperatures have increased more than the global average. During the 20th century, the region has warmed by about 1.5 degrees, based on readings taken around the area and analyzed by University of Washington scientists. They expect temperatures to increase another 2.5 degrees by the 2020s.

WESTERN WASHINGTON TEMPERATURE CHANGE

Observed and projected average monthly temperatures



ENVIRONMENTAL IMPACT INLAND

Scientists can't precisely predict how a warming Earth will affect a given region, but can paint a likely picture based on some of the warming that already has gone on.

FLOWERS

For nearly a half-century, a network of monitoring stations across the West reported on the bloom time of lilac and honeysuckle bushes. The research shows the average bloom date moving up by 5 to 10 days since the 1970s.



INSECTS

Sachem skipper butterfly
Since the early '90s, sachem skipper butterflies have taken up residence in the Tri-Cities because of warmer temperatures, scientists say. As warming continues, tree-killing bark beetles could thrive, reproducing faster and avoiding lethal cold snaps.



TREES

As it grows hotter, trees are likely to lose more water through their leaves and needles, and the soil will dry out. Western hemlock and other water-loving trees could disappear from some areas. The most severe impact will be an increase in major wildfires.



BY LISA STIFFLER AND ROBERT MCCLURE

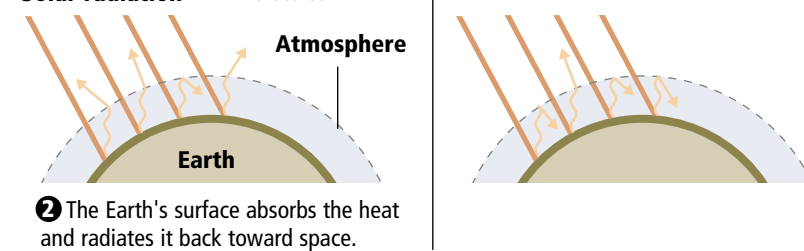
P-I reporters

Surprisingly small fluctuations in average global temperatures can have far-reaching impacts on any given region because those global averages mask extremes. For example, the Earth has warmed just 9 degrees since emerging from the last Ice Age about 12,000 years ago. Over the next century, average global temperatures are expected to warm 2.5 to 10.4 degrees. The Pacific Northwest has already felt the impacts of climate change - from melting glaciers to shrinking populations of some native fish species. Here's how the warming happens, and how scientists predict it will affect the region:

THE GREENHOUSE EFFECT

Carbon dioxide, methane, nitrous oxide and other gases capture and hold heat in the earth's atmosphere instead of letting it escape into space. The trapped heat warms the planet like a greenhouse. The gases occur naturally, but human activities since the Industrial Revolution are believed to have greatly boosted their concentrations. Some greenhouse gases can linger hundreds of years in the atmosphere and vary in their ability to trap heat. Nitrous oxide traps heat 296 times better than CO₂, while methane is 23 times more potent.

1 The sun's heat passes through the clear atmosphere.
2 The Earth's surface absorbs the heat and radiates it back toward space.
3 Some heat passes through the atmosphere, and some is re-emitted in all directions by greenhouse gas molecules.



Increased concentrations of greenhouse gases

More heat is trapped inside the Earth's atmosphere.

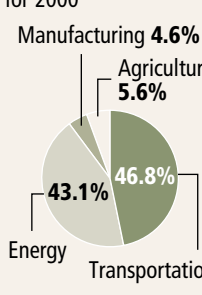
GREENHOUSE GASES BY SECTOR

Emissions by U.S. economic sectors, and their percentage change in output from 1990 to 2000. Figures in millions of metric tons.

Sector	% Change	1990 (Millions of metric tons)	2000 (Millions of metric tons)
Electricity Generation	+25%	1,898	2,377
Transportation	+23%	1,528	1,877
Industry	-6%	1,394	1,315
Agriculture	+8%	495	536
Residential	+10%	485	532
Commercial	+8%	304	328

TOP PRODUCERS IN WASHINGTON

In percent, by sector for 2000



CARBON EMISSIONS BY COUNTRY

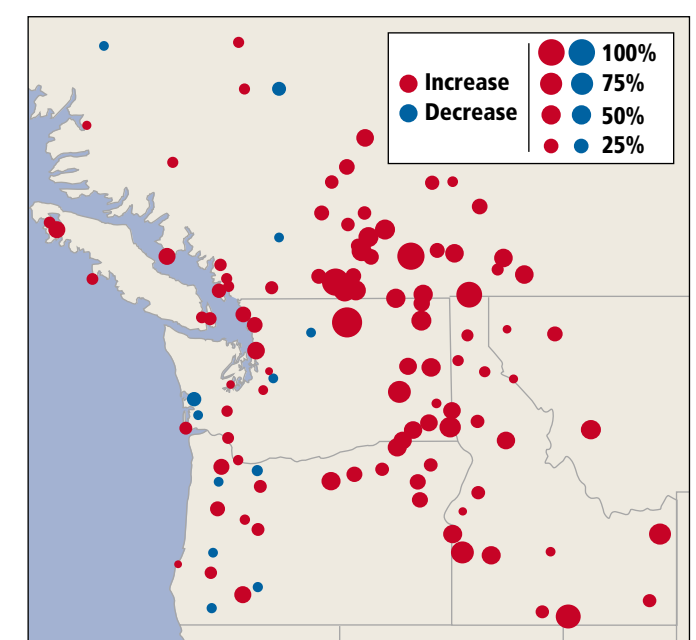
Country	Metric tons (in millions)	Percent change from 1980
UNITED STATES	1,578	22.5%
China	780	98.0%
Japan	310	18.8%
India	249	203.7%
Germany	226	-22.3%
Canada	158	26.4%
United Kingdom	151	-10.1%
Italy	121	17.5%
South Korea	116	231.4%
France	109	-19.9%

Sources: University of Washington Climate Impacts Group; Intergovernmental Panel on Climate Change; National Academy of Sciences; Washington State University; Bulletin of the American Meteorological Society; Nichols College; Portland State University; Washington Department of Fish and Wildlife; U.S. Environmental Protection Agency; U.S. General Accounting Office; U.S. Geological Survey; University of Alberta.

DAVID BADDERS/SEATTLE POST-INTELLIGENCER

REGIONAL PRECIPITATION CHANGES

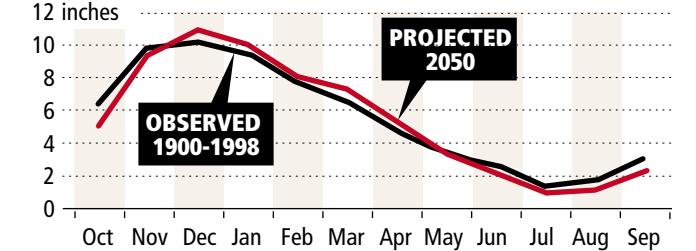
Dots indicate areas where readings were taken from 1930 to 1995



Over the past century, rainfall has increased across the Northwest. The increase in rain, on average, could be as much as 38 percent. While precipitation trends are harder to forecast than temperature, most predictions show climate change will result in more rain overall.

WESTERN WASHINGTON PRECIPITATION CHANGE

Observed and projected average monthly precipitation



ENVIRONMENTAL IMPACT AT SEA

WATER BIRDS

Off the coast of British Columbia, there have been mass starvations of tufted puffin chicks.



KILLER WHALES

Orcas are expected to suffer if salmon runs are hampered by climate change as expected. They could also be hit with more pollutants as contaminants are released from melting snow-packs and flow downstream.



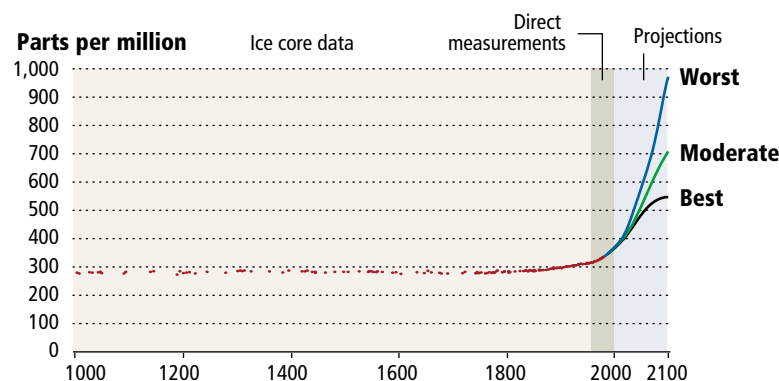
FISH

Pacific cod, which are at the southern end of their range, have nearly vanished from Puget Sound. Baby salmon get munched as predators migrate north when the water warms. Marlin, mahi mahi and ocean sunfish have also joined the northward migration.



CO₂ PROJECTIONS

Gas bubbles trapped in polar ice show that carbon dioxide levels remained stable stretching back 1,000 years. But in the last century, direct measurements show that CO₂ has spiked. Even if drastic steps are taken to curb emissions, CO₂ levels are expected to soar over the next century, with amounts more than tripling in the worst-case scenario.



THE CUMULATIVE EFFECTS

Even if CO₂ emissions are reduced drastically in the next century, because it sticks around for so long in the atmosphere, the damaging effects will last for a very long time. This illustration shows that the earth's temperature is expected to continue rising for centuries and the sea level to increase for thousands of years, causing widespread flooding.

Degree of increase

