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Feeling the Heat

It appears more certain than ever that global warming is a fact. Here's a look at how a changing climate might affect Washington and its economy

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It's a clear day in the Northwest and the snow-draped peaks of the Olympics and Cascades glisten in the sunlight.

Those white-capped mountains have been part of our Northwest culture from the very beginning. Thousands of families and dozens of businesses come and stay here for the promise of unspoiled nature.

But few realize that those snowy caps are also a key ingredient in the state's economic competitiveness. Washington's mountains are blessed with some of the heaviest snowfalls in the world, storing massive amounts of water that feeds the region's streams and rivers through the dry summer months.

All that water has made for cheap hydroelectricity, productive irrigated farms, and bountiful salmon runs.

Yet if Washington's climate warms as scientists are predicting, nature's endowment of "white gold" will evaporate like a 2001 tech stock portfolio. In June, the Bush Administration delivered its *Climate Action Report* to the United Nations and conceded that climate change is a reality, and that the Pacific Northwest could lose between 63 and 87 percent of its spring snowpack by the end of the century. [1]

Now more than ever, it's time to examine what a warmer climate might mean for the state's economic future.

THE SCIENCE

To understand what will happen in Washington, you have to start with the experts: the climate modelers and their supercomputers.

Atmospheric scientists have improved their ability to measure how the world's climate responds to heat-trapping gases, such as carbon dioxide and methane. At naturally occurring levels, these "greenhouse" gases trap energy from the sun, keeping the planet warm, humid, and hospitable.

But billions of tons of emissions from cars, factories, and farms are beginning to smother the planet. As both computing power and climate science have advanced, so too has the certainty that the climate really is changing.

There are, of course, uncertainties in the predictions. Computer models are imperfect, and the data that feed them are incomplete. But virtually all of the models point to the same conclusion: It is getting hotter. Human activities, especially burning fossil fuels, are a central cause. And it appears that the changes can already be measured.

Last year was the second hottest year on record, according to independent research at NASA's Goddard Institute for Space Studies, the National Oceanic and Atmospheric Administration, and the World Meteorological Organization. The reigning champ is 1998, though nine of the 10 hottest years recorded have occurred since 1990.

And temperatures just keep rising. April 2002 was the second-hottest April ever recorded. Second, that is, to April 2000. What's more, different scientists studying satellite readings, ocean temperatures, rapid glacial retreats around the world, melting ice sheets, soil samples, tree rings, and coral, are all pointing to the same culprit: human-induced global warming.[2]

The Intergovernmental Panel on Climate Change (IPCC), the preeminent authority on global climate trends, predicts that average global temperatures will be 1.4 to 5.8 degrees Celsius warmer in 2100 than they were in 1990.

At the University of Washington in Seattle, a multi-departmental collaboration known as the Climate Impacts Group (CIG) is chartered to study climate change in the Pacific Northwest.

In 2001, CIG reported that average temperatures in the US Pacific Northwest increased 1.5 degrees Fahrenheit in the past 100 years, a rate slightly higher than the global average.

Based on results from eight different climate models, CIG predicts that the region will experience a warming in the range of 3.1 to 6.3 degrees Fahrenheit by the 2040s. A few degrees may not sound like much, but the likely consequences are serious, threatening the Northwest's water, forests, coasts, and farms.[3]

DISAPPEARING SNOWPACK

The principal impact will be seen on Washington's snowy peaks. While some models show that global warming may actually increase the level of precipitation in the state, the amount captured as snow is expected to decrease. By mid-century, if winter temperatures in the Northwest warm 5 degrees Fahrenheit, the freezing level should move about 1,700 feet upslope. That's enough to put ski areas like Snoqualmie Pass out of business (and lay off more than 1,000 winter-time workers).[4]

But in such a scenario, defunct ski areas will be the least of Washington's worries. Because of the conical shape of most mountains—the higher you go, the smaller they get—rising snowlines mean drastically less total snowpack. A 1,700-foot rise would shrink the area of winter snowpack in the Columbia Basin nearly in half. Snowfall would probably increase at higher elevations, but not enough to offset the reduction in snow-covered area. Reduced snowmelt could cut the Columbia River's flow by up to 15 percent during the next 20 years.[5]

When it comes to water, scarcity means competition. Even in normal years there is intense competition between salmon fisheries, irrigators, and hydroelectric generators, not to mention the domestic and commercial consumption needs of a rapidly growing state.

In drought years, not only do suburban lawns turn brown, but salmon die, farmers go bankrupt, and electricity prices climb. For a sneak peek at what we might expect more often in a warmer future, we can recall the summer of 2001, which followed a winter of unusually low snowfall.

During the 2001 drought, all seven of Washington's electricity-hungry aluminum smelters shut down as power rates shot up. Washington's power providers needed the smelters' electricity just to keep the lights turned on at home.

The Northwest's ten aluminum smelters (including plants in Oregon and Montana) employ about 6,000 people when operating at full capacity. In many cases, the Bonneville Power Administration paid smelter operators to temporarily shut down, and workers received a percentage of their regular wages. The reasons for the smelter shutdowns are many, but the energy costs were a main contributor. [6]

If those shutdowns continued, or became permanent, smelter jobs would be lost in nearly every corner of the state, from Bellingham to Spokane to Vancouver.

Water, when used for hydroelectricity generation, provides roughly three-fourths of the Northwest's electricity. All else being equal, less supply tends to mean higher prices.[7]

Economists believe that in the short term, rising energy prices and tightening supplies will slow economic growth, especially for industries that have relied on Washington's historically cheap power.[8]

AGRICULTURE

Farming will also be deeply affected. Irrigated crops—apples, cherries, hops, potatoes, carrots, asparagus, and grapes—account for roughly $2.3 billion in sales, nearly 70 percent of the state's crop value.

That means $2.3 billion dollars of annual production is tied directly to agricultural irrigation. The Yakima Basin—the state's farming powerhouse that alone produces $1 billion a year of agricultural goods—can expect a 14 to 17 percent loss in production value during a drought year similar to 2001, according to state economists. Statewide, predicted losses range between 6 and 9 percent. What's more, poor farm production pinches the network of exporting, warehousing, and distribution that serve the agri-food industry. [9]

Though some crops, like wheat, will probably do better in a warmer climate, drought is generally bad news. When water buyback programs and non-irrigated crop losses are factored in, summer drought could cost Washington between $270 to $400 million in agricultural production each year and between 4,600 and 7,500 farm jobs, threatening as many

as 1,400 additional jobs in agriculture-related industries.[10]

Even worse, if a 2001-style drought were to continue for two or three years, Washington officials estimate that the "multiplier" effects would gut another 4,500 to 6,000 jobs in the construction, retail, and service sectors. And these estimates almost certainly understate the economic harm. If farmers lose perennial water-intensive crops like orchard trees, hundreds of millions more dollars will be lost in subsequent years.[11]

FISHERIES

Salmon are even more at risk in a warmer Washington. Reduced stream flow impedes salmon migrations in both directions. Slower stream flows and warmer air both contribute to increased water temperatures, creating a hostile environment for cold-water-loving salmon.[12]

Based on IPCC predictions, warmer water caused by warmer air alone (not including the effects of low stream flow) are expected to rob salmon of 4 to 22 percent of their Washington habitat. Meanwhile, increased winter flows and associated flooding can scour the gravel nests that protect salmon egg nests, wiping them out before they can hatch.[13]

Fewer salmon means less food for the state's marine mammals, such as orcas, that are already teetering dangerously toward a population crash.[14]

Of course, fewer salmon also means hard times for the state's fishing industry, already battling extinction. As of 1996, the decline of salmon fisheries in the Columbia basin from historic levels led to the loss of an estimated 25,000 jobs, or about $500 million in earnings.[15]

Overall, data on the economic value of salmon are spotty. One calculation puts the net asset value of Columbia basin salmon at $13 billion.[16]

FORESTS

If—as scientists predict—the snowpack melts earlier in the spring and higher temperatures cause water to evaporate more quickly, forests will become drier during the Northwest's already dry summers.

Forest fires will burn more frequently and probably more intensely. The risk of catastrophic fires in the central Washington Cascades, for example, could triple.[17]

In 2001, more than 1100 forest fires scorched nearly a quarter million acres of timber. It's nearly impossible to calculate the economic impacts though, in part because fires sometimes allow certain tree species to flourish. Forests at the drier and hotter edges of their ranges—such as lowland ponderosa pine forest and many interior Douglas fir forests—are likely to be replaced by grassland and shrubby woodlands. One troubling prediction from the Environmental Protection Agency estimates that warming could mean a 15 to 25 percent decline in forested areas, mostly east of the Cascades.[18]

Though stands may disappear at low elevations, trees are already encroaching upon alpine meadows in the Olympics and Cascades—a trend believed to be unprecedented in the last few hundred years—threatening both rare alpine plants and recreational activities. Nearly half of Mount Rainier National Park's two million annual visitors, for example, go to the summer wildflower displays at Paradise.[19]

FLOODING

Higher temperatures will increase the risk of winter flooding, because more precipitation will fall as rain, which immediately runs off into streams and rivers, rather than being stored as snow.[20]

At the same time, warming is expected to increase evaporation rates, leading to more frequent and intense rainstorms.[21]

It's difficult to predict precisely what the economic consequences will be. But recent events can serve as a rough yardstick. The 1996-97 floods were especially damaging: Tens of thousands of northwesterners were evacuated, and several people in rural Oregon and the Seattle area lost their lives when landslides triggered by floods demolished their homes.

Total damages in the Northwest states were estimated at $3 billion. In Idaho, mudslides and flooding stranded more than 10,000 people, and road repair alone cost $10 million.[22]

COASTS

Sea levels will rise nearly 20 inches over the next 100 years, according to scientific predictions. Washington's coastal ecosystems

will be irreparably harmed even while the advancing saltwater threatens development and property around Puget Sound. Protecting ourselves will cost money.

The cumulative cost of sand replenishment, for example, to protect coastal land, infrastructure, and buildings is estimated to cost between $143 million and $2.3 billion in today's dollars. Among Washington's major cities on the Sound, Olympia is particularly vulnerable, and will likely require the protection of dikes, an expensive proposition.[23]

SOLUTIONS

There is some good news. A changing climate will probably benefit some industries.

Businesses that devise ways to ameliorate the impacts of winter floods and encroaching seawater will flourish. As water resources dry up and electricity prices climb, efficient appliances and equipment will be in higher demand. And as the United States responds to global climate change, as it eventually must, Washington companies can lead the way with alternative power sources and clean forms of transportation.

Unfortunately, the bad news outweighs the good. Ski resorts closing up shop, shrinking forests, vanishing alpine meadows, and endangered waterfront property: While it is true that the entire country's climate will change, bad news for Washington's climate also spells bad news for the state's business climate.

Washington trades on its quality of life, attracting cutting-edge businesses because they in turn can attract employees with the prospect of skiing and whale-watching, fishing and hiking. As the Northwest's ecosystems begin to fail in a changing climate, the state's economy will suffer too.[24]

Substantively reducing greenhouse gas emissions will require coordinated efforts both locally and globally, but the problems are not insurmountable. Interestingly, one of the principal drivers of greenhouse gas emissions is also blamed for driving businesses out of Seattle: too many cars.

Burning fossil fuels, especially the gasoline and diesel in cars, now accounts for roughly three-quarters of Washington's total contribution to global warming. The state's leaders can reduce our dependence on fuel-guzzling autos by promoting compact well-planned urban growth and supporting alternatives to driving. Further emissions reductions can be achieved on the farm with better animal waste management and at landfills by capturing the escaping methane and using it for electricity.

In some circles, including most notably the Bush Administration, resistance to enforced greenhouse gas reduction arises not out of a disbelief in anthropogenic global warming, but rather from the perspective that since humanity has already raised carbon dioxide levels to the point where significant climate change is bound to occur, all we can do now is try to cope with the changes.

Scientists agree that the longevity of carbon dioxide in the atmosphere means that, as a CIG report puts it, "a warmer climate will persist for centuries, even long after any successful effort to reverse the changes." However, it is generally agreed that the magnitude of climate change and the severity of its effects is directly linked to the concentration of greenhouse gases. Continuing to produce carbon dioxide at current levels will cause ever greater environmental change.[25]

Washington is one of the world's wealthiest and most technologically advanced places. The state can conceivably muster the billions of dollars necessary to continually fend off rising seas, develop new crops, repair flood damage, and make up for lost hydropower. But Washington's economy is increasingly connected to the global economy, and in particular to the economies that encircle the Pacific Rim. Climatic impacts elsewhere in the world, especially in Asia, are sure to reverberate here.

As Raul Estrada-Oyuela, the Argentine chairman of the global climate treaty negotiations said, "We are all adrift in the same boat. And there's no way that only half the boat is going to sink."[26]

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ENDNOTES

[1] US Dept of State, *US Climate Action Report 2002*, (Washington, DC: US Govt Printing Office, May 2002), *yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsUSClimateActionReport.html*.
[2] April temperatures from Leonie Haimson, "How's the Weather?: Taking the Earth's temperature," *Grist Magazine*, May 24, 2002, *www.gristmagazine.com/grist/heatbeat.* Scientific findings from Patrick Mazza and Rhys Rother, "Global Warming is Here: The Scientific Evidence," Climate Solutions, Feb 2000, *www.climatesolutions.org.*
[3] Pacific Northwest temperature change predictions from Philip Mote, "Scientific Assessment of Climate Change: Global and Regional Scales," Joint Institute for the Study of the Atmosphere and Ocean (JISAO), University of Washington, Seattle, July 2001, *tao.atmos.washington.edu/PNWimpacts/Infogate.htm*.
[4] Number of employees from The Summit at Snoqualmie's Web site, *www.summitatsnoqualmie.com/winter/employment.html*.
[5] Snoqualmie Pass out of business, snowpack, and Columbia River flow from John Ryan, *Over Our Heads: A Local Look at Global Climate*, (Northwest Environment Watch (NEW): Seattle, 1997).
[6] Number of smelter jobs from Gail Kinsey Hill, "Power Crisis Creates Turmoil for Troutdale Alcoa Employees," *The Oregonian*, Aug 12, 2001.
[7] Share of electricity from hydropower from "Questions and Answers Concerning Economic Impacts of the Drought in Washington State," Washington Office of Financial Management (WaOFM), June 25, 2001 at *http://www.ofm.wa.gov/fiscal/drought/drought.pdf.*
[8] Effects of energy prices from WaOFM op cit. note 7.
[9] Irrigated crops and farming losses from WaOFM op. cit. note 7.
[10] Farming losses from WaOFM op cit. note 7.
[11] Farming losses from WaOFM op cit. note 7.
[12] Salmon environment from Patrick Mazza, "In Hot Water – A Snapshot of the Northwest's Changing Climate," Climate Solutions, June 1999, *www.climatesolutions.org*.
[13] Flooding and salmon nests from Kirkman O'Neal, "Effects of Global Warming on Trout and Salmon in U.S. Streams," Defenders of Nature, May 2002; and Philip Mote et al., "Impacts of Climate Variability and Change, Pacific Northwest," National Atmospheric and Oceanic Administration and JISOA/School of Marine Affairs (JISOA/SMA), University of Washington, Seattle, 1999.
[14] Food for marine mammals from Nathan Mantua, "How will salmon far in a warmer world?" presented at Expert Briefing: Impacts of Climate Change on the Pacific Northwest, JISAO/SMA, University of Washington, Seattle, Nov 8, 2001.
[15] Salmon economy from The Institute for Fisheries Resources (IFR), "The Cost of Doing Nothing: The Economic Burden of Salmon declines in the Columbia River Basin," Oct 1996, *www.amrivers.org/snakeriver/reports99.htm.*
[16] Net asset value of Columbia basin salmon IFR op cit. note 15.
[17] Risk of fires from Ryan op cit. note 5.
[18] Forest fires in 2001 from "Drought Update: final review of the 2001 drought," Wash. Dept of Ecology, Sept 25, 2001 at *www.ecy.wa.gov/news/2001news/2001-168.html.* Economic impacts and role of fire from Douglas Sutherland, Washington Commissioner of Public Lands, private communication, June 13, 2002. Forested area decline from "Climate Change and Washington," US Environmental Protection Agency (US EPA), Sept 1997 at *yosemite.epa.gov/oar/globalwarming.nsf/content/ImpactsStateImpactsWA.html.*
[19]Vanishing meadows trend from David Peterson, Professor of Forest Resources, Ecosystem Sciences Division University of Washington, private communication, June 18, 2002. Mt. Rainier wildflower visitors from Ryan op cit. note 5.
[20] Winter flooding from Mote et al. op cit. note 13.
[21] Evaporation from Mazza op cit. note 12.
[22] Northwest damages from Ryan op cit. note 5.
[23] Sea level rise and cost of sand replenishment from US EPA op cit. note 18. Olympia's vulnerability from Mote et al. op cit. note 13.
[24]Attracting employees from Amazon.com's employment Web site, *www.amazon.com/exec/obidos/tg/feature/-/164723/103-8580189-0151036.*
[25]Climate change longevity from Mote op cit. note 3.
[26] State responses, economic connections, and Estrada-Oyeula quote from Ryan op cit. note 5.