Southern Oregon Climate Action Now

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Confronting Climate Change

# Climate Change in the Oregon 5th Congressional District

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### *Global and Regional Temperature*

Data from NASA plainly show that the Global and U.S. atmospheric temperatures have increased substantially since 1880 (Figure 1 and Figure 2). The future trajectory of climate change is dependent upon the greenhouse gas concentration in the atmosphere. Possible future scenarios are graphed in terms of scenarios defined by their "Representative Concentration Pathway", or RCP (Van Vuuren *et al.* 2011). Four potential pathways are described: RCP2.6, RCP4.5, RCP6, and RCP8.5 respectively identified by higher emissions trends. The RCP number correlates with greenhouse gas emission amounts – RCP 2.6 describes a scenario in which emissions peak between 2010 and 2020, and then decline substantially. RCP8.5 projects outcomes for a scenario in which human emissions continue along their current trajectory – this is also referred to as the "business as usual" scenario. In RCP4.5, emissions peak around 2040 and then decline. By the end of the century, temperatures will have risen in accordance with the RCP followed globally (Figure 3). If immediate action is taken (RCP2.6), the rise in temperature may only be 2°F. However, if no action is taken, and emissions rates continue to accelerate (RCP8.5), temperatures will soar by 9°F or more. Temperature projections for Oregon (Figure 4) suggest a similar range of temperature increases are possible, possibly reaching over a 13°F increase by the end of the century under the business-as-usual scenario.

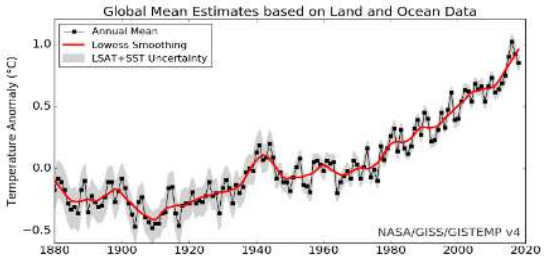


**Figure 1.** Historic global temperature trend NASA Goddard Institute for Space Studies 2019. https://data.giss.nasa.gov/gistemp/graphs/graph_data/Global_Mean_Estimates_based_on_Land_and_Ocean_Data/graph.png

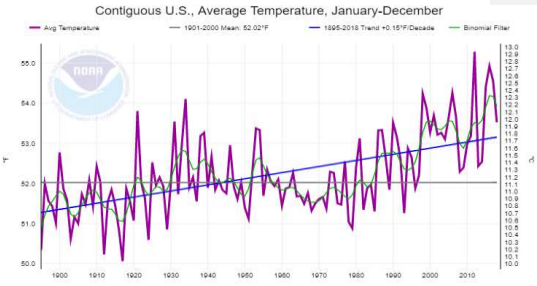


**Figure 2.** Historic U.S temperature trend. NOAA 2019. https://www.ncdc.noaa.gov/cag/national/time-series/110/tavg/12/12/1895-2018?base_prd=true&firstbaseyear=1901&lastbaseyear=2000&trend=true&trend_base=10&firsttrendyear=1895&lasttrendyear=2019&filter=true&filterType=binomial

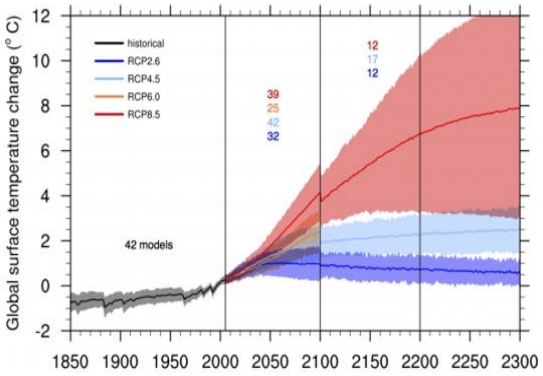


**Figure 3.** Intergovernmental Panel on Climate Change 2013 global projections. http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter12.pdf

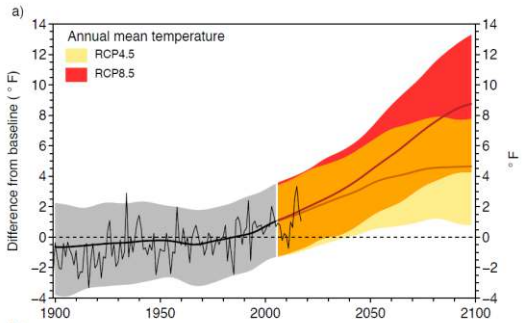


**Figure 4.** Oregon temperature history and projections through the century; baseline: 1970 - 1999 (Mote *et al.* 2019). http://www.occri.net/media/1095/ocar4full.pdf

The predicted temperature increase described in RCP8.5 would cause rapid ecosystem changes that would challenge the survival of most species. Diversity of life in natural systems would be devastated. Climate dependent agricultural, ranching, and forestry activities would also be threatened. Forest pests, such as bark beetles, would likely increase as warmer temperatures enhance insect growth and development rates and enable greater overwintering populations. Similarly, invasion of natural and agricultural systems by drought tolerant invasive species and pests will likely become more dramatic.

The lower predicted temperature increases resulting from the greenhouse gases already released is inevitable; for this we will simply have to prepare and adapt.

### *Regional Precipitation*

The 2013 US Climate Change Assessment (Melillo *et al.* 2014) provides projections for future precipitation (Figure 5) according to the 'business as usual' scenario.

Oregon is expected to see seasonal precipitation changes – winters may become slightly wetter, while summers will likely be considerably dryer. Spring and fall precipitation will not deviate greatly from historic patterns.

Water resources, already severely compromised in many locations, will become more threatened as snowpack declines and precipitation occurs as severe storms rather than the typical light drizzle that rejuvenates soil moisture. This trend will likely enhance floods, soil erosion and potentially landslides.

The reduced stream and river flow occurring during summer/fall will be warmer compromising many iconic Pacific Northwest cold-water aquatic species.

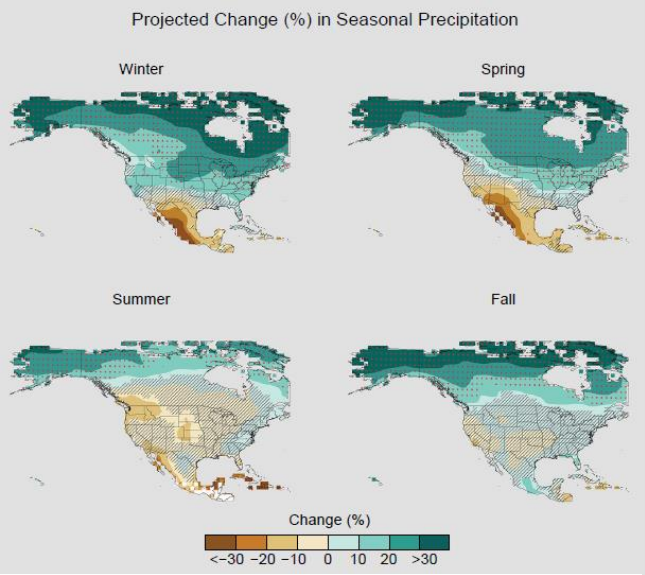


**Figure 5.** Projected change in precipitation compared to 2070 - 2099 average. Stippled areas large *cf* natural variation; hatched areas small *cf* natural variation. USGCRP 2017.

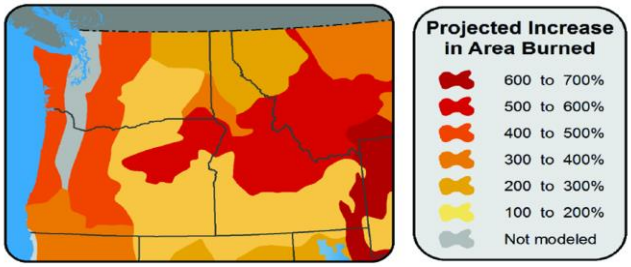


**Figure 6.** Anticipated wildfire consequences of a 2.2$^0$F warming in area burned (Melillo *et al.* 2014).
http://www.globalchange.gov/what-we-do/assessment

### *Wildfire*

Melillo *et al.* (2014) also offered wildfire projections accompanying just a 2.2$^0$F warming, a condition potentially evident by mid-century (Figure 6).

The fire season, already extended by 105 days since 1970s (Kenward *et al.* 2016), will likely become longer and more severe in Oregon. Both human safety and human health will likely be threatened.

### *Natural System Consequences*

That the geographic distribution of our natural ecological systems (biomes) is largely determined by the variables of temperature and precipitation (water availability) has been understood for decades. Community ecologist Robert Whittaker (1975) developed a classic chart indicating this relationship (modified in Figure 7). The chart depicts the climatic conditions that allow each of the designated biomes to exist. The critical message is that even a small shift in either of these variables from current conditions may threaten the viability of the biomes and the species of which they are comprised. This will be especially true for biomes currently existing at the edge of the climatic range that they require. It is especially worth

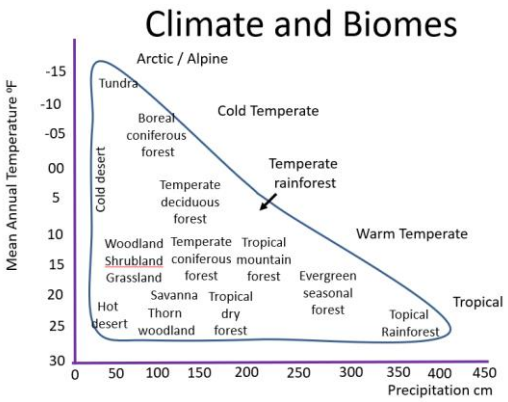


**Figure 7**. Global distribution of natural ecological systems in relation to mean annual temperature and precipitation patterns. Modified from Whittaker 1975.

comparing these temperature ranges to the potential shifts in Oregon's temperature through the century (Figure 4). From this it is evident that most of our state's precious natural systems will be threatened if not eliminated under future conditions. It is worth noting, also, that the same variables control our agricultural productivity, and clearly, our forest viability. Thus, climatic shifts of the dimensions anticipated, absent any adjustment in our collective behavior, will likely compromise agriculture and forestry in the state. Indeed, Dalton et al. (2017) indicated not only that "suitable climates for many important tree species and vegetation types may change considerably by the end of the 21st century…" but also that "different trees have varying degrees of sensitivity to climate change and adaptive capacity."

### *Coastal Concerns:*

Though much of Oregon is land-locked, and will suffer little directly because of ocean consequences, coastal regions, direct tributaries and their economies will have to contend with warming oceans, sea level rise, and increasing ocean acidification. This is particularly relevant along the coast of Oregon and its major tributaries, where the coastal forest range is susceptible to increased aridification.

**Warming Oceans.** Although there is considerable seasonal fluctuation in ocean temperature, warming of oceans in the Northwest between 1900 and this century are already documented with further increases to 2.0 $^{o}$F by mid-century expected. Besides influencing species directly, temperature changes impact such events as algal blooms and shellfish poisoning.

**Sea Level Rise.** Sea levels are rising and will continue to rise for two reasons. First, water expands as it warms from 4$^{o}$C (approximately 37$^{o}$F). As the ocean warms, it inevitably expands and sea level rises. Second, as land borne ice enters the ocean, whether as water or ice, it increases the volume of the ocean. Both these phenomena have already caused sea level to rise and are expected to continue this impact. The impact is influenced by the pattern of land adjustment: if land is rising, the impact is reduced, whereas a subsiding coastal plate will exacerbate the impact. This complication is particularly relevant to the impact of the Cascadia

Subduction Zone (CSZ) where a rising or falling land tectonic plate will influence apparent sea level rise along the coast. As the In Oregon, the impact of the oceanic Juan de Fuca plate sliding under the continental North American plate is a rising continental plate (Lieberman 2012) countering the sea level rise. However, should the earthquake occur, there will likely result a drop in the land level of a meter (3 feet) or so. Mote *et al* (2019), however, indicate that by century's end, the actual sea level rise off the coast of Oregon could plausibly reach 8 feet. During storm surges, a higher sea level will generate conditions that promote far greater storm damage and flooding than would otherwise have been the case. The impact of Hurricane Sandy is a perfect illustration of this problem. Not long ago, the suggestion that New York subways could be flooded by a coastal storm would not have been taken seriously – yet it happened! Results of ocean rise, such as increased erosion and compromised coastal habitat integrity for tidal flat, estuary, and marsh natural communities, could become serious.

**Ocean Chemistry.** Serious as direct climatic consequences are, they do not constitute the sum total of the impacts of our emitting carbon dioxide into the atmosphere.

Because carbon dioxide is absorbed by our oceans, and is transformed into carbonic acid, oceans are becoming more acidic. This is detrimental for marine organisms with carbon-based shells since either, they are unable to form shells in acid conditions, or they lose shells already established. Oysters suffering directly, and salmon indirectly, have been noted as particularly threatened by acidification. Acidosis, a build-up of acidic conditions in the tissues, threatens many marine life forms.

In addition, warming oceans exhibit reduced oxygen levels, potentially critical for marine animals since, like terrestrial animals, they rely on oxygen for basic metabolic respiration.

These consequences of increasing atmospheric greenhouse gases (notably carbon dioxide) pose threats to marine life, and thus to our fisheries, coastal economies, recreation, and tourism.

**Rural *vs* Urban Oregon**

Although climate change has a far greater direct effect on rural communities than urban areas, it must be remembered that urban areas rely on healthy rural regions for their water supply and their agricultural, and forestry products. Indirect effects, therefore, can be substantial. Climatic events that compromise natural systems, and thus urban watersheds, and regional agriculture and forestry will also have a profound impact on life in the urban centers. This impact will not be limited to impacts on prices of food and wood products, but will also compromise regional recreational opportunities as reduced snowpack diminishes skiing, reduced river flow potentially diminishes fishing and water recreation, rising seas compromise our coastal communities, and increasing wildfire risk compromise our forests and air quality.

Additionally, because the Pacific Northwest is projected to suffer less than most of the country from the warming climate, the region will become the target for climate refugees from across the U.S. These migrants will increase our population and place a greater burden on our natural resources and dwindling water supplies.

### *The 5th Oregon Congressional District Climate History and Projections*

Climate models can specifically project future temperature and precipitation trends that Oregon's 5th Congressional District is likely to experience as greenhouse gas emissions continue to increase. Average annual temperature is expected to increase, along with a decrease in summer rainfall. Figures seven through ten provide graphs plotting historical data, and two projections through the century: blue is based on RCP4.5 and red on RCP8.5. In general, the higher emissions of RCP8.5 result in climate change of greater severity.

Oregon's annual mean temperature trends (Figure 8) for the last half century show a slight rise from the 1970s. The low emissions scenario (blue) projection for the next century indicates a likely rise in average temperature of 5.4°F above the 1950-2005 average with average high temperatures reaching around 64°F by late century. The business-as-usual scenario (red) projects a rise in temperature of 10.1°F, with annual average highs of nearly 70°F at the end of the century. Congressional District 5, an inland region, with a large urban area, will experience greater severity of temperature rise (the eastern tier of

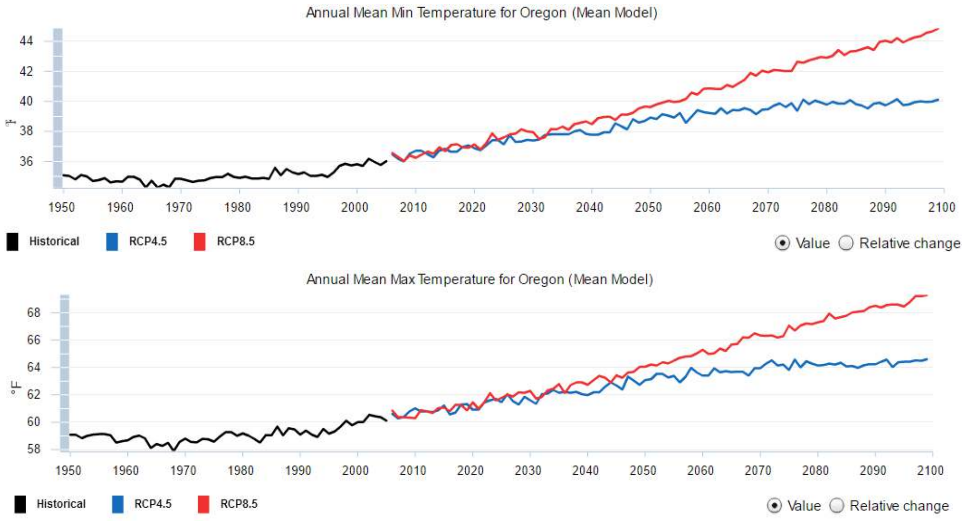


**Figure 8.** Annual Average Minimum & Maximum Temperature Trends and Projections for Oregon. http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

counties, for example, rising 11°F to reach an average max from 66° - North to 72.2°F South). Higher summer temperatures will create more potential for drought, particularly during the anticipated dryer summer growing season. The projected temperature increases may also bring about earlier breeding by animals and plants, a longer and more intense allergy season, and changes in vegetation zones.

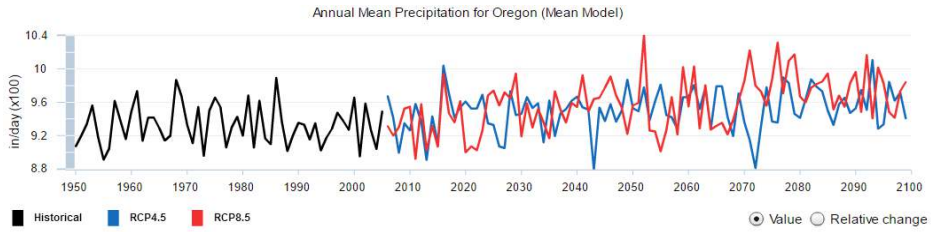


**Figure 9. A**nnual Precipitation Trends and Projections for Oregon.
http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Climate change models project that the Pacific Northwest region will not experience much, if any change in total annual precipitation (Figure 9). However, important seasonal changes

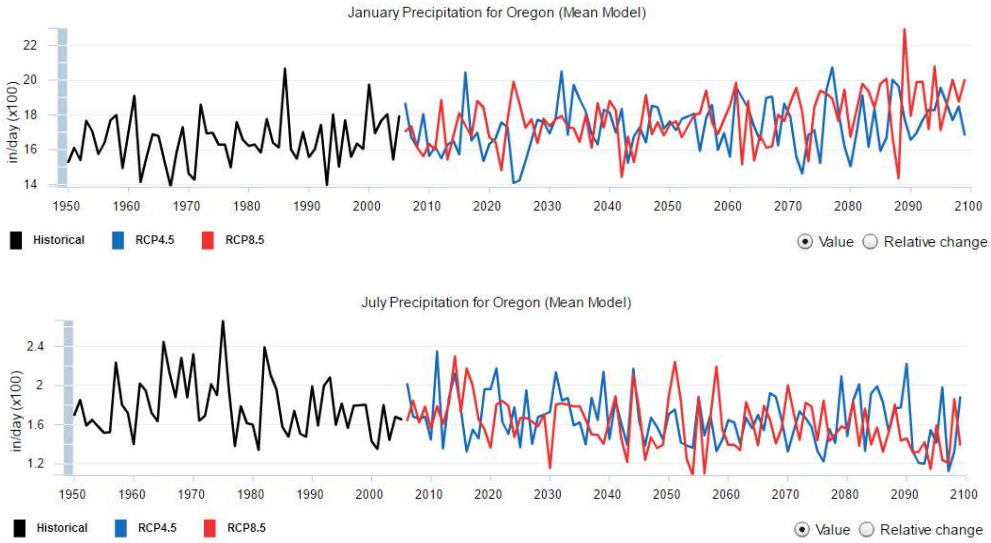


**Figure 10.** January & July Precipitation Trends and Projections for Oregon.
http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

are expected. Summers are anticipated to become dryer, while winters become wetter (Figure 10).

As depicted in the historical monthly precipitation chart (e.g., Washington County, Figure 11) Congressional District 5 is accustomed to relatively dry summers and wet winters (https://weatherspark.com/m/145188/9/Average-Weather-in-September-at-Clatsop-County-Airport-Oregon-United-States#Sections-Precipitation ), but, when coupled with higher temperatures, the region is likely to experience increased aridity and higher probability of severe wildfires in the east. Additionally, the effect on winter snowpack could potentially be devastating.

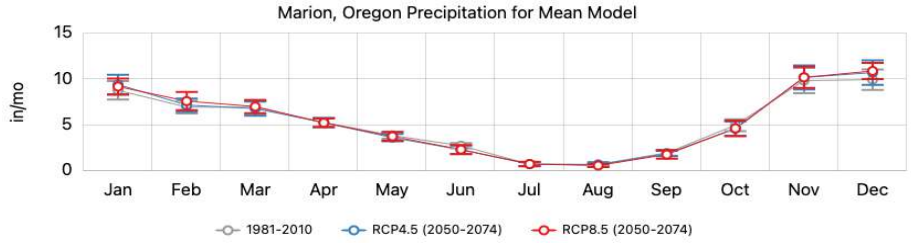


Figure 11. Average monthly precipitation, Multnomah County, OR.
http://regclim.coas.oregonstate.edu/nccv2/maca2/maca2_counties.html

Meanwhile, Figure 12, depicting the predicted change in annual snowfall as snow water equivalent (using the RCP 4.5 – blue line, and RCP8.5 - red line models), shows that Washington County will see considerably less snowfall and resulting snowpack. The cumulative annual drop in snowpack, averaged across all of Oregon, is expected to be by

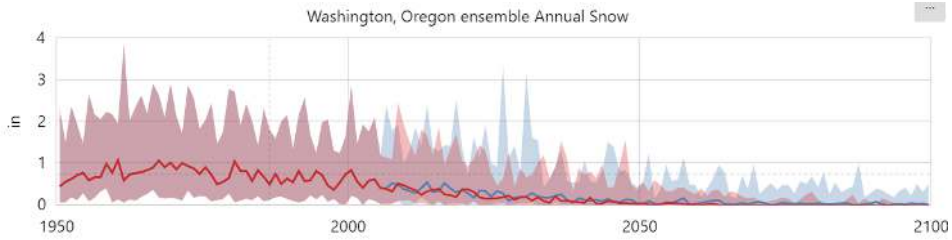


**Figure 12.** Annual Snowfall Trends Washington County, Oregon.
https://www2.usgs.gov/landresources/lcs/nccv/maca2/maca2_counties.html

80 – 90%.

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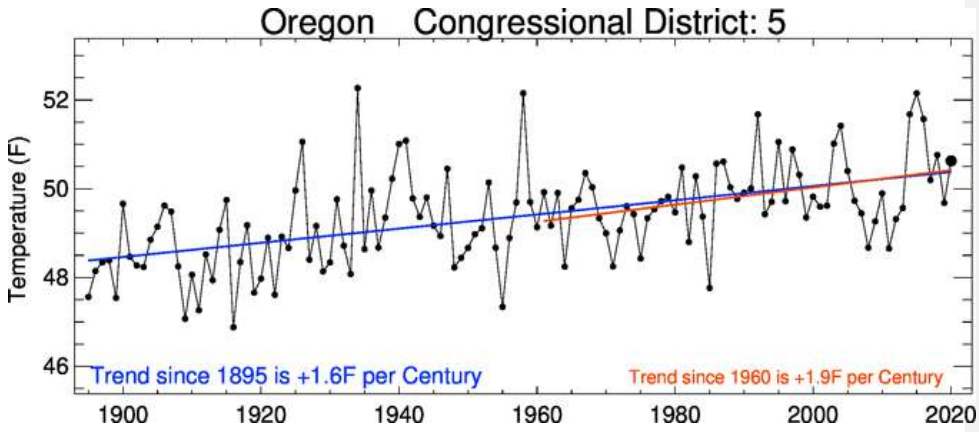


**Figure 13** Temperature trends for Congressional District 5 CCT 2018
http://temperaturetrends.org/district.php?district=5&state=OR

Figure 13 depicts the historical temperature trend in Congressional District 5 where the general warming can clearly be seen, as can the increased rate of warming over the last six decades or so.

### *Oregon's 5th Congressional District Economy*

Oregon's 5th Congressional District encompasses Linn County, most of Marion County, the southern part of Clackamas County and about half of Deschutes County, including Bend. Sitting in the northern middle of the state, healthcare and social assistance are the largest employers of the district, followed by retail. In Clackamas, Linn and Marion counties manufacturing comes in third largest employer, while accommodations and food services ranked third in Deschutes County, which has the Mt. Bachelor ski area for winter recreation and the Deschutes River for summer recreation. Agriculture, especially in Linn County makes up a small, but important part of the CD5 economy.

As a result, CD5, like CD1 is one of the fastest growing Congressional Districts in the country with a projected job growth of over 54 % over the next five years (https://www.bestplaces.net/economy/county/oregon/deschutes). However, because many of the jobs in CD5 are directly or indirectly impacted by the environment, the district is facing immediate impacts of climate change already facing much of the rest of the state, especially the rural areas.

### Healthcare and Social Assistance

CD5, like much of the rest of Oregon is home to an aging population; the area has not escaped the recent economic issues brought about by the pandemic, resulting in relatively high unemployment. The result is that healthcare and social assistance are in high demand in CD5 and the largest employers in the district.

### Forestry

Like all natural systems, our forests are influenced by the key variables of temperature and precipitation, the two factors most influenced by climate change. At the same time, because forests store carbon in their biomass, they can also have a profound direct impact on climate change, as they either store this carbon or release it through fire and logging operations. An important forest - climate interaction exists where each influences the other.

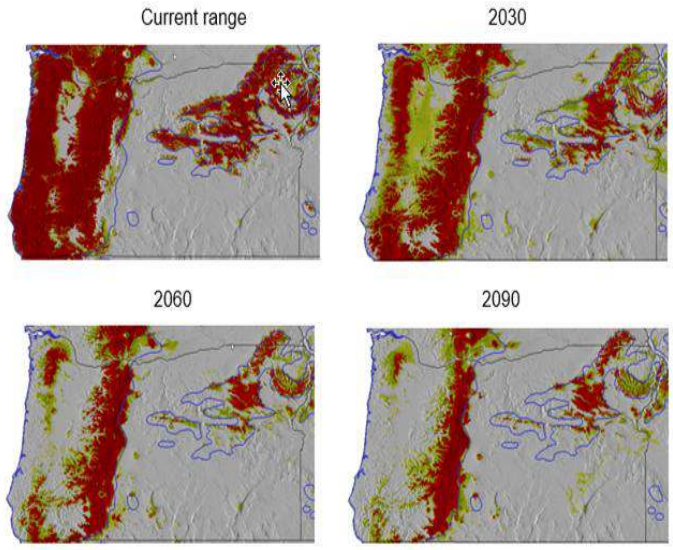


**Figure 14.** Douglas fir (*Psuedotsuga menzeisii*) current and projected distribution. http://charcoal.cnre.vt.edu/climate/species/

While the most important tree species in the 5th Congressional District is the Douglas fir, logging access across the district is limited. As important as Douglas fir is for logging, it is also critical in CD5 for the beauty it confers on the region that brings in tourism and recreation each year. The current distribution and the location of appropriate climate conditions through the century have been analyzed at the USDA Forest Service Labs in Moscow Idaho (Rehfeldt *et al.* 2006). Projections for Douglas fir distributions are presented in Figure 14 for models that assume a continuation of the current trend of increasing atmospheric carbon dioxide emissions. High tree viability conditions are indicated in red, low viability in green and completely unfavorable conditions in gray. These projections suggest the

geographic range of conditions favorable for Douglas fir will be greatly reduced in the near future. This means that the forests and the timber industry of the district will likely be severely challenged as the century unfolds, especially if we do nothing to mitigate the climate trends already evident.

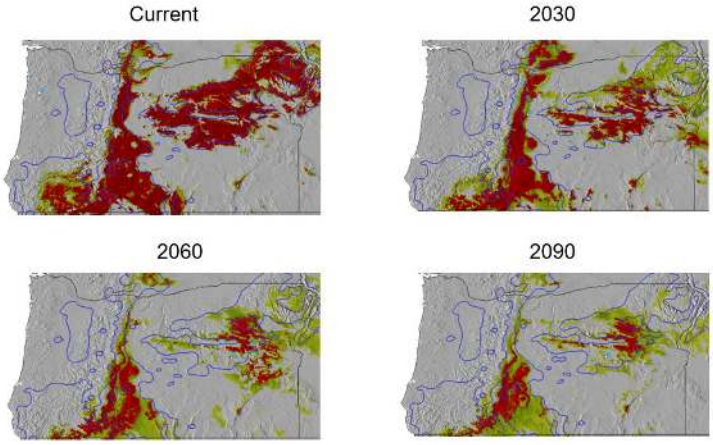


**Figure 15.** Ponderosa pine (*Pinus ponderosa*) Current and Projected Distribution through the 21st Century

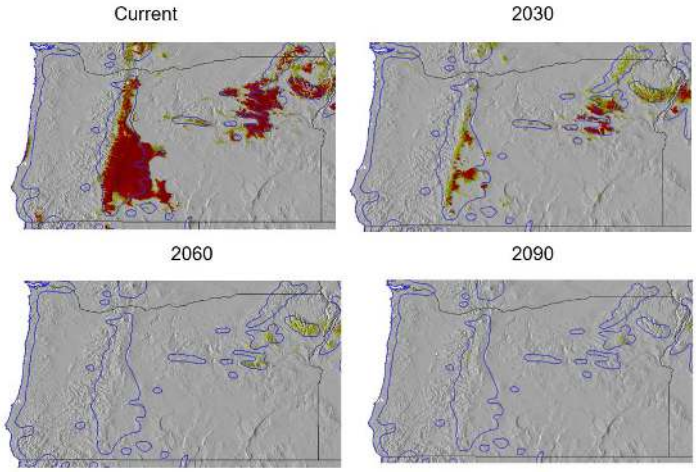


**Figure 16.** Lodgepole pine (*Pinus contorta*) current and projected distribution (http://charcoal.cnre.vt.edu/climate/species/).

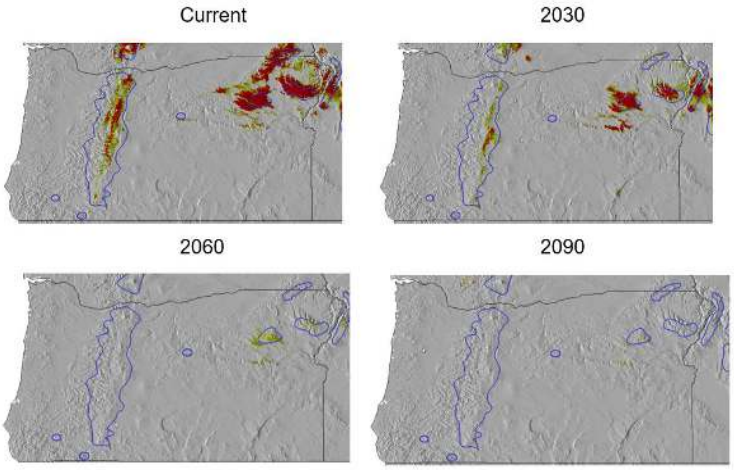


**Figure 17** Englemann spruce (*Picea englemannii*) Current and Projected Distributions (http://charcoal.cnre.vt.edu/climate/species/).

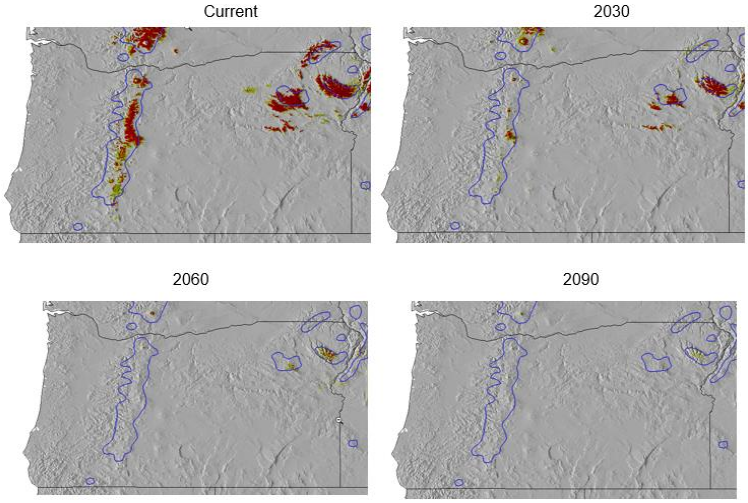


**Figure 18.** Subalpine fir (*Abies lasiocarpa*) current and projected distributions (http://charcoal.cnre.vt.edu/climate/species/).

Meanwhile, Ponderosa pine (Figure 15) Lodgepole pine (Figure 16) and the high elevation species (Figure 17 and 18) will also be impacted. Ponderosa pine range will likely be reduced while Lodgepole pine and the high elevation Engelmann spruce and Subalpine fir species will

likely be extirpated from Oregon. Forestry activities relying on these species will be severely compromised.

**Recreation**

Travel Oregon, in partnership with the Oregon Parks and Recreation Department (OPRD), the Oregon Office of Outdoor Recreation (OREC), Oregon Fish & Wildlife (ODFW) and Earth Economics, released a new Outdoor Recreation Economic Impact Study that demonstrates the importance of Oregon's vast range of outdoor recreation opportunities to the state's economy (https://industry.traveloregon.com/resources/research/oregon-outdoor-recreation-economic-impact-study/). With the presence of the Deschutes River, Silver Creek Falls and Mt. Bachelor, outdoor recreation is an important part of Oregon's 5th Congressional District's economy, bringing in approximately $1.7 billion in 2020. The region receives around 153 sunny days per year, and during summer visitors enjoy activities such as hiking, birding, mountain biking, rock climbing, camping, golfing, boating, rafting, and sightseeing. In the winter months, down-hill and cross-country skiing, snowshoeing, snowboarding, and snowmobiling are all popular activities. Both summer and winter recreation will be affected by climate change; the indirect effects of this include the loss of tourism revenues to local restaurants, hotels, and other forms of amusement, and job losses within the recreation and tourism sectors.

Recreation is extremely dependent on the natural resource base and the weather. Impacts from climate change will vary among leisure activity. Many plant and animal species will likely be unable to adapt to changing climates and warming oceans and may become extinct or extirpated. The ongoing health of our natural ecosystems is necessary if that revenue stream is to be retained. This could become a major problem in the Columbia River and its headwaters. Hunters and wildlife enthusiasts will follow the wildlife north or learn to hunt and view other forms of wildlife that move into the areas that they themselves usually frequent.

***Potential Health Risks***

The population of Oregon's 5th Congressional District is like many others in the state, aging. Climate change can impact the health of the most vulnerable segments of the population, and poses long term threats to the respiratory systems of the elderly. The Oregon Health Authority conducted a recent study to determine impacts of climate on health. Consequences depicted below in Table 1 could have a severe impact on the health of Oregonians and visitors. Many of the health consequences involve respiratory problems due to heat and particulates emitted by wildfires. Health costs in the area are likely to rise as a result. Not only will the projected climate change be negative for our economy, it will also change the lives of people in the 5th Congressional District. It's not a question of if climate change will negatively affect the Third Congressional District's natural resources, its

citizens and its economy, but a question of when and how. Scientists can help to answer some of these questions, but it's up to government officials at every level of government to act now in order to prevent problems before they arise.

**Table 1**. Climate Impacts to Health
Oregon Health Authority (2014)

| Impacts to Health | Top Health Concerns | Vulnerable Communities |
|---|---|---|
| Drought | Poor Air Quality | Low-income Households |
| Wildfire | Poor Water Quality | Native Americans |
| Heat | Respiratory Illness | Private Well Users |
| Infectious Disease | Occupational Hazards | Agricultural Workers |
| | Recreational Hazards | Outdoor Recreation Workers |
| | Heat-Related Illness | Firefighters |
| | Displacement | First Responders |
| | Contaminated Drinking Water | Children |
| | Water Insecurity | Pregnant Women |
| | Food Insecurity | Elderly |
| | Vector-Borne Disease | |
| | Income Loss | |
| | Economic Instability | |
| | Mental Health Impacts | |

***Renewable resources***

In 2019, renewable resources, led by hydroelectric power, accounted for more than three-fifths of the electricity generated in Oregon, much of that along the Columbia River. Although hydroelectric generation typically accounts for three-fourths of the state's renewable generation, utility-scale electricity generation from renewable sources other than hydroelectric power doubled in the past decade. Most of the increased generation came from wind. With wind farms along the Columbia Gorge and in eastern Oregon's Blue Mountains, the state has more than 1,900 wind turbines with more than 3,400 megawatts of wind capacity. In 2019, wind power accounted for more than one-tenth of Oregon's total utility-scale generation. (https://www.eia.gov/state/analysis.php?sid=OR). Due to its geography and geology CD5 is well situated to develop wind and solar in the immediate future.

## *A Timeline for Action:*

Based on the projected consequences of the warming global climate, international agreements (e.g., UNFCCC 2015) have established 2$^{o}$C (preferably 1.5$^{o}$C) above pre-industrial conditions as the limit beyond which we should not allow the global temperature to climb. This limit is echoed by the World Bank (2014). Meanwhile, in a startling report, the Intergovernmental

Panel on Climate Change (IPCC 2018a) indicated that the 2$^{o}$C limits push us too close to many global tipping points beyond which recovery is less possible. We absolutely should target 1.5$^{o}$C is we wish a reasonable chance of retaining a livable planet.

In its Assessment Report 6, the first instalment of which appeared in mid-2021, the Intergovernmental Panel on Climate Change offers, as United Nations Secretary General António Guterres called it, a "Code Red for Humanity!" (IPCC 2021). The report indicates that, in order to limit warming to 1.5$^{o}$C above pre-industrial conditions, our 2020 carbon dioxide emissions budget was just 500 Gigatonnes for a 50% chance, 400 GT for a 67% chance and 300 Gt for an 83% chance. At the current rate of emissions globally, these budgets will be exhausted respectively by 2030, 2028 and 2026. Considering the current accelerating rate of emissions, the IPCC (2018a) conclusion that by 2030 we must impose a substantial (45%) reduction in emissions, and we must reach net zero emissions by 2050 seems both conservative and reasonable. It is worth underlining that the World Bank (2012) long ago acknowledged there is: “no certainty that adaptation to a 4$^{o}$C world is possible.”

There can be little doubt that substantial urgency must be attached to addressing this issue.

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