Technical Investigation Part 1: The Context

Climate Action Plan (CAP)

Clackamas County

June 2021

Prepared by SSG

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Introduction

This technical investigation summarizes key Clackamas County characteristics in preparation for the development of the County's climate action plan (CAP). The report is structured in three parts.

Part 1 summarizes relevant geographic, demographic, and socioeconomic characteristics of the county, and highlights opportunities for the CAP to advance equity. It also includes profiles related to emissions from key sectors: buildings; transportation; waste and wastewater; and agriculture, fishing, and forestry. Much of the content in this section pertains to the County demographic, activity, and infrastructure contexts that are responsible for energy use and greenhouse gas (GHG) emissions production.

Part 2 examines current and anticipated climate change impacts in Clackamas County. Drawing from local, state, and national studies and publications, this section of the report provides a summary of anticipated weather and climate changes, as well as some insights on their potential impacts and resulting costs.

Part 3 summarizes the policy context at the federal, state, and county level. It highlights key legislation, regulations, plans, and policies related to climate action.

This technical investigation is not an exhaustive account of any of these topics. Rather, it is a summary of elements that are important to consider in developing a climate action plan for Clackamas County. This document provides readers with the base knowledge required to meaningfully contribute to plan development and understanding.

Part 1: Geography, Population, Economy, & Equity

Geography

Located in north central Oregon in the Willamette Valley, Clackamas County has a diverse landscape and settlement pattern, including urban, suburban, rural, and wild areas, spanning 1,879 square miles. The northwest part of the county includes part of the Portland Metropolitan Region, as well as a number of small communities. The county encompasses rich forest and farmland, as well as several rivers, the Mt. Hood National Forest, and the Bull Run Watershed, which provides the primary drinking supply for Portland.[1] The county's diverse geography offers opportunities for carbon sequestration, as well as renewable energy development, and greening forestry and agricultural industries.

Clackamas Population

Clackamas County's total population has grown steadily since 2000, to just over 452,000. Over the next 30 years, Clackamas County is projected to grow further by over 50,000 new people. The population has been increasing fastest in the areas outside of the County's Metro boundary. The highest growth rates in recent years were in Sandy and Molalla, respectively.[2] Migration into these areas from outside the county appears to be driving most of the growth.[3]

Clackamas Economy

The most recent Economic Landscape Report stated that Clackamas GDP was $18.8 Billion in 2015, and trending upward.[4] The primary industries in Clackamas are shown in Figure 2. The top three—Professional Business Services, Wholesale Trade and High Tech—make up nearly two-thirds of the total.

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[1] Portland Water Bureau. (n.d.). *Bull Run Watershed.* City of Portland. Retrieved Jan. 2021 from: https://www.portlandoregon.gov/water/29784; Clackamas County. (n.d.). *About Clackamas County*.

[2] Jurjevich, Jason R., Nicholas Chun, Kevin Rancik, Risa Proehl, Julia Michel, Matt Harada, Charles Rynerson, and Randy Morris. "Coordinated Population Forecast for Clackamas County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2017-2067." (2017).

[3] Based on data received from Oregon Metro Regional Government.

[4] FCS Group. (June 9, 2016). Clackamas Economic Landscape: Emerging Trends Update, 2017 update. Clackamas County. Retrieved from: https://dochub.clackamas.us/documents/drupal/f41d066e-8a27-4680-9fe9-1cebcb1558c9.

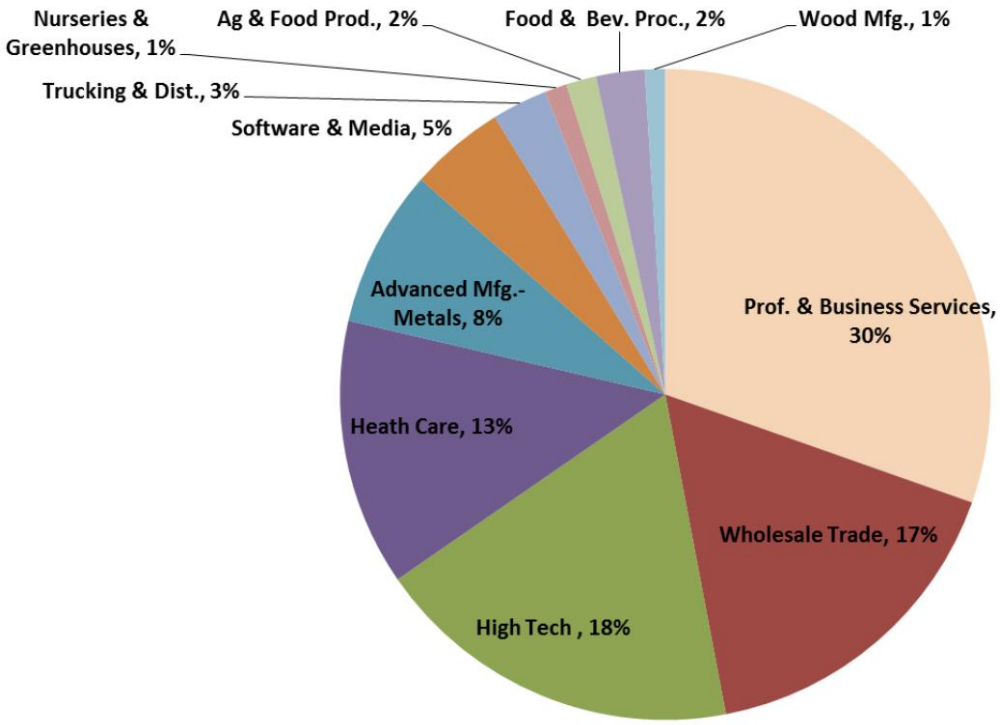

Figure 2: Economic sectors' contribution to County GDP.[5]

Jobs in Clackamas are distributed across a variety of industries, including manufacturing, health services, leisure, and commerce.[6]

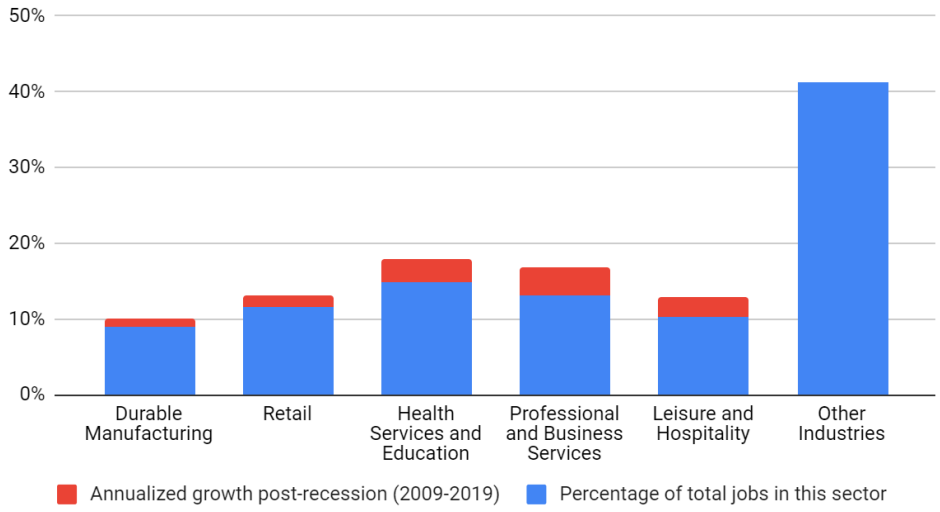

Figure 3: Current size and recent annualized jobs growth in dominant Clackamas economic sectors.[7]

[5] Ibid., p. 12. Source: FCS GROUP based on 2015 IMPLAN data, adjusted to 2017 dollar values.

[6] Potiowsky, Thomas, and Portland State University, Northwest Economic Research Center. (Oct. 2019). Portland MSA Economic & Population Outlook. Northwest Economic Research Center Publications and Reports, 41. Retrieved from: https://pdxscholar.library.pdx.edu/nerc_pub/41.

[7] Ibid.

Currently, the county's largest employers are in the health and education sector. However, this may change in the future: the fastest growth is in the domain of professional and business services. This sector includes a wide range of relatively low-carbon activities related to law, accounting, engineering, computer systems, and management.

At the end of 2019, 171,600 people were employed in Clackamas earning $1,109 per week on average. This reflected a 2.5% growth in jobs over the previous year[8]—a steady growth trend that began in 2009 post-recession, but which was disrupted in March of 2020 by COVID-19. The disruption is depicted in Figure 4, which charts the overall unemployment rate between 2000 and January of 2021.

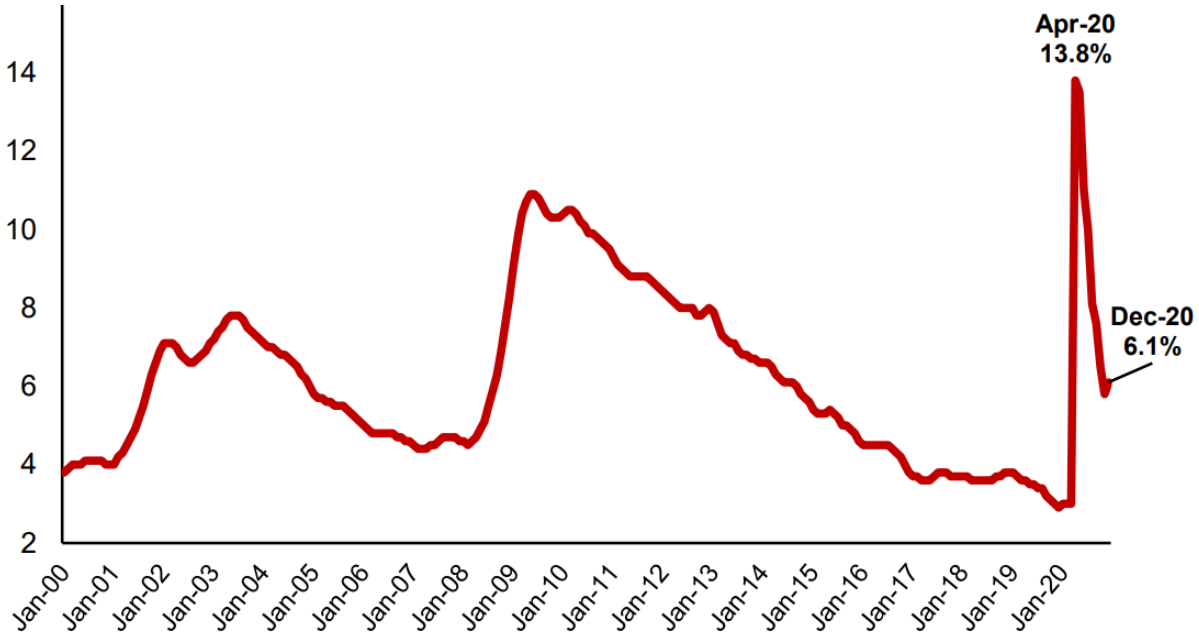

Figure 4: Unemployment in Clackamas County (seasonally adjusted).[9]

The Oregon Office of Economic Analysis predicts that employment levels will rebound to pre-COVID levels by 2023.[10] This rebound is intrinsically linked with the future of the climate. A financial analysis of paths forward, including 'business-as-usual' and 'low carbon' scenarios, plan a recovery that is a win-win.

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[8] U.S. Bureau of Labor Statistics Western Information Office. (2019). County Employment and Wages in Oregon - Fourth Quarter 2019. Retrieved from: https://www.bls.gov/regions/west/news-release/2020/countyemploymentandwages_oregon_20200721.htm#table1.

[9] Adapted from the State of Oregon Employment Department, LAUS. "Clackamas County Economic Indicators January 2021" Factsheet. Retrieved from:
view (state.or.us)

[10] Oregon Office of Economic Analysis. (2020). Economic and Revenue Forecast. Retrieved from: forecast1220.pdf (oregon.gov)

Demographics

Clackamas County has a population of 452,828 persons living in 167,865 households. 85% of the population is White. The remainder identifies as Asian (5%), mixed race (4%), Black/African American (1%), American Indian/Alaskan Native (1%), or another race (4%). In addition, 9% of the population identifies as Latino.[11]

Clackamas County households have an average income of $123,333 and a median income of $89,480 (compared to $95,518 and $69,640, respectively, for Oregon overall). Of residents over 25, 47% hold a post-secondary degree (compared to 43% for Oregon overall).[12]

Household incomes vary widely, and income inequalities are correlated with race. Black/African American households have the lowest average income ($75,888) and median income ($44,273), followed by American Indian/Alaskan Native households.[13]

Table 1: Average and median household income by race and ethnicity.[14]

Household race/ethnicity	Average income	Median income
All	$123,333	$89,480
White	$108,051	$90,152
Black/African American	$75,888	$44,273
American Indian/Alaskan Native	$92,622	$81,897
Asian	$130,878	$119,716
Native Hawaiian/Pacific Islander	$159,847	$166,935
Some other race	$80,222	$65,423
2+ races	$94,355	$75,805

[11] Claritas. 2021 Demographics. Jan. 2021. Blueprint Clackamas. Retrieved from: http://www.blueprintclackamas.com/demographicdata?id=2262

[12] Ibid.

[13] Ibid.

[14] Ibid.

In addition, 7.2% of households lived in poverty in 2019.[15] According to an analysis of 2018 data by Feeding America, 9.1% of households are food insecure.[16,17] Feeding America projects that, during the pandemic, the food insecurity rate increased to 13.1%.[18] According to the Clackamas County Community Needs Assessment completed in 2016, the County's small rural towns tend to have higher concentrations of poverty, including "isolated seniors in need of basic resources".[19]

The assessment also said that "people of color are disproportionately impacted by poverty" with Native American, Black, and Hispanic residents more likely to live below the poverty line than residents of European or Asian descent.[20] The Homeless Solutions Coalition of Clackamas County has also raised concerns that poverty in the County is tied to systemic racism, and that Black people and other people of color are overly represented among the County's homeless population.[21]

Equity

While the climate is a geophysical system, climate change is also a profoundly socioeconomic challenge. Health and socioeconomic equity impacts are intertwined with climate stressors. It is important to consider the impacts of actions (or lack of action) on household income levels, neighborhoods, and racial and ethnic groups.

Potential climate actions can be designed to reduce inequities. For example, Clackamas's older, less efficient housing stock tends to be more affordable, but comes with higher utility bills. Moreover, those who rent are more likely to pay a higher percentage of their income for housing. Table 2 shows the split between owning and renting in Clackamas, and the average cost of owning versus renting as a percentage of household income.

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[15] United States Census Bureau. Quick Facts. Retrieved March 2020 from: https://www.census.gov/quickfacts/fact/table/clackamascountyoregon/PST045219

[16] Feeding for America using USDA's measure for food insecurity, which indicates that households lack access, at times, to enough food for an active, healthy life for all household members or nutritionally adequate foods.

[17] Feeding America. (n.d.). Child Food Insecurity in Clackamas County. Retrieved from: https://map.feedingamerica.org/county/2018/child/oregon/county/clackamas

[18] Feeding America. (Oct. 30, 2020). The Impact of the Coronavirus on Food Insecurity. Retrieved from: https://www.feedingamericaaction.org/the-impact-of-coronavirus-on-food-insecurity/

[19] Health, Housing & Human Services. (2016). Clackamas County Community Needs Assessment. Retrieved from: https://dochub.clackamas.us/documents/drupal/7d5bdf3a-448e-4361-ad79-973b14c7fb71

[20] Ibid.

[21] Deshler, Lynne. (July 2, 2020). "Systemic racism drives Clackamas county homelessness". *Sandy Post.* Retrieved from: https://pamplinmedia.com/sp/69-opinion/472297-382037-systematic-racism-drives-clackamas-county-homelessness

Table 2. Cost of owning versus renting in Clackamas County.[22]

Private Dwellings	Number (%)	Cost of owning or of renting as % of Household Income
Owner-occupied units	1,005,896 (62%)	29.0 %
Renter-occupied units	606,086 (38%)	41.2 %

The burden of greater utility costs can adversely affect lower income households, which include a disproportionate percentage of people of color. The CAP can identify neighborhoods where renters would experience the greatest savings from improved energy efficiency. Reducing emissions by improving efficiency can enhance the quality of housing and reduce energy bills, creating a win-win for lower income households; however, policies may need to be carefully considered in order to incentivize owners of building stock to make improvements.

Housing is just one example of the synergy between climate change mitigation and improving quality of life for Clackamas residents. Transit and transportation improvements, such as those identified in Clackamas County Transit Plan will have substantial impacts for the population living near transit stops. In Clackamas County, a higher proportion of communities of color (compared to White communities) and higher proportion of households below the poverty line (compared to households above it) live within ¼ mile of a transit stop. [23] Access to and improvements in transit can thus create benefits for lower-income households and people of color, while reducing emissions.

The CAP also has the potential to positively impact economic equity. Investments necessary to counter emissions, including increasing renewable energy, building retrofits, and investments in public transit, all create jobs and boost economic growth. Implementing these investments through policies with an equity lens can improve equity in the county. For example, policies promoting renewable energy might be accompanied by investments in skills training to help marginalized groups enter the renewable energy sector.

[22] American Community Survey. (2019). *Clackamas County Selected Housing Characteristics,* Table ID DP04. Retrieved from: https://data.census.gov/cedsci/table?q= Clackamas County Housing&tid=ACSDP1Y2019.DP04&hidePreview=false

[23] Clackamas County. (May 22, 2020). *Clackamas County Transit Development Plan: Background Information and Existing Documents*. Retrieved from: https://dochub.clackamas.us/documents/drupal/304011a6-c343-49fe-98b5-e5e1cd555bfd.

Sector Profiles

Buildings

Built environment characteristics vary in Clackamas County's diverse regions, ranging from cities to villages; however, there are some overarching patterns in the building sector. If buildings are grouped by function, as residential, commercial/institutional, industrial or agriculture/forestry/ farming, then the relative emissions contribution from each building type is dominated by residential, followed by commercial and institutional, as shown in Figure 5.

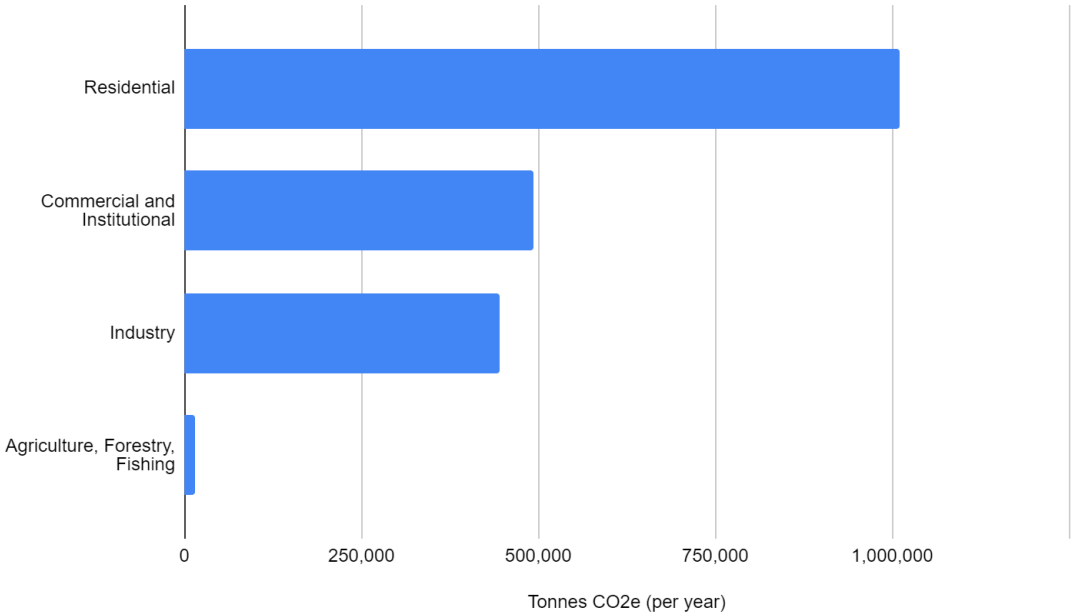

Figure 5: CO2e emissions in Clackamas County by building type.[24]

Across the County, residential buildings account for about half of all building-related emissions. Moreover, at 63% of the total stock, single-detached older housing dominates the residential form.[25] Figure 6 shows the distribution of residential buildings by age. The average age of buildings is 44 years old (built in 1976).

[24] SSG Clackamas Baseline Analysis (2021). Based on data supplied by the County.

[25] United States Census Bureau. (2019). American Community Survey. Clackamas County household and dwelling characteristics. Retrieved from: https://data.census.gov/cedsci/table?g=0400000US41_0500000US41005&tid=ACSDP5Y2019.DP04&hidePreview=true.

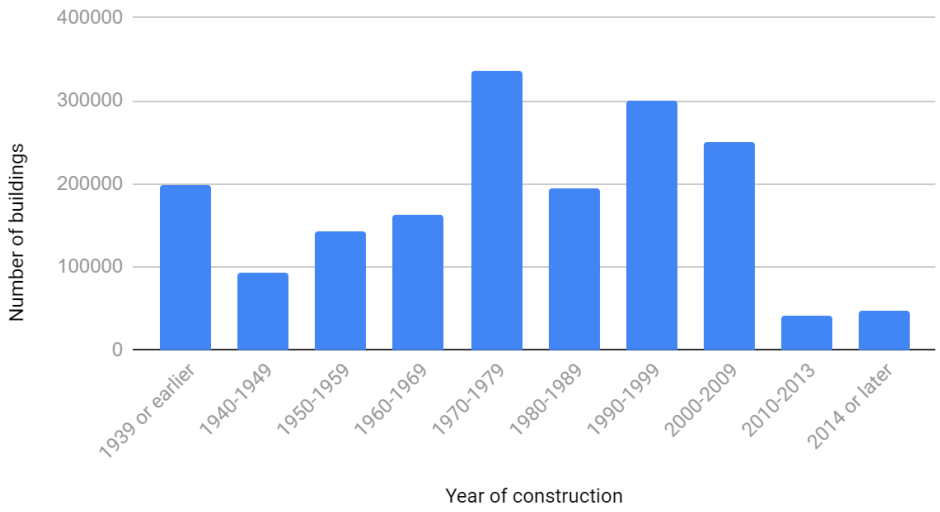

Figure 6: Housing stock in Clackamas County by age of building.[26]

This means that most of the buildings were erected when building codes were more lenient with regard to energy use. Between 2006 and 2015, the Oregon Building Codes Division (BCD) and Department of Energy required all new construction to increase energy performance by 15%.[27] This pattern results in Clackamas County's new buildings becoming more efficient at a rate of about 1.7% every year. Future iterations of the Oregon BCD are expected to continue that trend.

Because older buildings tend to be less efficient, there is an important opportunity for savings from energy efficiency retrofits in older building envelopes (e.g. air-sealing, increased insulation, improved windows and roofs). In selecting the best actions for Clackamas, consideration should be given to practicality, as well as equity.

Energy Supply and Distribution

In 2018, the electricity consumed in Clackamas County had an average emissions intensity of 738.7 lbs CO_2e/MWh. Canby Utility Board and Portland General Electric (PGE) supply most of the grid electricity to Clackamas residents. The underlying sources for this power supply include hydro (such as hydroelectric plants on the Clackamas River), as well as natural gas, coal, wind, and purchased power. Currently, PGE has set a target to reduce CO_2e/MWh levels 80% by 2030 and 100% by 2040.

For its municipal needs, the County purchases carbon-free electricity through a cost-optimized combination of renewables. The main County campus has a central utility plant that conditions multiple buildings, using electricity for cooling and natural gas for heating. Given this dependence on natural gas, staff is evaluating the purchase of carbon offsets.

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[26] American Community Survey. (2019). *Clackamas County Selected Housing Characteristics,* Table ID DP04. Retrieved from: https://data.census.gov/cedsci/table?q= Clackamas County Housing&tid=ACSDP1Y2019.DP04&hidePreview=false

[27] Oregon Building Energy Code (2015). Retrieved from: Building Energy Code (Oregon) | Open Energy Information (openei.org)

How People Move Around

Clackamas residents' trips are most often between 1-2 miles and overwhelmingly by private automobile (primarily as a driver, secondarily as a passenger). Figure 7 shows the transportation mode split by trip distance.

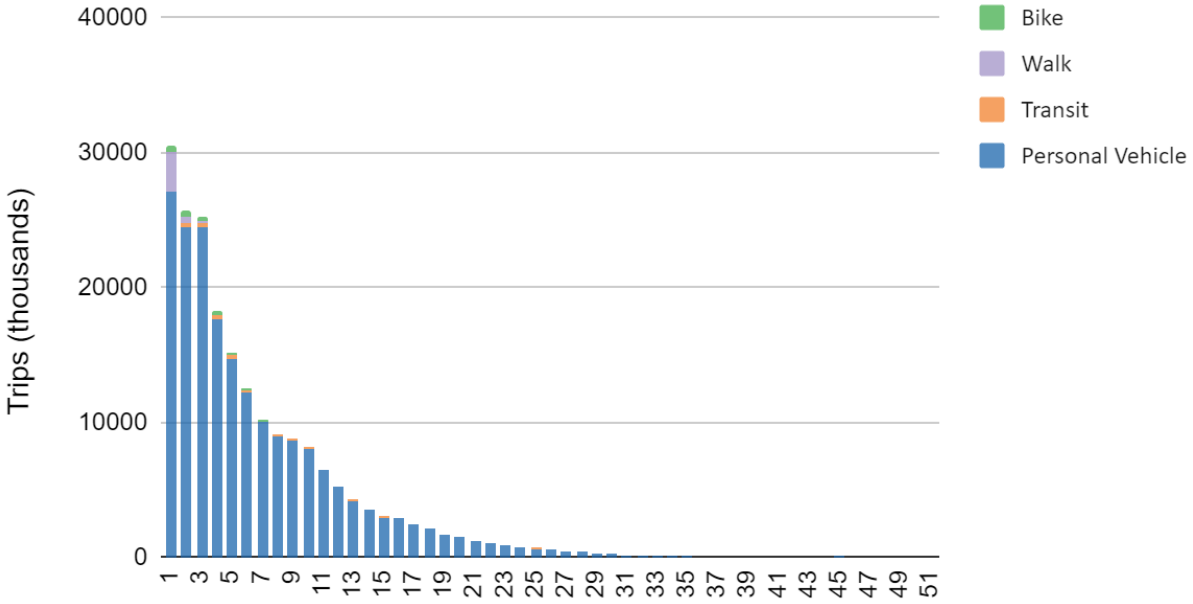

Figure 7: Number of trips in Clackamas, by distance (horizontal axis) and by mode of transportation, 2018.[28]

Overall, approximately 4 percent of trips are by active transportation (1.0% biking and 1.7% walking). The remaining trips are almost all by personal vehicle (96.2%), with only 1.1% taking transit options. Improving the regional public transit system and active transportation network has multiple co-benefits and is already part of high-level plans such as the 2021 Transit Development Plan,[29] the 2018 Clackamas County Comprehensive Plan,[30] and the 2015 Active Transportation Plan.[31]

Electrification of vehicles is already underway in the county and within municipal fleets. Clackamas has begun building charging infrastructure for public use and County use. Clackamas County has at least three electric vehicles in its municipal fleet and has partnered with PGE to assess economic and technical feasibility for electrification opportunities.

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[28] Modeled analysis by SSG (2021). Source data from State of Oregon Employment Department Transportation Data.

[29] 2021 Transit Development Plan Wright, Susan, Purser, K., Ryes, P., Doubleday, R., and Kittelson & Associates, Inc. (July 22, 2020). *Clackamas County: Transit Development Plan: Goals, Objectives, and Performance Measures* [Memorandum].

[30] Clackamas County Comprehensive Plan. Chapter 5: TRANSPORTATION SYSTEM PLAN. (Last amended Jan. 2017). Retrieved from: https://dochub.clackamas.us/documents/drupal/4f347d01-968b-47c4-ae92-7eaac0776a0f

[31] Clackamas County Active Transportation Plan. (2015).

Waste and Wastewater

Metro plans and oversees the region's solid waste system. Clackamas residents' waste goes to one of three landfill sites: Coffin Butte, Wasco County, and Columbia Ridge. Figure 8 shows a breakdown of what ends up in the landfill.

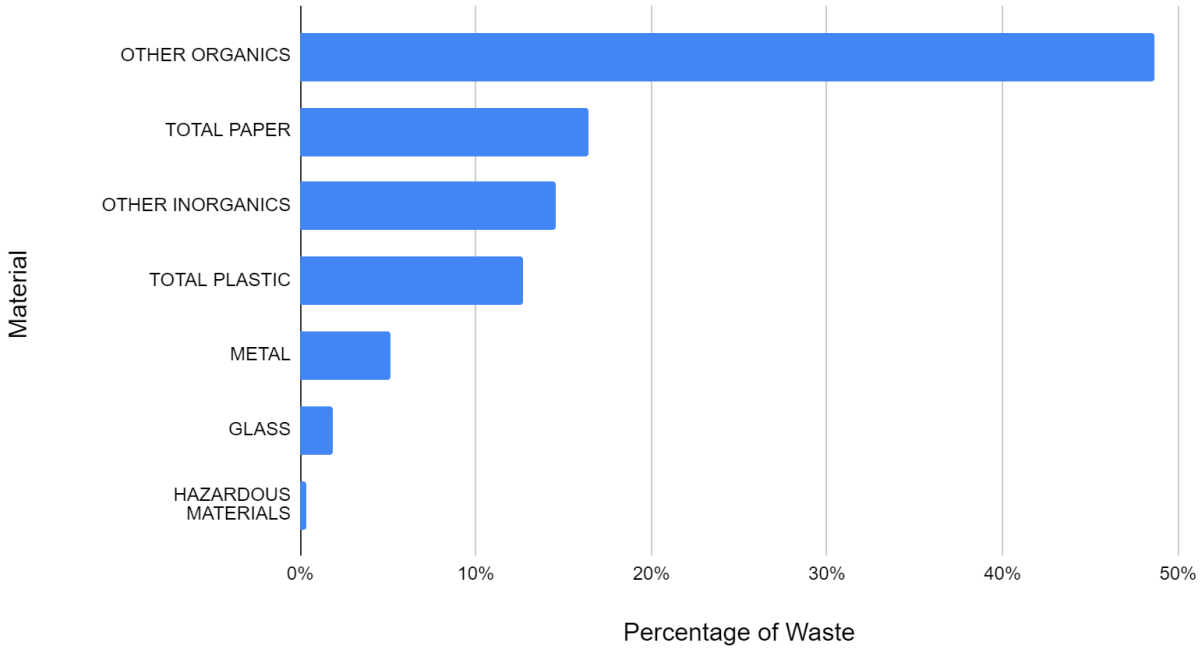

Figure 8: Percentage of all waste, by tonnage, categorized by material, 2018.[32]

Currently "other organics" make up 49% of solid waste. Oregon law identifies an increased recovery goal for food waste of 25 percent by 2020, and Metro has passed a requirement for food producing businesses to divert food scraps.[33] This is expected to incentivize Clackamas's wastewater treatment plants to add or increase their anaerobic digestion capacity.

There are several water collection and treatment entities in Clackamas. Water Environment Services (WES) provides the wastewater collection and treatment services to approximately half of the population of Clackamas County. WES operates two wastewater treatment plants, plus satellite facilities. Of these, Kellogg Creek treatment plant is the largest, serving over 120,000 people. South Fork Water Board also treats and delivers water from the lower Clackamas River to the cities of Oregon City and West Linn. Canby Wastewater Treatment Facility serves Canby area residents.

These wastewater treatment systems face a high level of risk from anticipated climate change impacts.[34] One co-benefit of the CAP is the potential to strategically invest in actions that may increase resiliency of Clackamas's wastewater infrastructure.

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[32] Department of Environmental Quality (2019). Data and Reports 18-202-ODEQ_Data_Summary

[33] Oregon Metro. (Nov. 9, 2017). *Public Comment Report: Business Food Waste Requirement.* Retrieved from: https://www.oregonmetro.gov/sites/default/files/2017/11/09/Business_Food_Scraps_Public_Comment_Report_110917.pdf

[34] EPA. (Oct. 20, 2019). Clackamas County Climate Resilience Evaluation and Awareness Tool (CREAT) Exercise Report.

Agriculture, Forestry, and Fishing

According to the most recent United States Department of Agriculture Census, Clackamas County has 157,426 acres of farming operations and the median size of an operation is 10 acres.[35] Methane from cattle is the most substantial contribution to emissions from agricultural activities: there are 15,000 cattle and cows in Clackamas, mostly beef cows.

Clackamas is rich in cropland, especially the areas surrounding the communities of Canby, Sandy, Boring, Wilsonville, and Molalla. The dominant crop is wheat. A critical part of the region's agricultural capacity are pollinator species, which service 83,738 acres of cropland in Clackamas.[36] Mitigation strategies for climate change will include adaptation co-benefits for protecting pollinators, which have downstream environmental and economic benefits.

According to the most recent Forest Management Plan, over 75% of the county residents support growing forests.[37] Forestry is an important industry for Clackamas, and forests are key to the quality of life in many respects. In addition to being at the center of the wood product industry, the county's forests provide habitat, clean air, and leisure opportunities, along with jobs tied to the leisure and hospitality sector.

[35] USDA National Agriculture Statistics Service. (2017). Census of Agriculture, Chapter 2, Table 1: Retrieved from: https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/OR.

[36] Ibid.

[37] Clackamas County Forest Management Plan. (2018). 2018 Forest Management Plan.pdf (dropbox.com)

Part 2: Anticipated Climate Change Impacts

The content in this section is largely derived from the excellent summary and analyses of the Fifth Oregon Climate Assessment, published by the Oregon Climate Change Research Institute at Oregon State University in January 2021.[38]

Climate and Natural Hazards

As evidenced by increasing average annual temperatures and instances of wildfire, climate change impacts are starting to be prominent across Oregon and in Clackamas County. Historical climate data analysis and climate change modeling projections provide estimates for the types and scales of climate impacts expected in the region in coming years. Of central interest are:

- Temperature;
- Precipitation;
- Snowpack and runoff; and
- Natural hazards, such as: extreme heat, drought, wildfire, and floods.

Much of the information in this section represents studies and modeled projections for the whole state of Oregon and is presented as average values. Precise projected values will vary by geographic region throughout the state and throughout Clackamas County.

Temperature

Oregon's annual average temperature is increasing at the average national rate (Figure 9). Annual average temperatures in Clackamas County have increased by about 2.2 degrees since 1901.[39]

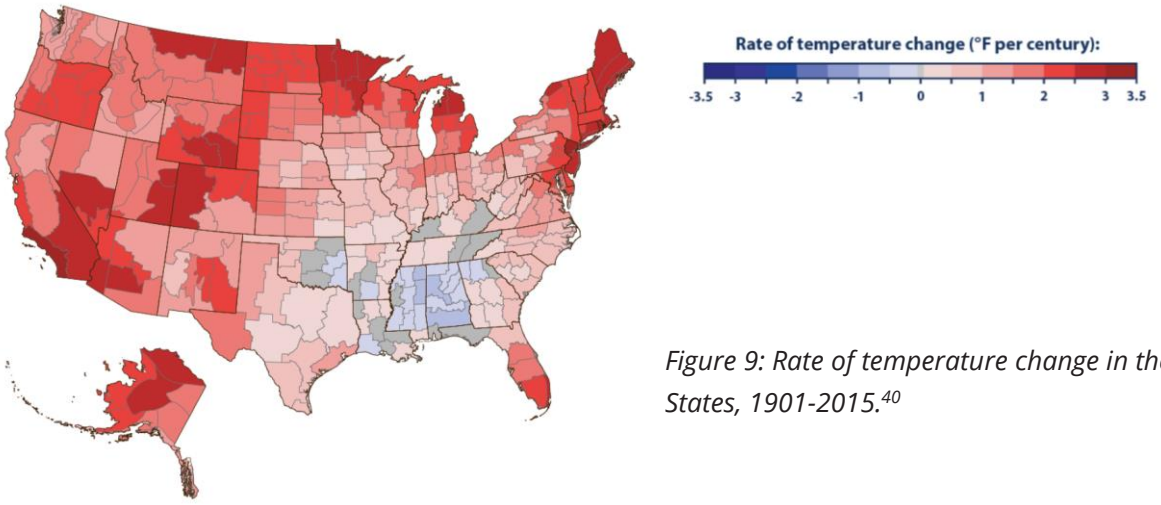

Figure 9: Rate of temperature change in the United States, 1901-2015.[40]

[38] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*. Oregon Climate Change Research Institute, Oregon State University, Corvallis, Oregon. https://oregonstate.app.box.com/s/7mynjzhda9vunbzqib6mn1dcpd6q5jka

[39] Ibid.

[40] EPA. (Aug. 2016). Climate Change Indicators: U.S. and Global Temperature. Retrieved from: https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-temperature

Oregon's temperatures are projected to increase in all seasons, with summer temperatures increasing the most (Figure 10).[41] In Figure 10, blue and red bars are observed temperatures (1900–2019) from the National Centers for Environmental Information. Solid lines are the mean values of 35 climate model simulations for the 1900–2005 period, which were based on observed climate forcings (black line), and the 2006–2099 period for the two future scenarios RCP 4.5 and red RCP 8.5 (orange and red lines). Shading indicates the range in annual temperatures.

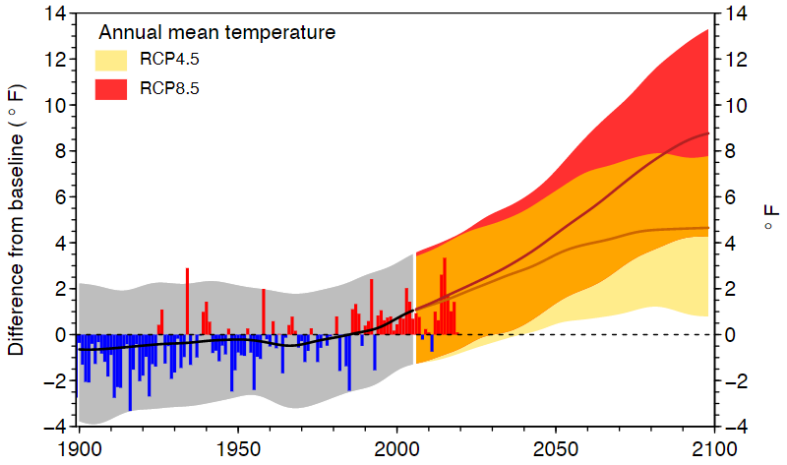

Figure 10: Observed, simulated, and projected changes in Oregon's mean annual temperature relative to 1970-1999 (baseline) under RCP 4.5 and RCP 8.5 future scenarios.

Representative concentration pathway (RCP) is a greenhouse gas concentration trajectory used in climate modeling to describe different climate futures considered possible depending on the volume of greenhouse gas emissions in years to come. RCP 4.5 is an intermediate scenario representing global temperature rise between 2 and 3°C (3.6 and 5.4° F). RCP 8.5 is the worst-case scenario, under which temperatures rise between 3 and 5°C (5.4 and 9°F).

Elevated and sustained temperatures will result in longer, hotter summers which are likely to induce droughts and heat waves, which are major threats to human survival, especially in vulnerable populations. Extended hot conditions can have many negative impacts, including on water supply and water quality, agricultural yields, livestock survival, ecosystem health, and soil erosion rates. Increased energy demand for air conditioning can put strain on electricity generation and transmission infrastructure, as well.

[41] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*.

Precipitation

The historical annual variability of Oregon's precipitation is expected to continue in future years, with a slight increasing trend (Figure 11). Precipitation is expected to increase during the spring and winter and decrease in summer months. It is likely that the intensity of heavy precipitation events will increase in coming years.[42]

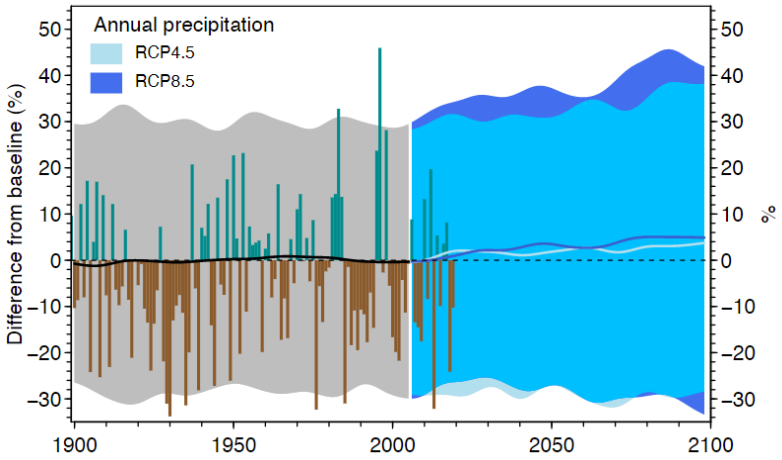

Figure 11: Observed, simulated, and projected changes in Oregon's mean annual precipitation relative to 1970–1999 (baseline) under RCP 4.5 and RCP 8.5 future scenarios. Green and brown bars are observed precipitation amounts (1900–2019) from the National Centers for Environmental Information. Solid lines are the mean values of simulations from 35 climate models for the 1900–2005 period, which were based on observed climate forcings (black line), and the 2006–2099 period for the two future scenarios, RCP 4.5 and RCP 8.5 (light and dark blue lines). Shading indicates the annual precipitation range from all models.

Increased precipitation and more intense storm events risk overwhelming stormwater management systems resulting in flooding and wastewater overflow issues in urban areas. Flooding and landslide risks are also increased, posing threats to housing, urban infrastructure, transportation, and energy generation and distribution networks.

Snowpack and Runoff

Many of Clackamas' rivers and streams rely on the melting of winter snowpacks in the Oregon Cascade Range mountains. Annual snowpacks in these mountains have been in decline in recent decades and are likely to continue to decrease as the climate warms. Warmer air temperatures will mean more moisture in the air which will fall more often as rain than snow. In the Oregon Cascade Range, fewer than 25% of wet days are projected to be days with snow by the mid-21st century, compared to about 50% during the late 20th to early 21st centuries. Continued warming is projected to result in earlier streamflow, declining summer flows, and increasing winter flows.[43]

[42] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*.

[43] Ibid.

Median summer runoff in the Clackamas River watershed is projected to decline 50% under an RCP 8.5 scenario. Extreme high flows are projected to increase up to 19%, and extreme low flows are projected to decrease by as much as 20 m^3/s by the middle and late twenty-first century. The center timing of flow is projected to shift two to three weeks earlier by the 2080s (2070–2099).[44]

Decreased snowpack and runoff will result in lessened stream flows and increased stream temperatures that may pose risks to stream and riparian wildlife. Hydroelectric utilities rely on steady stream flows and temperatures for consistent generation operation and thus are at risk from these climate change impacts.

Extreme Heat

Warming temperatures are increasing the frequency and severity of extreme heat days, seasons, and waves. Since 1940, the number of days exceeding 90°F increased by over eight days per year in Portland and Pendleton, and 21 days per year in Medford (Figure 12). The number of 90°F days in Portland in 2015 (29) and 2018 (31) broke records.[45]

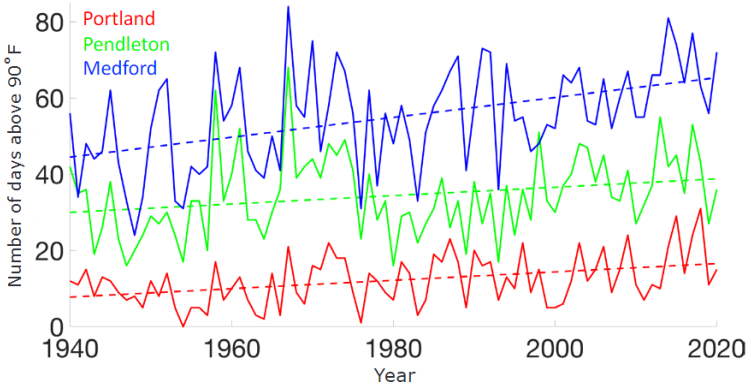

Figure 12: Number of days per year on which the daily high temperature exceeded 90°F at Medford, Pendleton, and Portland.[46]

Projections indicate that most areas in Oregon can expect annual extreme heat day (above 86°F) totals to increase by 30 days by the end of the century (Figure 13). The increase in extreme heat days will likely be smaller in Clackamas County's mountainous regions.

[44] Chen, J., and H. Chang. (2020). Relative impacts of climate change and land cover change on streamflow using SWAT in the Clackamas River Watershed, USA. *Journal of Water and Climate Change*. DOI: 10.2166/wcc.2020.123.

[45] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*.

[46] NOAA National Centers for Environmental Information. (n.d.). *Global HIstorical Climatology Network Daily - Data Access.* National Oceanic and Atmospheric Administration. Retrieved Jan. 2021 from: www.ncdc.noaa.gov/ghcnd-data-access.

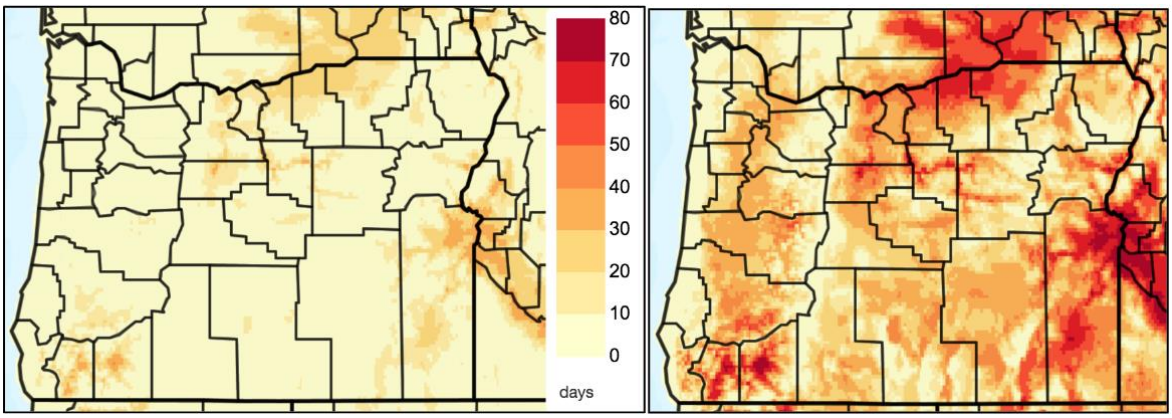

Figure 13: Number of days from April through October with a heat index ≥90°F in historic (1971–2000, left) and future (2040–2069, right) periods under RCP 8.5.[47]

Increased extreme heat event frequency will increase heat-related illness and death frequency, particularly among vulnerable populations (elderly; children; people with chronic illnesses; people with low incomes; Black, Indigenous, and People of Color; and outdoor workers).[48] Projections indicate a 422% increase in heat-related deaths under RCP 8.5 during the 2031-2080 period across the country.[49] Cooling systems in buildings can reduce extreme heat mortality risk. However, these systems contribute to climate change through their use of high greenhouse gas-intensive refrigerants and create increased electrical demand, posing challenges for the electricity grid. Sustained high temperatures and aridity can also contribute to the transmission of infectious diseases present in the state, including Lyme disease, West Nile virus, and Valley Fever.[50]

Drought

Persistent drought is common in the Northwest. Over the last 20 years, the incidence, extent, and severity of drought has increased in the Northwest compared with the twentieth century. These droughts have had numerous adverse impacts on agriculture, water availability, recreation, ecosystems, and wildfire risk.[51] Anticipated warmer, drier summers and decreased snowpack due to warmer winter temperatures are expected to result in increased drought frequency. As climate change reduces mountain snowpack, seasonal drought will become less predictable in Clackamas County and snow droughts will increase the likelihood of hydrological or agricultural drought during the following spring and summer.[52]

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[47] Dahl, K., R. Licker, J.T. Abatzoglou, and J. Declet-Barreto. (2019). Increased frequency of and population exposure to extreme heat index days in the United States during the 21st century. *Environmental Research Communication*s, 1 (7). https://doi.org/10.1088/2515-7620/ab27cf.

[48] Ebi, K.L., J.M. Balbus, G. Luber, A. Bole, A. Crimmins, G. Glass, S. Saha, M.M. Shimamoto, J. Trtanj, and J.L. White-Newsome. (2018). Human Health. In D.R. Reidmiller, C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (Eds.), *Impacts, risks, and adaptation in the United States: fourth National Climate Assessment, volume II* (pp. 539-571). U.S. Global Change Research Program, Washington, D.C

[49] Guo, Y., et al. 2018. Quantifying excess deaths related to heatwaves under climate change scenarios: a multicountry time series modelling study. PLoS Medicine 15:e1002629

[50] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*.

[51] Ibid.

[52] Ibid.

Increased summer drought conditions may warrant new infrastructure for water storage for potable and agricultural uses. Elevated water efficiency measures may be required for users and utilities as well. Drought also affects the availability of water for hydroelectric generation, risking decreased generation output.

Wildfire

Wildfire is a naturally occurring phenomenon whose frequency and severity is being increased by climate change. The Oregon 2020 fire season is one of the worst on record, with five wildfires over 100,000 acres each. These thousands of displaced people, destroyed structures and infrastructure, and contributed to hazardous air quality in many parts of Oregon and the Northwest US.

Various wildfire modeling efforts predict that under a mean temperature increase of 3.6°F the median annual area burned by wildfires in Oregon will increase 200%.[53] The incidence of very large fires (burning more than 5000 ha) is likely to increase 200-400% under RCP 8.5.[54] Increased wildfire frequency and severity are likely to increase risk of drought, insect outbreaks, and pathogens that can lead to substantial ecological changes and further risk to human health and survivability.

Clackamas County has many communities in wildland-urban interfaces, which are high-risk areas for wildfire damage to infrastructure and threat to human life. Wildfires' depletion of vegetation increases erosion, and flood and landslide risk. These pose additional risks to water supply infrastructure (e.g. treatment plants, reservoirs) via overflow, turbidity, and contamination.

Transportation is also at risk from wildfires, primarily due to on-road wildfire debris. Human and animal health is at risk during wildfire events as well; extremely elevated levels of airborne particulate matter pose threats to breathing, resulting in increased hospitalization for asthmatics and patients with other bronchial conditions, as well as increased susceptibility to respiratory viruses. Vulnerable groups, including the children and elderly, face higher risks.

Floods

Floods across Oregon are likely to be more severe in years to come because of three key climate impacts: large precipitation events are expected to be more intense, precipitation will fall more as rain than snow, and total wet-season precipitation volumes will increase. As the air warms it holds more moisture, causing more frequent and more severe precipitation. As less precipitation falls as snow, rain events have more volume. More frequent rain events means wetter soil and reduced depth to groundwater—conditions that enable flood events. Flood modeling predicts that by the 2030s and 2070s, major flood events on the nearby lower Columbia River (below the confluence with the Willamette River) will be 44% and 151% larger, respectively, under an RCP 8.5 scenario.[55]

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[53] Ibid.

[54] Barbero, R., J.T. Abatzoglou, N.K. Larkin, C.A. Kolden, and B. Stocks. (2015). Climate change presents increased potential for very large fires in the contiguous United States. *International Journal of Wildland Fire,* 24 (892–899).

[55] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*.

Wetter soils and increased flood conditions present greater risk of landslides in hilly and mountainous areas. As of 2020, less than 6% of Oregon's levees were certified by FEMA.[56]

Flooding poses risk to water supply, wastewater, and hydroelectric infrastructure, with the potential to overwhelm each. As many dams and reservoirs across the state are aging, their susceptibility to increased flood frequency and severity is elevated.

Climate Change Effects on Species of Note

There are many animal and plant species across Clackamas County, each of which will respond differently to local changes in climate. Some will adapt, some will migrate, and some may suffer in place. Most species will have to respond to habitat changes resulting from warmer temperatures, water availability, floods, warmer streams and lakes, landslides, less snow, food availability, etc. It would be overly speculative to estimate the effects of climate change on each species in this report, however there are two species that are known to be reacting to changes in climate already and they have great potential in negatively affecting tree populations, and thus animal habitats and the rate and severity of local climate change impacts: mountain pine beetle and Swiss needle cast fungus.

Warmer winters are likely to increase the presence of mountain pine beetles in the Cascade Mountain Range. Mountain pine beetle larvae burrow into conifers like ponderosa pine, lodgepole pine, limber pine, and whitebark pine (a candidate for listing under the U.S. Endangered Species Act), inhibiting nutrient and water flow in the trees, often to the point of tree death. Freezing temperatures kill the pine beetles, but fewer freezing days will result in more frequent and greater manifestations.[57]

Swiss needle cast fungus inhibits Douglas fir growth. Warmer winters and autumns and springs with more moisture are likely to increase its presence, threatening the well-being of Douglas firs in the region.[58]

Climate Change Impacts on Human Health

A variety of studies have attempted to qualitatively and quantitatively estimate the effects of climate change to human health. Table 3 summarizes six categories of climate effects, the major health risks associated with them, and the populations vulnerable to these effects.[59]

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[56] ASCE (American Society of Civil Engineers) Oregon Section. (2019). *2019 report card for Oregon's infrastructure*. www.infrastructurereportcard.org/state-item/oregon

[57] Dalton, M., and E. Fleishman (Eds.). (2021). *Fifth Oregon Climate Assessment*.

[58] Bennett, P.I., and J.K. Stone. (2019). Environmental variables associated with Nothophaeocryptopus gaeumannii population structure and Swiss needle cast severity in western Oregon and Washington. *Ecology and Evolution*, 9 (11379–11394).

[59] York, E.A., M.J.F. Braun, G.G. Goldfarb, and J.E. Sifuentes. (2020). *Climate and Health in Oregon: 2020 report*. Oregon Health Authority, Portland, Oregon. www.oregon.gov/oha/ph/HealthyEnvironments/climatechange/Pages/profile-report.aspx.

Table 3: Climate effects, health risks, priority populations, and example actions by the Oregon Health Authority.

Climate effects	Health risks	Priority populations	Example action
Storms, floods, landslides and sea-level rise	Injuries	People dependent on medical equipment that requires electricity	The Oregon Health Authority (OHA) partnered with the Oregon Department of Transportation (ODOT) to conduct a case study on creation of climate resilience on Oregon's North Coast (www.oregon.gov/ODOT/Programs/TDD Documents/Case-Study-Tillamook.pdf). The project interviewed state and local transportation and health leaders and documented lessons learned.
	Toxic exposures	Socially isolated people	
	Displacement	Older adults	
	Disruptions in medical care	Coastal communities	
	Mental health effects	Children	
		Pregnant individuals	
Wildfire	Respiratory diseases	People with pre-existing conditions	The 2019 OHA report *More days with haze: how Oregon is adapting to the public health risks of increasing wildfires* (www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/CLIMATECHANGE/Documents/2020/oha2688_0.2.pdf%22 %5Ct %22_blank) identified ways in which the public health system is adapting to increasingly severe wildfires and opportunities for climate adaptation.
	Cardiovascular diseases	Outdoor workers	
	Cancer	Children	
	Injuries	Pregnant individuals	
	Displacement	Older adults	
	Toxic exposures	Rural communities	
	Mental health effects	Tribal communities	
Infectious disease	Lyme disease	Outdoor workers	In 2016, OHA developed a guidance document for use of weather and environmental data with syndromic surveillance data (www.youtube.com/watch?v= BvTVSNZ2LuI&list=PLd4xfJU3qzMWQlcfWZDGEj1rMncXTUeWV&index=6) for rapid assessment of the correlation between weather factors or air quality measures and health outcomes, including infectious disease.
	West Nile disease	Outdoor recreationalists	
	Fungal diseases	People experiencing homelessness	
	Shigellosis	Tribal communities	
		Rural communities	
Drought and water quality hazards	Mental health effects	Low-income communities	In 2017, OHA partnered with members of the Confederated Tribes of Warm Springs on a digital storytelling project (www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/CLIMATECHANGE/Pages/perspectives.aspx) that documented climate-driven changes in water quality in rivers and water shortages on the reservation. OHA also has assessed water insecurity in Oregon (Schimpf and Cude 2020).
	Dehydration	Tribal communities	
	Toxic exposures	Rural communities	
	Diminished living conditions	Farming and farmworker communities	
		Coastal communities	
Extreme heat	Heat-related illness & death	People with pre-existing conditions	OHA contributed to the State of Oregon's 2020 Natural Hazard Mitigation Plan (www.oregon.gov/lcd/NH/Pages/Mitigation-Planning.aspx). For the first time, the plan includes a chapter on extreme heat. Inclusion makes the state eligible for Federal Emergency Management Agency funding for mitigation actions that reduce identified risks.
	Violence	Outdoor workers	
		Outdoor athletes	
		People without air conditioning or housing	
		Residents of urban heat islands	
		Children	
		Pregnant individuals	
		Low-income communities	
		Communities of color	
Air quality and allergens	Ozone and smog	Low-income communities	In 2018, at the request of the governor's Carbon Policy Office, OHA prepared a policy paper on climate change and public health (www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/CLIMATECHANGE/Documents/2018/2018-OHA-Climate-and-Health-Policy-Paper.pdf) that identifies communities most affected by health risks of climate hazards and pollutants from greenhouse gas emissions.
	Airborne pollen	Communities of color	
	Airborne molds	Communities near highways and industrial facilities	
		Outdoor workers	
		People with pre-existing conditions	
		Farmworker communities	

The Cost of Inaction

Studies point to climate change being a threat multiplier. The frequency and severity of natural events are increased under a climate that is warming and fostering unstable and fluctuating conditions. This is all accompanied by increased costs incurred in response to climate change events. Limiting climate change impacts through GHG emissions mitigation has costs, but these are dwarfed by the costs of inaction, which increase with each year action is not taken.

Various studies have modeled estimated economic damages of climate change impacts. The World Resources Institute summarizes several studies in its *10 Charts Show the Economic Benefits of US Climate Action* (2020). Figure 14 from this summary demonstrates how the damages from climate change and associated recovery costs will increase the longer action is delayed.[60]

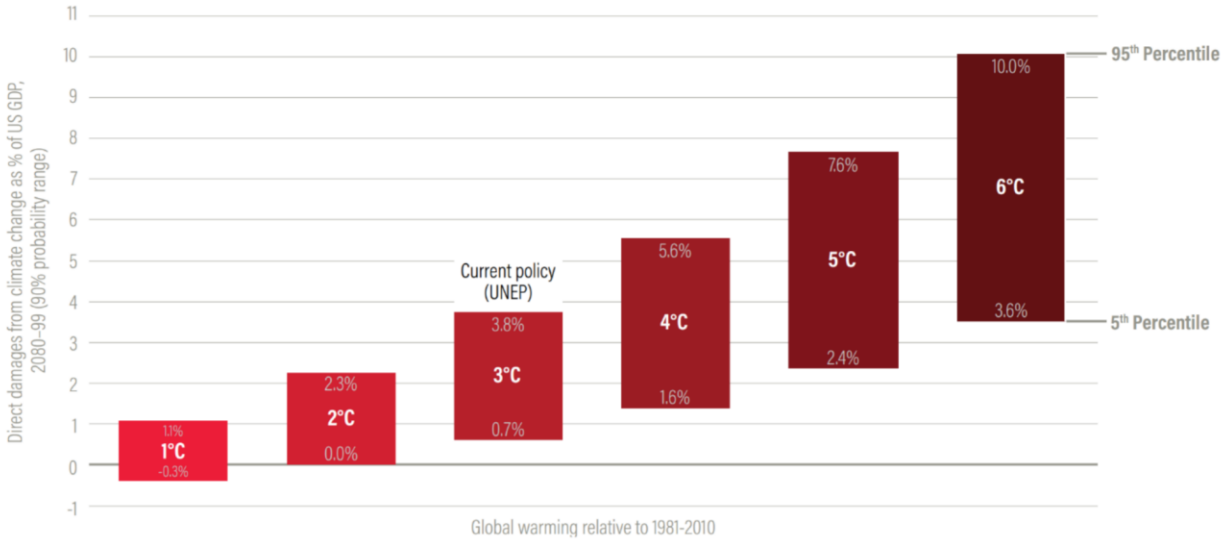

Figure 14: US economic damages at different levels of global warming.

From 1980 to 2020, Oregon experienced 32 natural disaster and storm events whose recovery exceeded $1 billion in costs (Table 4).[61] Twenty-five of these events have occurred in the past 20 years during which time the Earth has experienced its 19 hottest years on record.[62]

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[60] Jaeger, J. & Saha, D. (2020, July 28). *10 charts show the economic benefits of US climate action.* World Resources Institute. https://www.wri.org/blog/2020/07/economic-benefits-climate-action-us

[61] NOAA National Centers for Environmental Information (NCEI). (2021). *U.S. Billion-Dollar Weather and Climate Disasters* (2021). https://www.ncdc.noaa.gov/billions/, DOI: 10.25921/stkw-7w73.

[62] NASA. (n.d.). NASA Global Climate Change, Vital Signs of the Planet. Retrieved Jan. 2021 from: https://climate.nasa.gov/vital-signs/global-temperature.

Table 4: Billion-dollar events to affect Oregon from 1980 to 2020 (CPI-Adjusted).

Disaster Type	Events	Events/year	Percent Frequency	Total Costs	Percent Of Total Costs
Drought	13	0.3	40.6%	$2.0B-$5.0B	34.6%
Flooding	3	0.1	9.4%	$1.0B-$2.0B	15.9%
Freeze	1	0.0	3.1%	$100M-$250M	1.3%
Severe Storm	2	0.0	6.3%	$5M-$100M	1.0%
Wildfire	13	0.3	40.6%	$2.0B-$5.0B	47.1%
All Disasters	32	0.8	100.0	$5.0B-$10.0B	100.0%

The Oregon Global Warming Commission's 2020 Biennial Report includes this summary of recent climate change-exacerbated events and their costs:[63]

> *In Oregon in 2020, an extreme runoff event caused damage to and closed I-84 and flooded homes in the Pendleton area; Governor Brown issued drought declarations for 14 counties from the coast to northeastern Oregon; and in the fall we experienced devastating fires across the state—in which at least nine Oregonians lost their lives and more than 40,000 had to evacuate; more than 4,000 structures and nearly 1.1 million acres were burned with an estimated $354 million in fire-fighting costs. A 2018 Headwaters Economics study found that wildfire suppression costs may account for only 9 percent of the total direct and indirect costs of major wildfires. By all measures the costs to Oregonians are incalculable.*

This is one example from one municipal department. Climate change impacts will elicit such responses from many departments at all levels of government, as well as from businesses, organizations, and institutions. The incalculable costs will be all the more so. The cheapest option is emissions mitigation, even given the investments that must be made in sectors like renewable energy, buildings energy efficiency retrofits, EV infrastructure, etc. These investments are proactive, controllable, and predictable, unlike climate change impact responses will be.

[63] Oregon Global Warming Commission. (2020). *Biennial Report to the Oregon Legislature.* Retrieved from: https://static1.squarespace.com/static/59c554e0f09ca40655ea6eb0/t/5fe137fac70e3835b6e8f58e/1608595458463/2020-OGWC-Biennial-Report-Legislature.pdf.

Part 3: Government Context

National

On January 21, 2020, President Joseph Biden recommitted the United States to the Paris Agreement, which aims "to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels."[64] Under the Obama administration in 2015, the US committed to reduce national emissions 26-28 percent by 2025 from 2005 levels. During his campaign, Biden also promised to implement a "Green New Deal" to ensure the U.S. is carbon neutral and 100% powered by clean energy by 2050.[65] Since assuming office, Biden has brought on a more expansive team of climate change experts than any previous U.S. administration.[66]

On January 27, Biden issued an Executive Order on Tackling the Climate Crisis at Home and Abroad. The order acknowledges calls for an urgent, government-wide approach to the climate crisis; establishes the White House Office of Domestic Climate Policy and a National Climate Task Force; seeks to increase renewable energy production with a goal of doubling offshore wind by 2030; pauses new oil and natural gas leases on public lands or in offshore waters; and calls on the heads of federal agencies to submit Climate Action Plans within 120 days of the order, among other measures.[67]

This represents a significant change from the previous administration, which withdrew from the Paris Agreement in 2017. That administration also weakened key regulations related to climate action, including regulations for GHG emissions from passenger cars and trucks,[68] and the Clean Power Plan, which set targets for cutting greenhouse gas emissions from power plants by 32% below 2005 levels by 2030.[69] In January 2021, a federal court struck down the previous administration's change to the Clean Energy Plan (known as the Affordable Clean Energy rule).[70]

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[64] UNFCC. (n.d.). *The Paris Agreement.* https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.

[65] Biden Harris. (n.d.). *The Biden Plan for A Clean Energy Revolution and Environmental Justice.* Retrieved Jan. 2021 from: https://joebiden.com/climate-plan/.

[66] Friedman, Lisa. (Jan. 21, 2021). "A 'Nerve Center' for Climate in the Biden White House". *The New York Times.* Retrieved from: https://www.nytimes.com/2021/01/19/climate/biden-climate-change.html

[67] The White House. (Jan. 27, 2021). *Executive Order on Tackling the Climate Crisis at Home and Abroad*. Retrieved from: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/.

[68] Environmental Protection Agency. (n.d). *Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks*. Retrieved Jan. 2021 from: https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-passenger-cars-and

[69] Irfan, Umair. (June 19, 2019). "Trump's EPA just replaced Obama's signature climate policy with a much weaker rule". *Vox.* Retrieved from: https://www.vox.com/2019/6/19/18684054/climate-change-clean-power-plan-repeal-affordable-emissions.

[70] Volcovici, Valerie. (Jan. 19, 2021). "U.S. court deals final blow to Trump EPA's clean power rule replacement." *Reuters.* Retrieved from: https://www.reuters.com/article/us-usa-climate-powerplants-idUSKBN29O2BO.

Federal Funding

Various sources of funding and assistance that can support climate action and adaptation at the local level are available through federal agencies. A few are summarized here, and the EPA maintains a comprehensive list for adaptation funding.[71]

Congestion Mitigation and Air Quality Improvement Program

The federal government's Congestion Mitigation and Air Quality (CMAQ) Improvement Program provides over $8.1 billion dollars in funds to State DOTs, MPOs, and transit agencies to invest in projects that reduce emissions from transportation-related sources, focusing on carbon monoxide, ozone, and particulate matter pollution.[72] The supported measures that encourage alternatives to driving alone, decrease congestion, improve traffic flow, and help urban areas meet air quality goals decrease these pollutants. In addition to reducing the regulated emissions, these programs also reduce carbon emissions as an ancillary effect by reducing travel delays, engine idle time, and unproductive fuel consumption.

Environmental Finance Centers

The EPA's Environmental Finance Centers (EFCs) provide technical assistance to states, tribes, local governments, and the private sector related to managing the costs of environmental financing and program management. The Environmental Finance Center at the Rural Community Assistance Corporation headquartered in Sacramento, CA, serves Oregon. It focuses on helping small rural communities and Tribes with developing financial solutions to pay for infrastructure.[73]

Water Infrastructure and Resiliency Finance Center

The EPA's Water Infrastructure and Resiliency Finance Center helps communities make informed decisions for drinking water, wastewater, and stormwater infrastructure to protect human health and the environment.[74] As part of its work, it provides financial technical assistance and tools, and support in securing related federal funding.[75]

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[71] EPA. (n.d.) Federal Funding and Technical Assistance for Climate Adaptation. Retrieved from: https://www.epa.gov/arc-x/federal-funding-and-technical-assistance-climate-adaptation

[72] US Department of Transportation Centre for Climate Change, Federal Programs Directory: Congestion Mitigation and Air Quality (CMAQ) Improvement Program. Retrieved from: https://www.transportation.gov/sustainability/climate/federal-programs-directory-congestion-mitigation-and-air-quality-cmaq

[73] EPA. (n.d.). *Environmental Finance Centers*. Retrieved from: https://www.epa.gov/waterfinancecenter/efcn; RCAC. (n.d.). *Environmental Finance Center.* Retrieved from: https://www.rcac.org/environmental/environmental-finance-center/.

[74] EPA. (n.d.). *About the Water Infrastructure and Resiliency Finance Center.* Retrieved from: https://www.epa.gov/waterfinancecenter/about-water-infrastructure-and-resiliency-finance-center

[75] EPA. (n.d.) *Effective Funding Frameworks for Water Infrastructure.* Retrieved from: https://www.epa.gov/waterfinancecenter/effective-funding-frameworks-water-infrastructure; EPA. (n.d.). *Financial Technical Assistance and Tools for Water Infrastructure.* Retrieved from: https://www.epa.gov/waterfinancecenter/financial-technical-assistance-and-tools-water-infrastructure.

Oregon

The Oregon Legislature first established GHG emission reduction goals in 2007, with the goal of beginning to reduce emissions in 2010, achieving 10% reductions below 1990 levels by 2020, and achieving at least 75% reductions below 1990 levels by 2050.

Despite the previous administration's rollback of environmental regulations, lower levels of the government, including Oregon State, continued to work on climate action plans and set targets in alignment with the Paris goals. For example, Oregon is a member of the United State Climate Alliance, a bipartisan coalition of 25 state governors committed to reducing greenhouse gas emissions in alignment with the Paris Agreement, which was formed in response to the previous federal administration's withdrawal from the Paris Agreement.[76]

In March 2020, the State of Oregon issued Executive Order 20-04, which established a new interim goal of achieving reductions of at least 45% below 1990 levels by 2035 and updated the 2050 goal to achieving reductions of at least 80% below 1990 levels by 2050. The order also places priority on cost-effective actions, helping those more vulnerable to climate change impacts, and environmental justice.

The Executive Order directs state commissions and agencies to take measures to reduce and regulate emissions in alignment with the targets through five general directives. First, it called on them to exercise their authority to help Oregon achieve its emissions reduction goals. Second, it called on agencies to prioritize and expedite procedures that could accelerate emissions reductions. Third, it called on agencies to "consider and integrate climate change, climate change impacts, and the state's GHG emissions reduction goals into their planning, budgets, investments, and policy making decisions." Fourth, it directed 10 agencies[77] with influence over key emissions sectors to report to the governor with proposed actions for reducing emissions and mitigating climate change impacts. Fifth, the order called on a subset of agencies and commissions[78] to participate in an interagency workgroup that would be convened by the Governor's office to develop strategies to guide state climate action.
The Executive Order also included specific directives for key commissions and agencies. Relevant programs and regulations these directives aim to establish include:

- Amendment of Clean Fuel Standards to reduce the average amount of GHG emissions per unit of fuel energy by 25% below 2015 levels by 2035 (directive to Environmental Quality Commission, EQC, and Department of Environmental Quality, DEQ);
- A sector-specific cap-and-reduce program (directive to EQC and DEQ);

[76] United States Climate Alliance. (2019). *2019 Fact Sheet*. Retrieved from: https://static1.squarespace.com/static/5a4cfbfe18b27d4da21c9361/t/5f1f0b2cf13e090f828e58dc/1595869997700/USCA+Fact sheet_Dec+2019.pdf

[77] DEQ, DLCD, ODA, ODOE, ODFW, ODF, ODOT, OWRD, OWEB, and PUC.

[78] DEQ, DLCD, ODF, ODFW, ODOE, ODOT, OHA, OWEB, OWRD, PUC, Environmental Justice Task Force, Oregon Global Warming Commission, Oregon Parks and Recreation Department, and Oregon Sustainability Board.

- Regulation of landfill methane emissions (directive to EQC and DEQ);
- Reduction of food waste by 50% by 2030 (directive to EQC and DEQ);
- Measures to rapidly reduce GHG emissions from the grid, including transitioning to clean energy resources and expanding low-transportation choices (directive to Public Utility Commission of Oregon, PUC);
- 2030 energy efficiency goals and code updates for residential and commercial construction to reduce new building annual site consumption of electricity by at least 60% (directive to Department of Consumer and Business Services Building Codes Division); and
- Updated energy efficiency standards for products and appliances in alignment with the most stringent West Coast jurisdictions (directive to Oregon Department of Energy).

Additionally, the executive order directed the Oregon Global Warming Commission to submit a proposal to the governor with recommendations for carbon sequestration and storage goals for the state by June 30, 2021.

The state commissions and agencies subject to the executive order include:

- Business Oregon;
- Department of Administrative Services (DAS);
- Department of Consumer and Business Services Building Codes Division (BCD);
- Department of Land Conservation and Development (DLCD) and Land Conservation and Development Commission (LCDC);
- Environmental Justice Task Force;
- Environmental Quality Commission (EQC) and Department of Environmental Quality (DEQ);
- Oregon Department of Agriculture (ODA);
- Oregon Department of Energy (ODEO);
- Oregon Department of Fish and Wildlife (ODFW);
- Oregon Department of Forestry (ODF);
- Oregon Department of Transportation (ODOT) and Oregon Transportation Commission (OTC);
- Oregon Global Warming Commission;
- Oregon Health Authority (OHA);
- Oregon Water Resources Department (OWRD);
- Oregon Watershed Enhancement Board (OWEB); and
- Public Utility Commission or Oregon (PUC).

Oregon Global Warming Commission

Created in 2007 by the Oregon Legislature, the Oregon Global Warming Commission tracks trends in local greenhouse gas emissions, recommends ways to coordinate state and local efforts to reduce emissions, and works to prepare communities for the effects of climate change. The Commission is

composed of 11 members appointed by the Governor, while the Oregon Department of Energy Provides Staff Support.[79] The Commission submits a biennial report to the legislature.[80]

Its 2020 report found that Oregon is not on track to meet its emissions reduction goals. Preliminary 2019 data indicate emissions exceed the 2020 reduction goal by 26%, and that Oregon is not on track to meet the 2035 or 2050 goals from Executive Order 20-04. The report recommends the "Legislature fully fund the needed rulemaking and agency work plans called for in EO 20-04", along with 36 additional actions. If implemented, the recommended actions would have a significant impact on climate action in Clackamas County. The recommended actions include calling on all state agencies to adopt a climate equity framework and consider climate mitigation and adaptation in all decision-making; requiring all local jurisdictions with populations over 10,000 to create Climate Action Plans and providing them with funding and technical assistance to do so; directing all state agencies to use the Social Cost of Carbon as a metric to evaluate public investment decisions; passing legislation to authorize utilities to increase investments in EV infrastructure; allow cities and counties to adopt the state Reach Code as the mandatory base code for all buildings; and more.[81]

Oregon Renewable Energy Standard and Senate Bill 1547

In March 2016, the Legislature passed Senate Bill 1547, which called for the elimination of coal-fired power (which provided about a third of Oregon's electricity at the time) by 2030 and increased its Renewable Portfolio Standard requirement to 50% renewables by 2040.[82]

Oregon Climate Change Adaptation Framework (2021)

The Oregon Department of Land Conservation and Development recently updated Oregon's 2010 Climate Adaptation Framework, which provides a framework for state agencies to respond to the impacts of climate change. The Framework focuses on increasing resilience and adapting to climate risks with respect to six themes: the economy, natural ecosystems, built environment and infrastructure, public health, cultural heritage, and social systems and relationships. In addition, a Climate Change Equity Blueprint was developed alongside the Framework to provide guidance for state agencies on incorporating principles of equity, diversity, and inclusion into climate change planning and adaptation.[83]

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[79] Oregon Global Warming Commission. (n.d.). "About Us". Retrieved Jan. 2021 from: https://www.keeporegoncool.org/about-the-commission.

[80] Oregon Global Warming Commission. (n.d.). "Oregon Global Warming Commision Reports". Retrieved Jan. 2021 from: https://www.keeporegoncool.org/reports

[81] Oregon Global Warming Commission. (2020). *Biennial Report to the Oregon Legislature.*

[82] State of Oregon. (n.d.). *Energy and Climate Change.* Retrieved Jan. 2021 from: https://www.oregon.gov/gov/policy/Pages/energy_climatechange.aspx

[83] Department of Land Conservation and Development. (2021). *2021 State Agency Climate Change Adaptation Framework.* State of Oregon. Retrieved from: https://www.oregon.gov/lcd/CL/Documents/2021_Climate_Change_Adaptation_Framework_with_Blueprint.pdf.

Climate Justice

A number of groups have a mandate to consider environmental issues, including climate impacts, from an equity perspective as part of a statewide effort focused on environmental justice. In 2010, Oregon established the Environmental Justice Task Force to advise the state government on environmental justice issues. In addition, Governor Kate Brown created the Racial Justice Council in July 2020 to reform state programs and policies. Third, Executive Order 20-04 established the Interagency Workgroup on Climate Impacts to Impacted Communities (IWCIIC) to guide state climate actions through an equity lens. Fourth, the Oregon Global Warming Commission and the Oregon Sustainability Board, which oversees sustainability plans and initiatives, both examine policies from the perspective of equity. Finally, the Department of Land Conservation and Development and the Oregon Department of Transportation are making rules to implement elements of Executive Order 20-04 with a focus on ensuring benefits to historically marginalized populations.[84]

Clackamas County

Clackamas County has acknowledged the need to take steps towards greenhouse gas mitigation since 2008, when it adopted the U.S. Cool Counties Climate Stabilization Declaration and a resolution on climate change. That same year, the County appointed the Sustainable Clackamas County Task Force to develop a three- to five-year sustainability action plan. The Task Force created the Action Plan for a Sustainable Clackamas County, which set a goal for the County to become carbon neutral and reduce its GHG emissions by 80% by 2050.

In 2017, the Board reaffirmed the County's climate goals. County staff developed a greenhouse gas emissions inventory for County operations and began exploring ways to reduce their GHG impact (e.g. fleet electrification, renewable electricity, High Performance Building Policy, etc.).[85] In 2018, the Board directed staff to develop an updated countywide climate action plan. In 2019, it set a goal to adopt a climate action plan (CAP) by January 2022, which was extended to 2023 in recognition of the delays created by COVID-19, historic wildfires in 2020, and an ice storm in 2021.[86] The County has also prepared a community greenhouse gas inventory with 2018 as the baseline year.[87]

In addition, in 2018, the County formed the Clackamas County Climate Exchange, which brings staff from across County departments together every month to support the development of the climate action plan and coordinate climate action. Six departments participate in the Climate Exchange: Transportation Development; Water Environment Services; Health, Housing and Human Services;

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[84] Ibid.

[85] Clackamas County Board of County Commissioners. (Sept. 4, 2019). *Policy Session Worksheet.* Retrieved from: https://dochub.clackamas.us/documents/drupal/5278a5d8-ed56-494e-9d74-8af990c6b2b0

[86] Clackamas County. (n.d.). *A Timeline of Climate Action By the Board*. Retrieved Jan. 2021 from: https://www.clackamas.us/sustainability/climateaction#timeline.

[87] Clackamas County Board of Commissioners. (June 9, 2020). *Policy Session Worksheet.* Retrieved from: https://www.clackamas.us/meetings/bcc/presentation/2020-06-09-0.

Disaster Management; Business and Community Services; and Public and Government Affairs. This body has the potential to track and implement the CAP, as well as to engage the support for it.[88]

In 2019, the County formed the Climate Exchange Steering Committee, which is made up of a small, focused group of Climate Exchange members to provide direction and produce work to support the CAP. The group worked with the Institute for Sustainable Solutions to define the scope of work for the CAP. This group is responsible for managing the creation and implementation of the CAP.[89]

Climate Action in the Portland Metropolitan Region

Jurisdictions within Clackamas County are also contributing to regional climate action. In 2014, the Oregon Metro Council adopted the Climate Smart Strategy with the aim of reducing per capita greenhouse gas emissions from cars and light trucks by at least 20% by 2035. The actions in the strategy focus on land use and transportation. Key policies include improving transit accessibility, frequency, affordability, and convenience; making biking and walking safe and convenient; and supporting a transition to cleaner, low-carbon fuels and more fuel-efficiency vehicles.[90]

Portland also adopted a joint Climate Action Plan with Multnomah County in 2015. The plan aims to reduce emissions by 80% relative to 1990 levels by 2050. According to a progress report, most of the actions in the plan were on track to be completed by 2020; however, declines in GHG emissions had plateaued and transportation emissions had increased.[91]

Policy Mechanisms Available to Clackamas County

Clackamas County has power over a variety of policy mechanisms that shape regional emissions. These mechanisms differ within the County based on whether a locality is an incorporated city or an unincorporated community, and whether it falls within Oregon Metro, the regional government for the Portland Metropolitan Area. Oregon Metro manages land use, transportation planning, green space, and solid waste and recycling in the cities and communities within its boundaries.[92]

There are 16 cities within Clackamas County. Eleven of these (Gladstone, Happy Valley, Johnson City, Lake Oswego, Milwaukie, Oregon City, Portland, Rivergrove, Tualatin, West Linn, and Wilsonville) fall

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[88] Allison, Sarah. Clackamas County. Oct. 30, 2020. *Summary of Pre-Contract Work.*

[89] Ibid.

[90] Oregon Metro. (May 29, 2015). Climate Smart Strategy. Retrieved from: https://www.oregonmetro.gov/climate-smart-strategy.

[91] Multnomah County and City of Portland. (2015). Final Progress Report: Climate Action Plan. City of Portland. Retrieved from: https://www.portland.gov/sites/default/files/2020-06/2015-climate-action-plan-final-progress-report-single-pages-v8.pdf.

[92] Oregon Metro. (n.d.). *What is Metro?*. Retrieved Jan. 2021 from: https://www.oregonmetro.gov/regional-leadership/what-metro.

within Oregon Metro.[93] Unincorporated communities "are settlements located outside urban growth boundaries in which concentrated residential development is combined with limited commercial, industrial, and public uses."[94]

Many aspects of climate action fall under the jurisdiction of the Clackamas County Department of Transportation & Development (DTD), which is responsible for transportation engineering and maintenance, planning and zoning, building codes, the county surveyor, urban renewal and some economic development activities (via the Development Agency), code enforcement, dog services, and sustainability and solid waste.[95]

Performance Clackamas (2014)

Performance Clackamas, the County's strategic plan, was established in 2014 with 28 strategic goals that fell under five strategic priorities:

1. Building public trust through good government;
2. Grow a vibrant economy;
3. Build a strong infrastructure;
4. Ensure safe, healthy and secure communities; and
5. Honor, utilize, promote and invest in our natural resources.

Performance Clackamas' 2020 update identified the creation of a CAP with specific recommendations to reach carbon neutrality by 2050 as a key action for the fifth strategic priority. Moving forward, it also called for the application of four lenses to County decision-making, including (1) Equity, Diversity, and Inclusion; (2) Carbon Neutrality; (3) Healthy and Active Lifestyle; and (4) Family Stability. In addition, the update identified four key initiatives on which the County would provide leadership and develop policies and partnerships. These included growing the mass timber industry and the Pollination Policy Initiative.[96] County Commissioners have made the preservation of pollinators a priority, noting they are a critical part of the region's agricultural industry.[97]

Clackamas County Comprehensive Plan

The Clackamas County Comprehensive Plan guides the development, growth, and land use in Clackamas County. The plan divides land into six land-use categories: urban, urban reserve, unincorporated communities, rural, agriculture, and forest. It includes guidance focused on densification and infill, and minimizing the expansion of urban boundaries.[98]

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[93] Clackamas County. (n.d.). *About Clackamas County.* Retrieved Jan. 2021 from: https://www.clackamas.us/pga/about.html.

[94] Clackamas County Comprehensive Plan. Chapter 4: LAND USE. (Last amended Oct. 2020). Retrieved from: https://dochub.clackamas.us/documents/drupal/7f7f1fb5-e923-4cd1-94bb-e5b473082b70

[95] Clackamas County. (n.d.). *Transportation and Development.* Retrieved Jan. 2021 from: https://www.clackamas.us/transportation

[96] Clackamas County. (Jan. 2020). *Performance Clackamas: Clackamas County Strategic Plan, January 2020 Update.* Retrieved from: https://dochub.clackamas.us/documents/drupal/f4718e32-d394-42c2-b8a0-9c5a5f6a4b66.

[97] Clackamas County. (Feb. 3, 2020). *Commissioners affirm importance of pollinators* [press release]. *Retrieved from:* https://www.clackamas.us/news/2020-02-03/commissioners-affirm-importance-of-pollinators.

[98] Clackamas County Comprehensive Plan. Chapter 4: LAND USE. (Last amended Oct. 2020).

Zoning and Land Use

The Clackamas County Department of Transportation and Development's Planning and Zoning Division administers state, regional and local land use and zoning regulations in unincorporated areas. The Clackamas County Zoning and Development Ordinance (ZDO) guides land use in unincorporated Clackamas County.[99] Its purpose is to implement the goals and policies of the Comprehensive Plan.[100]

Metro manages the boundary separating urban land from rural land in the Portland Metropolitan region, while incorporated cities manage land use within their jurisdictions.

Transportation Plans

Clackamas County's Transportation System Plan (TSP), which is part of the Comprehensive Plan, was adopted by the board in December 2013 and is designed to guide the development of transportation in unincorporated Clackamas County until 2023. An Active Transportation Plan was added to the TSP in 2015 and aims to improve the accessibility and quality of active transport, including walking, cycling, and horseback riding.[101] The plan sets out six goals, including a goal to "provide a transportation system that optimizes benefits to the environment, the economy and the community."[102] Metro and incorporated cities manage transportation planning within their jurisdictions in coordination with the County.

Transit Plan

Transit frequency, access, and connectivity vary across the County and there are large areas without access to transit service. Clackamas County has seven transit providers, which are detailed in Figure 15 below. In 2020, the Department of Transportation & Development worked with the community, transit providers, and partners to evaluate the existing system and create a Transit Development Plan to guide future transit development with a vision for a connected and coordinated transit service. The plan applies to the TriMet service area, which includes most county cities, and unincorporated areas indicated in grey in Figure 15. The plan was approved by the Board of County Commissioners in April 2021.[103]

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[99] Clackamas County. (n.d.) *Zoning and Development Ordinance.* Retrieved Jan. 2021 from: https://www.clackamas.us/planning/zdo.html.

[100] Clackamas County Zoning and Development Ordinance. Section 100. (2018). https://dochub.clackamas.us/documents/drupal/90d4badf-e934-449e-9c53-8abf0977aec1

[101] Clackamas County. (n.d.). *Transportation System Plan*. Retrieved Jan. 2020 from: https://www.clackamas.us/transportation/tsp.html

[102] Clackamas County Comprehensive Plan. Chapter 5: TRANSPORTATION SYSTEM PLAN. (Last amended Jan. 2017). Retrieved from: https://dochub.clackamas.us/documents/drupal/4f347d01-968b-47c4-ae92-7eaac0776a0f

[103] Clackamas County. (n.d.). *Clackamas County Transit Development Plan*. Retrieved Jun. 2021 from: https://www.clackamas.us/planning/transit; Clackamas County. (2020). *Help Clackamas County Plan Better Transit Service*. Retrieved Jan. 2021 from: https://dochub.clackamas.us/documents/drupal/a424faea-1fdd-4032-81e4-3cd3a955d0cc.

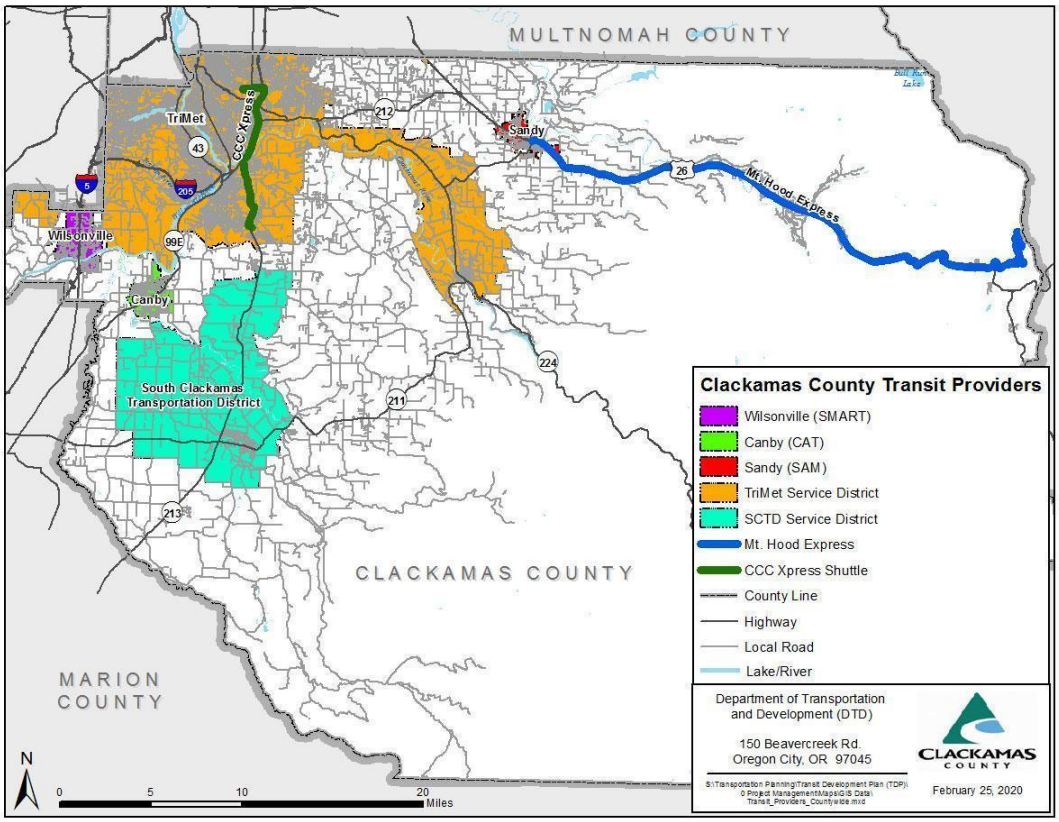

Figure 15. Map of transit provision in Clackamas County. [104]

In Closing

Clackamas County faces a variety of challenges related to climate change, including significant wildfire and flood risks, impacts to human health and ecosystems, and significant severe weather event recovery costs. At the same time, with its commitment to equity and sustainability, growing population, and institutional support, Clackamas County is well-positioned to address climate change challenges, in part through the development and implementation of a climate action plan to achieve its commitment of carbon neutrality by 2050. The CAP can integrate key state and county policies to create a vision that is aligned with Performance Clackamas' strategic priorities of growing a vibrant economy; building strong infrastructure; ensuring safe, healthy, and secure communities; and honoring, utilizing, promoting, and investing in natural resources.

[104] Clackamas County. (n.d.). *Clackamas County Transit Development Plan*.