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## Alaska: Warming is Disturbing Preview of What's to Come, Scientists Say

by Seth Borenstein, Knight Ridder Newspapers  
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ANCHORAGE, Alaska - Alaska is melting.

Glaciers are receding. Permafrost is thawing. Roads are collapsing. Forests are dying. Villages are being forced to move, and animals are being forced to seek new habitats.

What's happening in Alaska is a preview of what people farther south can expect, said Robert Corell, a former top National Science Foundation scientist who heads research for the Arctic Climate Impact Assessment team.

"If you want to see what will be happening in the rest of the world 25 years from now, just look at what's happening in the Arctic," Corell said.

Alaska and the Arctic are warming up fast, top international scientists will tell senior officials from eight Arctic countries at a conference in Iceland next week. They will disclose early, disturbing findings from a massive study of polar climate change.

In Alaska, year-round average temperatures have risen by 5 degrees Fahrenheit since the 1960s, and average winter temperatures soared 8 degrees in that period, according to the federal government. The entire world is expected to warm by 2.5 to 10 degrees Fahrenheit by 2100, predict scientists at the International Panel on Climate Change.

2002 was the hottest year in Alaskan history, and this past winter was the second warmest on record, according to the National Climatic Data Center in Asheville, N.C., which found that Alaskan temperatures began to rise dramatically in 1976. This July, Anchorage recorded its second highest temperature ever as tourists got suntans.

Deborah Williams, the executive director of the Alaska Conservation Foundation, used to take visitors from the Lower 48 to the famous Portage Glacier just outside Anchorage, where the \$8 million Begich-Boggs visitor center opened in 1986. By 1993, the Portage glacier had receded so much that it no longer could be seen from the visitors' center. Williams still takes visitors to the site, seeing the glacier's retreat as a warning.

"Alaska is the melting tip of the iceberg, the panting canary," said Williams, who was the chief Interior Department official for Alaska during the Clinton administration.

Portage is "a glacier that's almost out of water; it's thinned dramatically," said U.S. Geological Survey geologist Bruce Molnia, the author of the book "Glaciers of Alaska." About 98 percent of Alaska's glaciers are retreating or stagnant, he said.

Alaskan glaciers add 13.2 trillion gallons of melted water to the seas each year - the equivalent of more than 13 million Olympic-sized swimming pools, University of Alaska in Fairbanks scientists concluded after a decade of studying glaciers with airborne lasers. The rate of glacier run-off has doubled over just a few decades, they found. Alaska's melting glaciers are the No. 1 reason the oceans are rising, Molnia said.

Another frozen staple of Alaska's northernmost lands - permafrost - is also thawing and "is

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probably the biggest problem on land," said Gunter Weller, director of the Center for Global Change and Arctic System Research at the University of Alaska in Fairbanks.

Permafrost is land that stays frozen year-round. Villages rely on the hard permafrost to prevent beach erosion from violent ocean storms. Two Alaskan native villages, Shishmaref and Kivalina, must relocate because melting permafrost has caused beach erosion, leaving the towns vulnerable to severe storms.

About 600 people live in 150 homes in Shishmaref, a centuries-old village on a barrier island just south of the Arctic Circle. On the island's northern edge, erosion is so severe that the village voted to move two years ago, but villagers haven't been able to find a new site or money to finance the massive undertaking, said Percy Nayokpuk, president of the Shishmaref Native Corporation.

"It's a matter of safety," Nayokpuk said. "We're on this small low island. One bad storm could possibly wipe out the village. There is nowhere to run."

Melting permafrost also means trouble for the oil industry. Oil companies build pipelines and roads on it to support drilling on the North Shore. To minimize damage to Arctic tundra, oil companies explore for oil on Alaska's North Slope only when roads are frozen with a foot of ice and six inches of snow. The ice-road season has dropped from 200 days a year in 1970 to 103 days in 2002, according to Alaska state documents.

"It is unlikely the oil industry can implement successful exploration and development plans with a winter work season consistently less than 120 days," an Alaska Department of Natural Resources budget document said in March.

While global warming is hurting oil drilling, it's the increased burning of fossil fuels such as oil that causes global warming. In June, the Department of Energy announced that it would spend \$270,000 to help Alaska rewrite its rules about how thick ice roads should be.

Permafrost lies under 166 Alaskan towns and 1,700 miles of Alaskan highways. Melting is causing whole chunks of the Alaska Highway to come apart, state officials said at a January global-warming conference.

Permafrost is melting "under forests as well as under buildings and roads," said atmospheric scientist Michael MacCracken, who headed federal climate-change studies in the 1990s.

So far, the greatest effect on forests has come from the spruce-bark beetle, according to Glenn Juday, a professor of forest ecology at the University of Alaska at Fairbanks. The beetle, which kills spruce trees, has long lived in Alaska's forests, but normally takes two years to grow and reproduce; cold spells cut their numbers.

With global warming, however, the beetles now are damaging as many trees each year as they used to ruin in two, Juday said. More than 4 million acres of spruce - Alaska's predominant tree - have been killed, especially on the Kenai Peninsula.

"It's the largest episode of insect-caused tree mortality ever recorded in North America," Juday said.

The spruce-bark beetle isn't alone. Other tree-killing invaders made welcome by warmer weather include the larch soft fly, the aspen leaf miner and the birch leaf roller, Juday said.

As Alaska's climate gets warmer and drier, Juday's studies indicate, black and white spruces, which make up 80 percent of the state's main forests, won't survive. By the turn of the next century, Alaska's forests will resemble the Aspen-treed grasslands along the northern edge of the Great Plains in North Dakota and Montana, Juday said.

Some scientific reports also blame global warming for plummeting herring and salmon populations, Williams said. In the Yukon River, a warm-water parasite has infected salmon and herring, a key food source for marine mammals such as the stellar sea lion.

Warm waters have made Alaska's Bristol Bay salmon runs occur earlier than normal, making it harder for the salmon to survive, said Alaska Department of Fish and Game biologist Slim Morstad.

In addition, warm-weather wildlife, such as moose and beaver, are heading unusually far north, while species that require frigid weather "don't have anywhere to move to," said scientist MacCracken. Marine mammals such as walruses, ring seals and polar bears may soon see their numbers shrink along with the Arctic ice, Weller said.

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