

The future of northwest forests in a changing climate

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The effects of atmospheric and oceanic warming have been relentless this year as concentrations of atmospheric CO₂ hit a new record in May; with worldwide CO₂ emissions continuing to rise.

Record heat has scorched Asia, Europe, and North America; where more than 400 Canadian wildfires have burned over 8 million acres, with massive plumes of smoke drifting into the United States. The oceans have absorbed 90% of the excess heat generated by the burning of fossil fuels, and global ocean temperatures are now the highest ever recorded.

The Arctic Ocean is expected to be virtually ice-free in late summer by the mid-2030's, a decade earlier than predicted. El Nino, a warming of the equatorial regions of the Pacific Ocean, is predicted to strengthen later this year, disrupting global weather patterns while amplifying the effects of oceanic and atmospheric heating and likely pushing global temperatures to new record highs.

With the average planetary temperature continuing to rise, "100-year" or "1,000-year" storms, droughts, floods and wildfires are becoming much more frequent and severe with each incremental increase in global temperature. Major insurance companies have stopped writing new homeowners insurance policies in California due to the increased risk of catastrophic losses related to climate change.

Our infrastructure, food production system and global civilization were not designed for the impacts of a rapidly warming planet. The global climate has been unusually stable and benign over the past 2,000 years,

but the 8 billion human inhabitants on earth are now the unwilling participants in a massive experiment with the planet's inherently unstable climate system.

Fears are increasing that the planet is rapidly approaching, or may already have crossed, several critical climate "tipping points", where accelerating atmospheric and oceanic heating will become unstoppable, uncontrollable and irreversible. In the late 1990's, after decades spent researching past changes in earth's climate, paleo-climatologist Wallace Broecker said that "the earth's climate is very volatile; it can do some weird things; sharp rapid warmings and coolings that can transform the global climate in a human lifetime or even a decade," warning that "the climate system is an angry beast and we are poking it with sticks."

With these recent climate events in mind, the Cannon Beach Gazette had the opportunity to talk with Jim Gersbach, a board member of the non-profit tree education and advocacy group "Oregon Community Trees", who works as a Public Affairs Specialist for the Oregon Department of Forestry.

Before joining the Department of Forestry, Gersbach was an Urban Forestry Specialist for the City of Portland, and is a long-time volunteer for the tree-planting organization "Friends of Trees" and a founding member of "Trees for Life Oregon", a Portland non-profit with a mission to protect and preserve Portland's big trees.

The in-depth discussion with Gersbach looked at the impacts of climate change on our local coastal temperate rainforest and threats to native trees throughout the Pacific Northwest. While the outlook is sobering, Gersbach sees a few rays of hope in a changing Pacific Northwest climate.

Discussing the impact of a rapidly warming and increasingly volatile climate on trees and plants, Gersbach explained that "the patterns we've relied on for generations are changing. Plants and trees are going to experience more extremes such as droughts, heat waves and torrential rain events" adding that "the new extremes are now exceeding the normal variations experienced in the past."

The typical summer dry season used to be 2-4 months, but has now extended into the spring and fall months. With warmer winter temperatures, more precipitation falls as rain instead of snow at low and mid-elevations, with warmer spring weather causing the snowpack to melt earlier in the season. High elevation snowpack that used to release water well into July is now melting earlier, resulting in less water for trees during the hot, dry summer months.

Drought years in the Pacific Northwest that used to occur once or twice a decade are now happening five or six times within a decade. It can take several years for some tree species to recover from an extremely dry year, and one or two wet years following a drought may not be enough for them to fully recover before the next dry spell hits. Climate change is a chronic stressor on trees, making them much more susceptible to large outbreaks of disease and insects.

The record-shattering "heat dome" in June 2021 hit trees at a vulnerable time, with new tree growth being susceptible to the several days of extreme temperatures and low humidity. Forests of the Oregon Coast Range

are not adapted to this type of extreme heat event, with western hemlock in particular suffering significant damage.

Research by Oregon State University, which tracked tree growth in the Coast Range and Cascades, showed that tree growth slows or stops in hot weather, and that growth has slowed in all four conifer species studied (western hemlock, western red-cedar, Douglas fir and ponderosa pine) due to higher temperatures and longer dry periods in the summer months.

Conversely, the lack of hard winter freezes, along with wetter and warmer spring weather, creates ideal conditions for some plant pathogens, such as Swiss Needle Cast disease, which dramatically slows the growth of trees. Affecting only Douglas fir, private timber companies are suffering the consequences of this fungal disease which has affected hundreds of thousands of acres of their single-species, even-aged commercial tree plantations in the central and northern Oregon Coast Range.

Some recently harvested areas have seen successive failures of recently-planted Douglas fir trees due to Swiss Needle Cast disease, and the failure of young western hemlock trees due to hotter and dryer summers.

Up until the early 20th century, the coastal temperate rainforest of the northern and central Oregon Coast Range were a mix of Sitka spruce, western hemlock, western red-cedar, red alder and Oregon big-leaf maple, with Douglas fir making up about 20% of the forest. This original coastal temperate rainforest, now mostly destroyed, contained some of the highest “biomass per acre” of any forest on the planet.

Along with shifting rainfall patterns, warmer temperatures, disease and insects, Pacific Northwest forests are facing an increasing threat of large, catastrophic wildfires. The ability of native forests to regenerate after a high-intensity fire is being impaired by a warming climate.

Studies in Colorado show that some lower-elevation forests impacted by high-severity wildfire are unable to regenerate due to the warmer and drier conditions, with shrubs and grass taking the place of the original forest cover.

Unless worldwide greenhouse gas emissions are drastically reduced within the next decade or two, the Oregon State University Climate Research Institute predicts a 2* F average increase in temperature for the Willamette Valley before the end of this century.

Predictions for Portland’s climate show that by 2080 it will be similar to the present-day climate in Sacramento or northern California. Trees and plants that require a cool, moist climate are going to be in trouble, but some tree species with “plasticity”, the ability to tolerate a broad climate range, could survive. Trees growing in the southern part of their climate range are extremely vulnerable and won’t do well as climate zones shift northward. Older trees might survive, but younger trees may not.

Gersbach said that we are entering new territory, with a warmer and drier climate creating conditions beyond the ability of some trees to grow or reproduce. Trees species can survive by growing in areas farther north or at higher elevations, but unlike animals, trees and plants migrate slowly. Humans can help by planting trees north of their current range.

Studies of current tree species in Oregon have demonstrated that western hemlock will do poorly in a warming climate, with ponderosa pine showing more resilience, and Douglas fir somewhere in-between.

There have been recent studies documenting wide-spread die-backs and die-offs of native tree species such as western red cedar, Douglas fir and true firs such as grand fir, silver fir, noble fir, Shasta red fir and white fir throughout the Pacific Northwest and British Columbia. Oregon white oak, a species well adapted to hot, dry conditions and widely distributed throughout the Willamette Valley and areas in the rain shadow of the coastal ranges of Washington, Oregon and California, might be expected to do well in a warmer and dryer climate, but the recent discovery in Oregon of the non-native, invasive Mediterranean Oak Borer Beetle threatens the future of these climate-resilient trees.

Focusing on our local coastal temperate rain forest, Gersbach described the north Oregon coast as a “mild, wet paradise” due to the ocean moderating the extremes of temperature and climate. But even here, climate change will have an impact on native trees.

Gersbach explained that Sitka spruce, which is the dominant tree species along the coast, is currently growing near the southern end of its range, which extends all the way to the south coast of Alaska, making the species vulnerable to a changing climate. Sitka spruce will likely experience a decline, especially on coastal headlands, but some will survive in microclimates such as cooler north-facing slopes.

Gersbach added that western hemlock are showing signs of stress in many places along the coast and coast range, along with an observed die-back of Oregon big-leaf maple, which colonizes warm, sunny sites. Red alder might continue to do well, though alder is a short-lived species that grows in disturbed landscapes.

Shore pine could also persist along the immediate coastline. The salt spray and high wind near the shoreline are difficult for many species, with Douglas fir intolerant of salt, and western hemlock and western red cedar, with their shallow root systems, unable to tolerate high winds. Oregon myrtle is an evergreen broadleaf species that might do well on the future north Oregon coast.

Western white pine, a species that was widespread and abundant in the Pacific Northwest before largely being wiped out in this area by white pine blister rust in the early 20th century, could be a future candidate for the north Oregon coast. Its historic range was coastal British Columbia, Vancouver Island, the Olympic Peninsula, Coast Range and Cascades.

Researchers are searching for forms of resilience and resistance in native species that could allow them to grow and thrive in a changing climate, while searching for native species growing in areas farther to the south that might do well in a warmer and drier Pacific Northwest.

Visitors to the north Oregon coast in the year 2080, well within the lifetime of anyone younger than 25 today, will see a forest undergoing significant change from the one currently growing here. There will likely be more disturbed areas where trees have been felled by high winds, burned in wildfires or killed by new or more aggressive pests or diseases.

This will open up gaps that could be filled by weedier, opportunistic plants like Scotch broom and Himalayan blackberry. There may be more erosion due to heavier rain events, stripping some areas of topsoil that make it harder for new trees to establish themselves. Where trees can grow, the species are likely to shift to those that are most resilient to weather extremes.

Highly adaptable invasive species, such as black locust, tree of heaven, English holly and English hawthorn may become even more prevalent. Gersbach warned that “atmospheric CO2 persists in the atmosphere for centuries, and we’ll have to live with the consequences of climate instability, so plan accordingly.”

Jim Gersbach was the featured speaker at the Hoffman Center for the Arts in Manzanita on June 17th, where he discussed “Coastal Trees for a Changing Climate” during a well-attended two-hour presentation. Jim Gersbach can be contacted at jim.gersbach@odf.oregon.gov