

Confronting Climate Change in Oregon

Current Impacts and Future Risks

HIGHLIGHTS

The Beaver State already is feeling climate change as record-breaking wildfires destroy communities and forests, declining mountain snowpack and earlier snowmelt jeopardize summer water supplies, and an acidifying ocean devastates shellfish hatcheries.

Climate models project Pacific Northwest temperatures to increase a further 5°F to 8.5°F above today's levels by the end of this century, with the rise depending on the rate at which we continue generating heat-trapping gases.

Global warming presents a severe challenge to Oregon's way of life. But that challenge can be met if residents, businesses, and policymakers act swiftly and in concert with the rest of the global community, which has pledged to lower heat-trapping emissions under the 2015 Paris climate agreement.

From its windswept Pacific coastline to its sprawling high desert, Oregon possesses a landscape of powerful rivers, abundant waterfalls, dense evergreen forests, and rugged mountains. These natural resources are critical. They support agriculture, forestry, and commercial fishery sectors, together contributing more than \$48 billion to the state's economy in 2015, as well as a vibrant tourism industry (May et al. 2018). However, this rich ecology and a thriving economy are highly vulnerable to the impacts of global warming.

As with the rest of the nation and the world, Oregon residents are experiencing impacts from global warming, resulting from the buildup of heat-trapping emissions in the atmosphere. The average annual temperature in the Pacific Northwest has risen by at least 1.5°F since the first half of the 20th century, and winter minimum temperatures have increased by more than 4.5°F (Vose et al. 2017). Record-breaking wildfires are destroying forests and communities, declining mountain snowpack and earlier snowmelt are jeopardizing summer water supplies, and an acidifying ocean is devastating production at shellfish hatcheries.

Unless Oregon—and the broader global community—make deep, swift cuts in heat-trapping emissions, future changes to our climate could be even more dramatic. Climate models project Pacific Northwest temperatures to increase another 5°F to 8.5°F from today's levels by the end of this century, with the actual warming depending on the rate at which we continue to emit heat-trapping gases (Vose et al. 2017). Heat waves could become as much as 12°F hotter in the next 20 to 50 years (Vose et al. 2017).



Kevin Abd/BLM

Scientific evidence shows that climate change is producing hotter, drier conditions, intensifying the risks of wildfires in the American West.

Greater Risk of Wildfires and Forest Damage

Forests, primarily comprised of Douglas fir and ponderosa pine, cover nearly half of Oregon, and the forest sector is critical to the economy. It employs about 61,000 people and contributes about \$12.5 billion in timber and wood-product sales and millions of tourism dollars to the state economy each year (OFRI 2017; OFRI n.d.).

However, forest mortality is rising in Oregon (Abatzoglou and Williams 2016). Wildfires are becoming more frequent and intense, and the costs to fight them are growing. In 2018, the price tag reached more than \$514 million, breaking the previous record, set in 2017, of \$447 million (Box 1) (NWCC 2018; Urness 2018). The 2012 fire season, when more than 1,290,000 acres burned, and the 2014 season, when 984,000 acres burned, were among Oregon's most severe on record (NWCC 2015; NWCC 2013). The costs to residents are also increasing, as real estate development proceeds in or near high-risk areas. More than 132,000 Oregon homes were at high or extreme risk of damage from wildfire in 2018 (CoreLogic 2018).

Changes in forest type, fire-suppression strategies, and land management will significantly influence the future of fire in the Pacific Northwest (Mote et al. 2014). However, continuing warmer and drier summer conditions could double the typical annual burn area in the region by the 2040s and quadruple it by the 2080s, relative to the 20th century (Littell et al. 2010).

Climate change also alters Pacific Northwest forests by affecting outbreaks of insect pests and the incidence of tree diseases. For example, higher temperatures and drought stress contribute to outbreaks of the mountain pine beetle, which can

cause widespread forest mortality. Projected wintertime warming of 7°F by the end of the 21st century could further intensify pine beetle outbreaks in the region (Vose et al. 2017; Preisler et al. 2012).

Diminishing and Uncertain Water Supplies

Higher temperatures and changes in precipitation already significantly affect water resources in the Northwest. Since 1955, parts of Oregon have experienced a decrease in average snowpack on April 1 of more than 70 percent (Mote et al. 2018). Abnormally high winter temperatures in 2015 led to a record low snowpack for the state despite near-normal precipitation, with widespread drought-related impacts (Box 2) (Dalton et al. 2017). Oregon experienced another significant

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drought in 2018 due to a low snowpack and a hot, dry summer (NWS 2018). Winter snow accumulation in the mountains is a natural water storage system on which Oregon relies during its drier summer months, most critically for agriculture. Snowpack decline is projected to continue as more winter precipitation falls as rain rather than snow throughout much of the Pacific Northwest (Wehner et al. 2017).

Snow already melts as much as 30 days earlier than in the mid-20th century, reducing summer stream flows in many of the Northwest's snow-fed rivers. This means less water is available during the hotter months when demand for water tends to peak (Fritze, Stewart, and Pebesma 2011). At the same time, earlier snowmelt and increased precipitation in the form of rain can pose flooding risks in the late winter and early spring.

A change in the timing of water supplies will decrease opportunities for electricity generation from hydroelectric dams—the source of more than 60 percent of Oregon's electricity in 2017—in the late spring and summer as stream flows are reduced (EIA n.d.). These changes can also complicate reservoir and irrigation management and stress freshwater fish, particularly salmon and trout (Dalton, Mote, and Snover 2013; Mantua, Tohver, and Hamlet 2010). Salmon are also

BOX 1.

Wildfires Harm Beaver State's Tourism

The wildfires of 2017 filled Oregon's skies with smoke and damaged beloved outdoor gems, including the Columbia River Gorge, Three Sisters, and Mount Jefferson. Air quality fell to unhealthy levels for sensitive groups on roughly 160 days, sparking a rise in emergency room visits. At times, the smoke led to cancellations of major outdoor events and the closure of Interstate 84. Six hundred more jobs were lost due to decreased tourism than would be expected from normal seasonal changes (OFRI 2018).

BOX 2.

2015 Snow Drought Causes Widespread Harm

In 2015, Oregon experienced unusually high temperatures and near-normal precipitation. The resulting record-low snowpack had far-reaching consequences. Treasure Valley farmers received only a third of their expected irrigation water. Visitors to Detroit Lake decreased by one-quarter due to low lake levels, and the ski industry suffered a shortened season. The population of spring

spawning salmon in the Columbia River was halved. The drought also contributed to the significant wildfire season in the Pacific Northwest. Continued rising temperatures mean that the conditions underlying the 2015 snow drought may become more common by mid-century (May et al. 2018; Dalton et al. 2017).

threatened by warmer stream and ocean temperatures and shrinking estuarine and nearshore habitats (May et al. 2018). And changes to water supplies could interfere with recreational activities such as fishing, rafting, and kayaking.

The Changing Ocean

Oregon's rugged coast is home to productive ecosystems that support diverse marine life, and each year Oregon residents earn more than \$500 million from the state's commercial fisheries (ODFW 2017). However, climate-driven changes in sea level and ocean acidity pose major threats to the area's habitat and infrastructure and could affect many Oregon residents.

More than 7,700 Oregonians live in areas at risk of chronic inundation by the end of the century as sea levels rise (Dahl et al. 2018). Sea levels have already risen nearly

two to four inches since the 1980s in some parts of Oregon, although natural land movements due to local plate tectonics also cause levels to rise more slowly in other places, or even to fall (NOAA n.d.). Different parts of the state could experience sea level rise of less than one foot to as much as 10 feet above 2000 levels by the end of the century, depending on our emissions choices and the stability of polar ice sheets (Sweet et al. 2017).

The increasing acidity of ocean surface waters is also damaging marine life. About 40 percent of the human-produced carbon dioxide released to the atmosphere over the last 250 years is now dissolved in the oceans, where it reacts chemically to make seawater more acidic and corrosive (DeVries, Holzer, and Primeau 2017).

Many types of shellfish are very sensitive to the effects of ocean acidification, posing potential risks to the fishing industry. For example, altered ocean chemistry contributed to declines in hatchery production near Oregon's Netarts Bay due to the softening of oyster shells at the largest independent producer of seed oysters in the Pacific Northwest (Barton et al. 2015). Increased ocean acidification is projected to continue altering the marine food web by decreasing the abundance of shell-forming species, which in turn threatens Pacific salmon and other culturally and commercially significant marine species (Dalton et al. 2017).

Climate Solutions for Oregon

Global warming represents a severe challenge to Oregon's way of life, but the challenge can be addressed if policymakers, businesses, and residents take swift action and work together—both in reducing emissions and responding to the changes already occurring.

Efforts by Oregon state and local governments are under way to identify actions that can assist communities in adapting to a changing climate by becoming more resilient. At the



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Ocean acidification, driven by absorption of carbon dioxide from the burning of fossil fuels, threatens production at Oregon's oyster farms.



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Oregon's natural resources support agriculture, forestry, and commercial fishery sectors, together contributing more than \$48 billion to the state economy, as well as a vibrant tourism industry. But global warming represents a severe challenge to Oregon's way of life, a challenge that can be met only if residents, businesses, and policymakers act swiftly.

same time, the emissions choices made today—in Oregon and throughout the world—will shape the climate our children and grandchildren inherit. Other states and regions have pioneered successful strategies for reducing emissions as their economies grow and new industries emerge. Oregon has made a start on such strategies, but it must do more to meet this important challenge.

The state has set goals of reducing heat-trapping emissions to 10 percent below 1990 levels by 2020 and to at least 75 percent below 1990 levels by 2050. However, additional action is needed to put the state on a path to achieve those levels (OGWC 2018).

To achieve its goals, as well as to contribute to national and global efforts to limit the worst consequences of climate change, Oregon should:

- Fund a transition to a clean energy economy that improves livelihoods in underserved communities, including communities of color, tribal communities, and rural and low-income communities.
- Establish a cap and price on carbon pollution for the companies responsible for a majority of the state's emissions.
- Continue increasing the use of clean fuels, such as sustainable biofuels and electricity, to reduce oil use and the carbon emissions associated with transportation fuels.

- Grow the market for electric vehicles with stronger consumer purchase incentives and policies to expand the charging infrastructure.
- Decarbonize the electricity sector by increasing the use of renewable sources of electricity, reducing reliance on polluting sources such as coal and natural gas, and modernizing the electricity grid.
- Improve energy efficiency in commercial and residential buildings, agriculture, and industry.

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