Southern Oregon Climate Action Now

SOCAN

Confronting Climate Change

Climate Change in the Oregon 2nd Congressional District

Compiled by Tracey Brandt & Alan Journet

(tracey.e.brandt@gmail.com)

(alanjournet@gmail.com, 541-301-4107)

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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 the Pacific Northwest (Figure 4) suggest a similar range of temperature increases are possible, reaching – as an average – nearly a 12°F increase by the end of the century under the business as usual scenario.

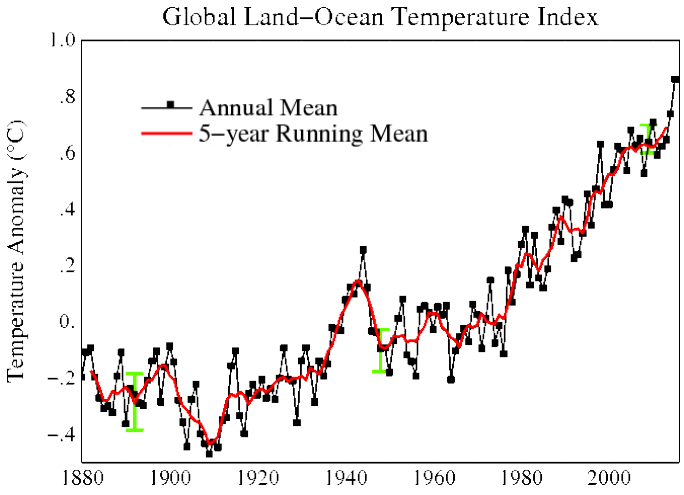

Figure 1. Historic global temperature trend. http://data.giss.nasa.gov/gistemp/graphs_v3/Fig.A2.gif

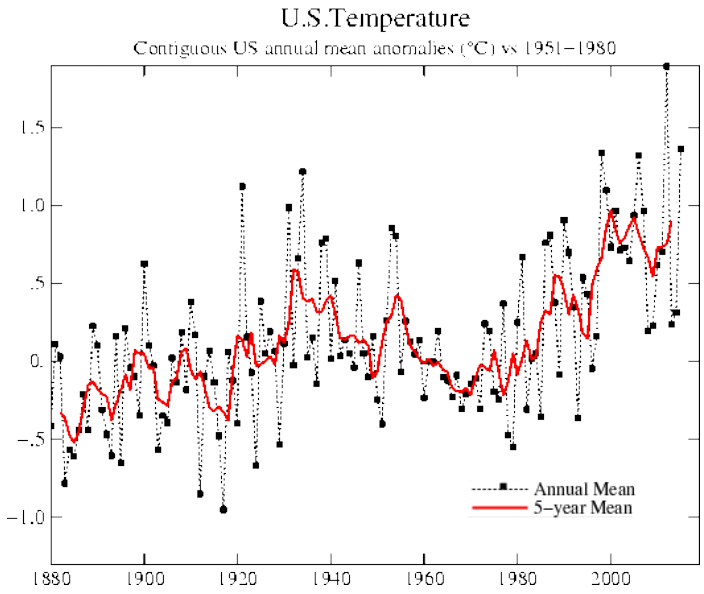

Figure 2. Historic U.S temperature trend. http://data.giss.nasa.gov/gistemp/graphs_v3/Fig.D.gif

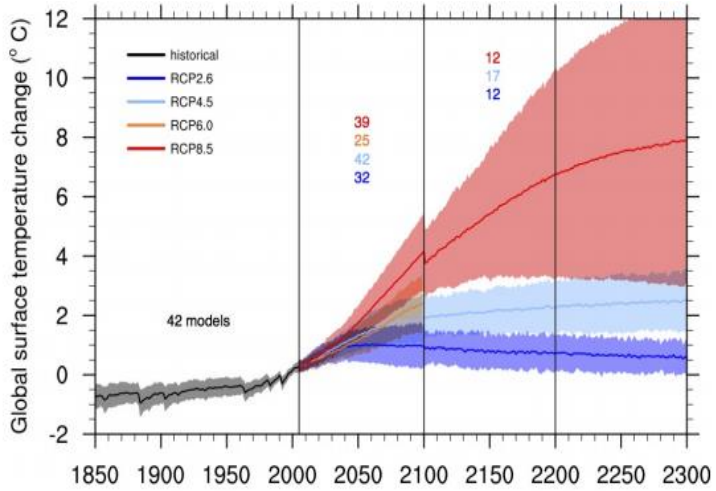

Figure 3. Intergovernmental Panel on Climate Change 2013 global projections.
http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_Chapter12.pdf

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.

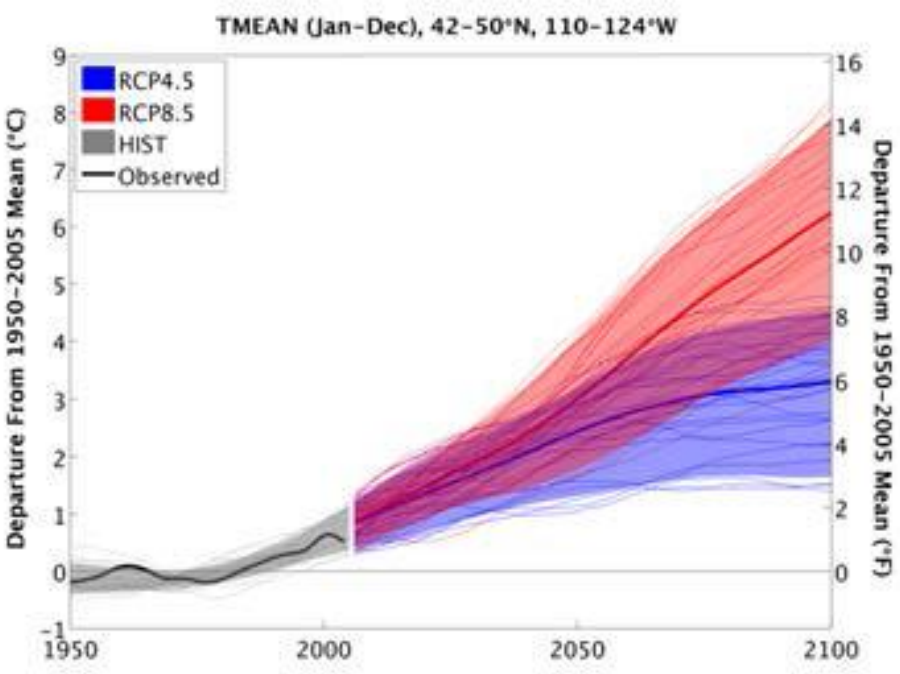

Figure 4. Pacific Northwest temperature history and projections through the century (Dalton *et al*. 2013).
http://library.state.or.us/repository/2010/201012011104133/summaries.pdf

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.

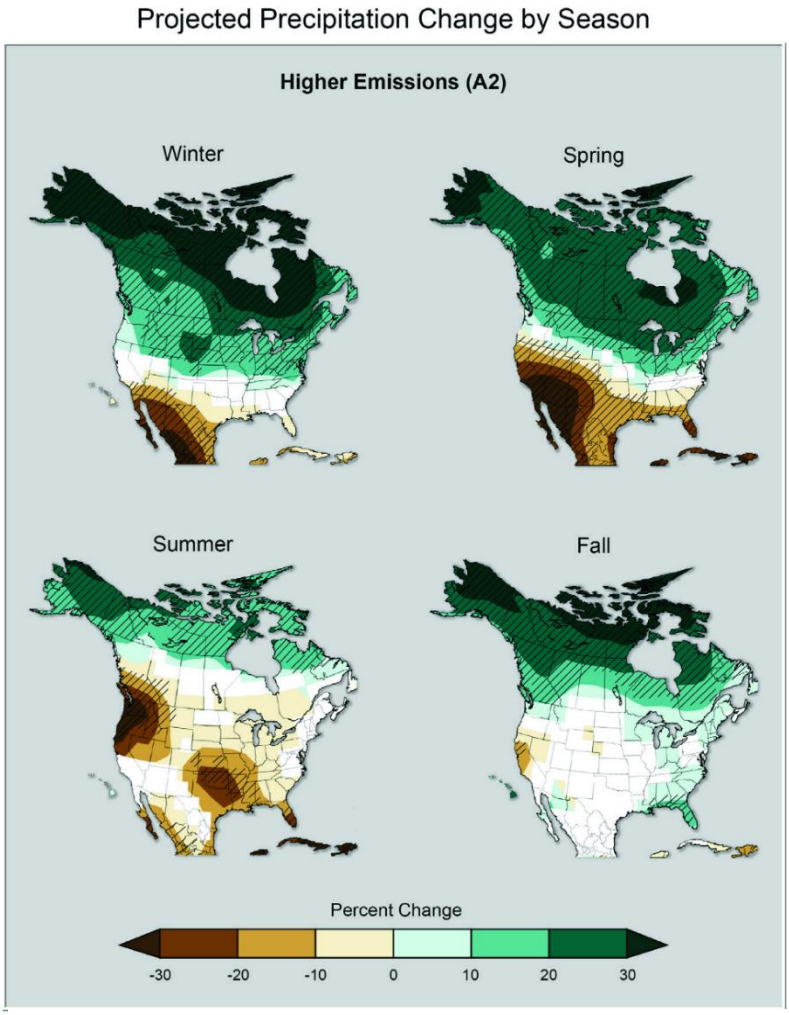

Figure 5. Projected precipitation patterns in the U.S. comparing 2071 – 2099 to the 1900 – 1960 average (Melillo *et al.* 2014). http://www.globalchange.gov/what-we-do/assessment

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 normal trends.

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.

Wildfire

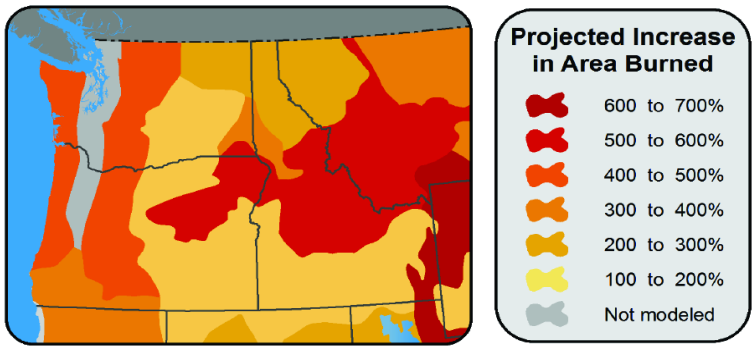

Figure 6. Anticipated wildfire consequences of a 2.2^{0}F warming in area burned (Melillo *et al.* 2014). http://www.globalchange.gov/what-we-do/assessment

Melillo *et al.* (2013) 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 2.5 months since 1970 (Westerling *et al.* 2006), will likely become longer and more severe in Oregon, with three to seven times as many acres burned. Both human safety and human health will likely be threatened.

The 2nd Oregon Congressional District Climate History and Projections

Climate models can specifically project future temperature and precipitation trends that Oregon's 2nd 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. The following figures (Figure 7 through Figure 10) 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 7) 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^{o}F above the 1950-2005 average with average high temperatures reaching around 64^{o}F by late century. The business as usual scenario (red) projects a rise in temperature of 10.1^{o}F, with annual average highs of nearly 70^{o}F at the end of the century. Congressional District 2, an inland region, will experience greater severity of temperature rise (the eastern tier of counties, for example, rising 11^{o}F to reach an average max from 66^o - North to 72.2^{o}F South) clearly reaching far higher temperatures than the more moderate coastal areas. 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.

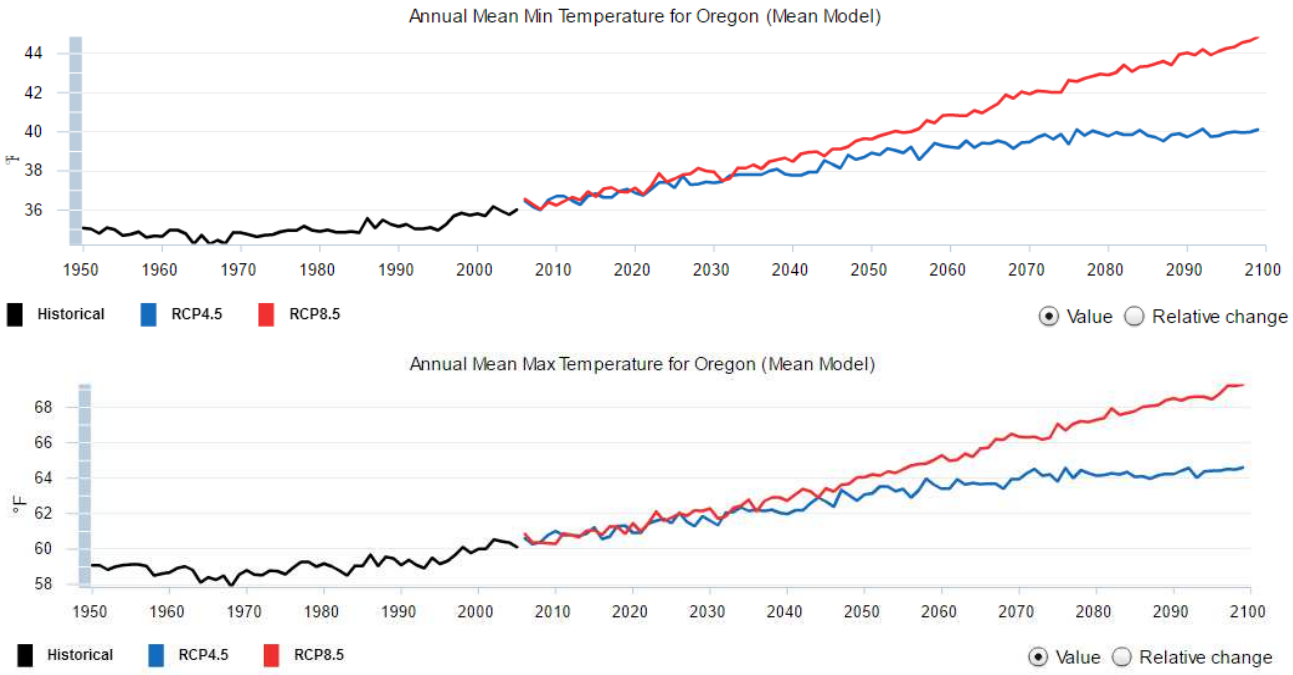

Figure 7. Annual Average Minimum & Maximum Temperature Trends and Projections for Oregon. http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

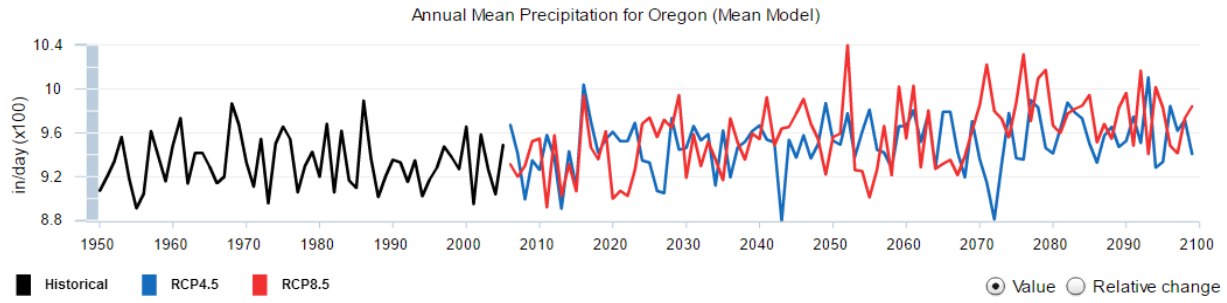

Figure 8. **A**nnual Trends and Projections for Oregon. http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Climate change models project that the Pacific Northwest region will not experience much, if any change in total annual precipitation (Figure 8). However, important seasonal changes are expected. Summers are anticipated to become dryer, while winters become wetter (Figure 9). Congressional District 2 is accustomed to dry summers and wet winters, but, when coupled with higher temperatures, the region is likely to experience more drought and an increase in wildfire severity. Additionally, the effect on winter snowpack could potentially be devastating.

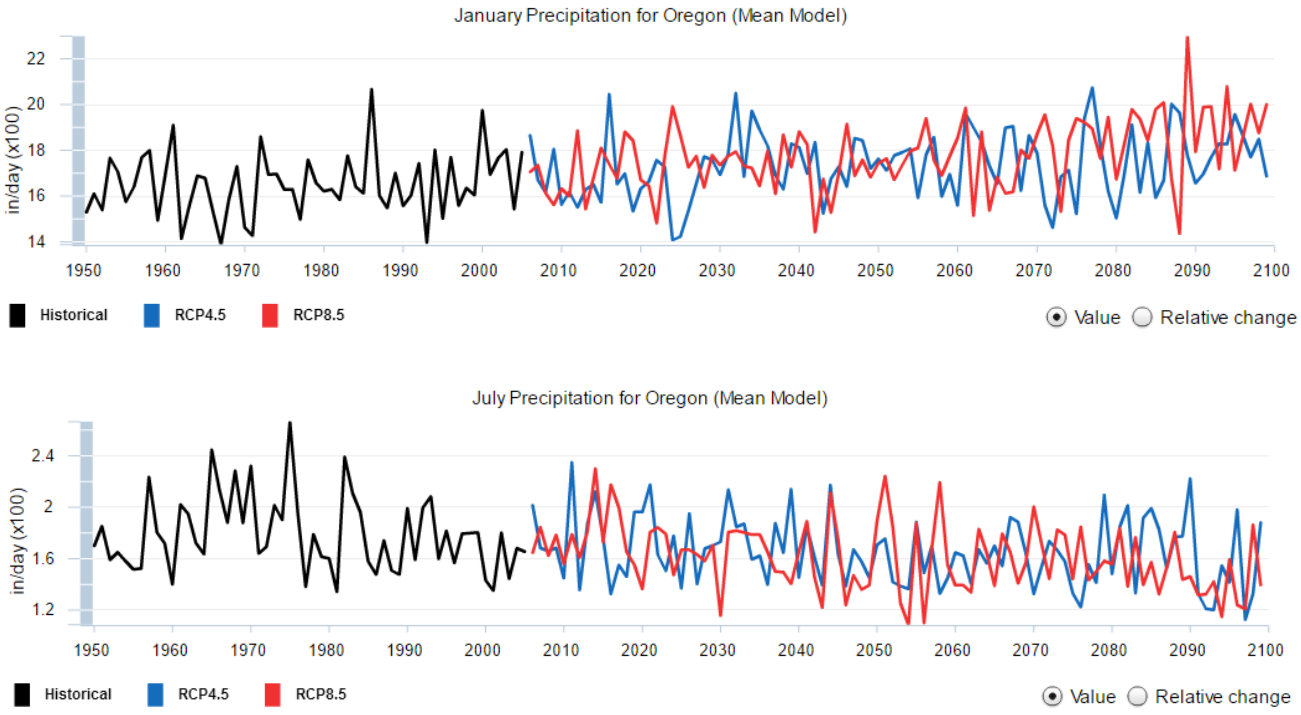

Figure 9. January & July Precipitation Trends and Projections for Oregon.
http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Figure 10, depicting the predicted change in annual snowfall (using the RCP8.5 model), shows that mountainous regions will see considerably less snowfall and resulting snowpack. The cumulative annual drop in snowpack, averaged across all of Oregon, is expected to be by 80 – 90%.

Natural ecosystems and Oregon residents will have to adjust to the coming temperature and precipitation trends. Wetlands and lower order streams are vulnerable to drying up; groundwater will decline; and aquatic species, such as native fish, will have to contend with lower stream flow and potentially a lethal increase in water temperatures. Agriculture is taking a hit from the reduced snowpack in the form of less available irrigation water when it is most needed. Cities that have historically relied on snow melt to fill reservoirs throughout

the summer are seeking new water sources to meet human consumption needs. Recreational water activities are hampered by falling reservoir and stream levels, and the winter recreation season is shortening. By choosing to change our carbon emissions habits, we can make the coming changes less drastic.

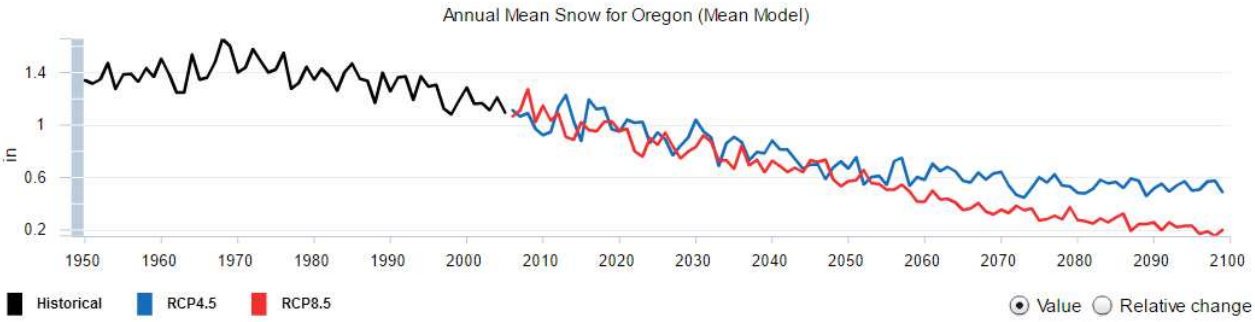

Figure 10. Annual Snowfall Trends and Projections for Oregon.
http://www.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

Oregon 2nd Congressional District Economy

Oregon's 2nd Congressional District is home to a suite of natural resources, and its economy reflects that. The economy is based in large part around forestry, agriculture and livestock, and tourism and recreation. Additionally, the healthcare industry is a large employer in the region, as parts of Oregon's 2nd Congressional District have experienced a boom in their retiree population as older folks have flocked from California and other parts of the nation to enjoy their "golden years."

Maximum annual Temperature projections for counties in Congressional District 2 are presented in Table 1 which show a clear trend from about a 10°F in the western counties to about 11°F in eastern counties.

Table 1 Temperature Projections in Congressional District 2	
County	***Average Max Temperature and (increase) by 2100***
Hood River	63.5°F (9.8°F)
Wasco	69.4°F (10.2°F)
Sherman	71.3°F (10.2°F)
Gilliam	71.8°F (10.5°F)
Morrow	71°F (10.5°F)
Umatilla	70°F (10.6°F)
Union	65.8°F (10.9°F)
Wallowa	66.0°F (10.9°F)
Jefferson	69.6°F (10.2°F)
Deschutes	67.3°F (10.3°F)
Crook	68.7°F (10.6°F)
Wheeler	69.0°F (10.5°F)
Grant	67.1°F (10.8°F)
Baker	67.4°F (11.2°F)
Josephine	70.7°F (9.0°F)
Jackson	70.7°F (9.6°F)
Klamath	67.5°F (10.3°F)
Lake	69.1°F (10.8°F)
Harney	70.2°F (10.8°F)
Malheur	72.2°F (11.4°F)

Forestry

Like all natural systems, 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.

The most important commercial tree species in the 2nd Congressional District are Douglas fir and Ponderosa pine. Other important species grown in the region include Lodgepole pine and Grand fir. Their current distributions, and the location of appropriarte climate conditions through the century have been analyzed at the USDA Forest Service Labs in Moscow Idaho. Projections for several tree species are presented below in Figure 11 through 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 these species will be considerably less widespread than currently is the case. 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.

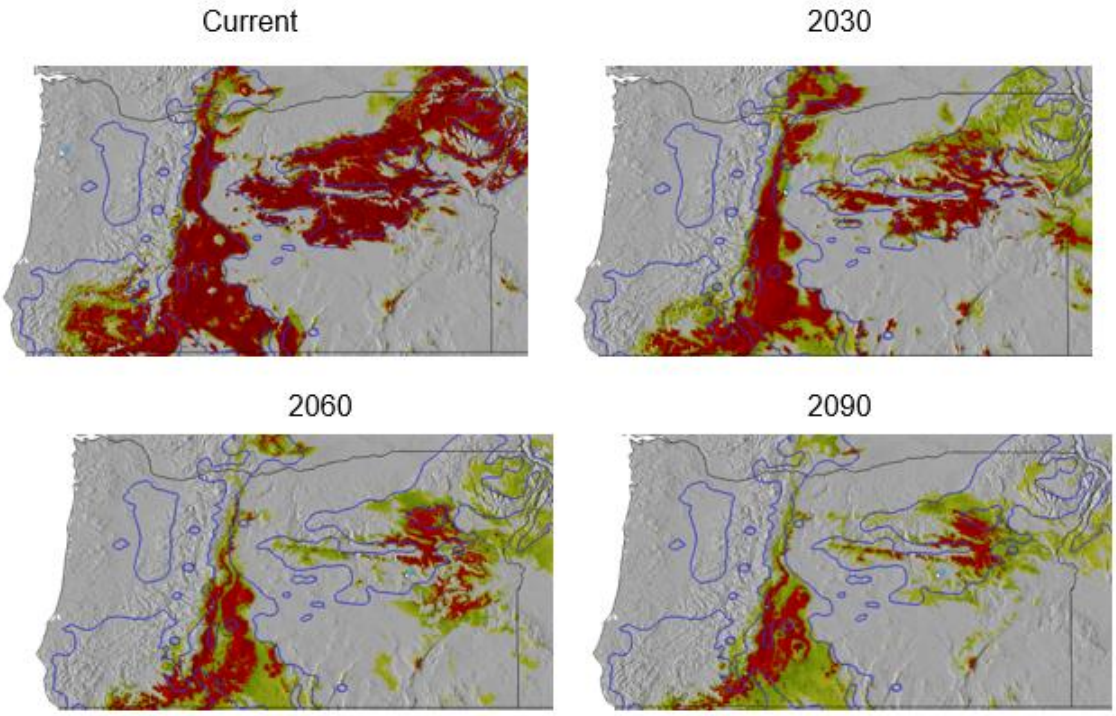

Figure 11. Ponderosa pine (*Pinus ponderosa*) current and projected distribution. http://forest.moscowfsl.wsu.edu/climate/species/index.php

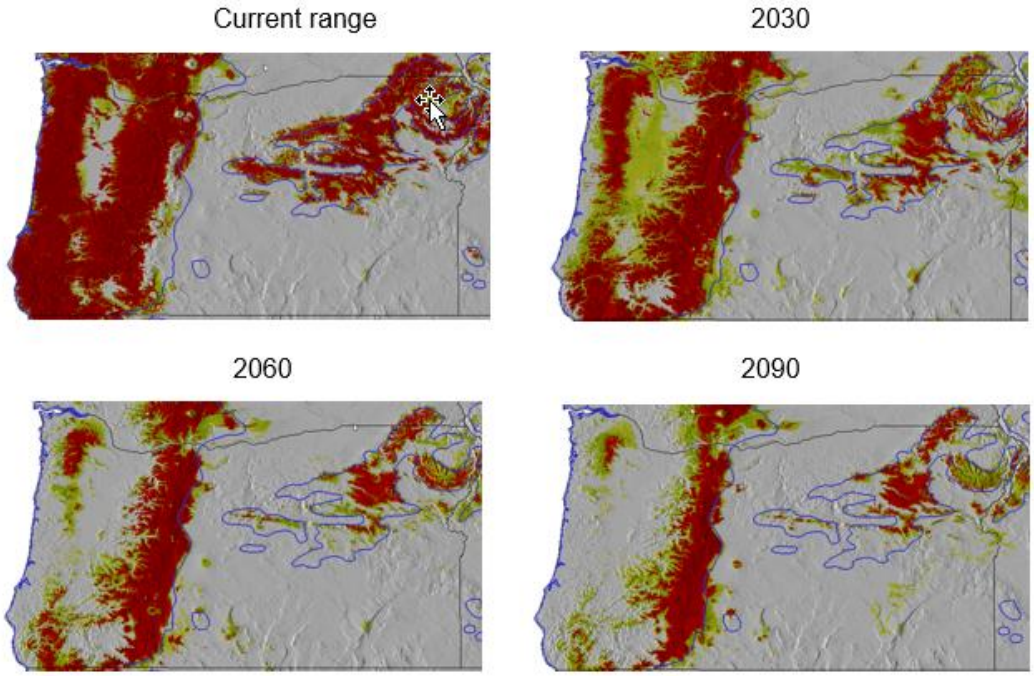

Figure 12. Douglas fir (*Psuedotsuga menzeisii*) current and projected distribution. http://forest.moscowfsl.wsu.edu/climate/species/index.php

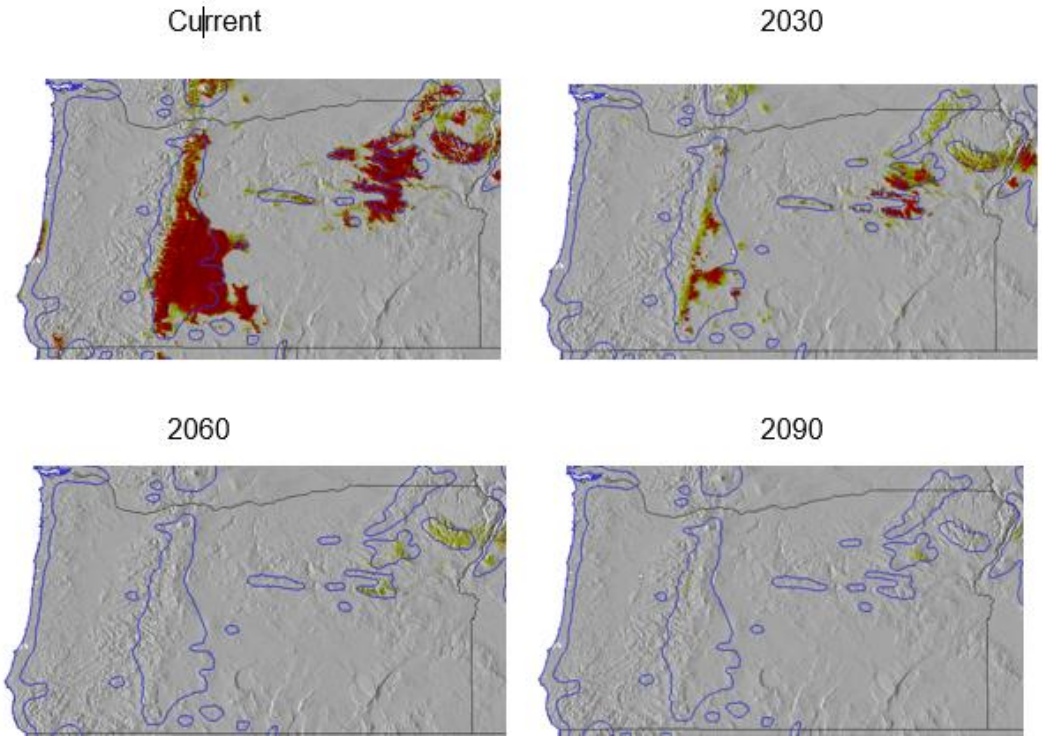

Figure 13 Lodgepole pine (*Pinus contorta*) current and projected distributions
http://forest.moscowfsl.wsu.edu/climate/species/index.php

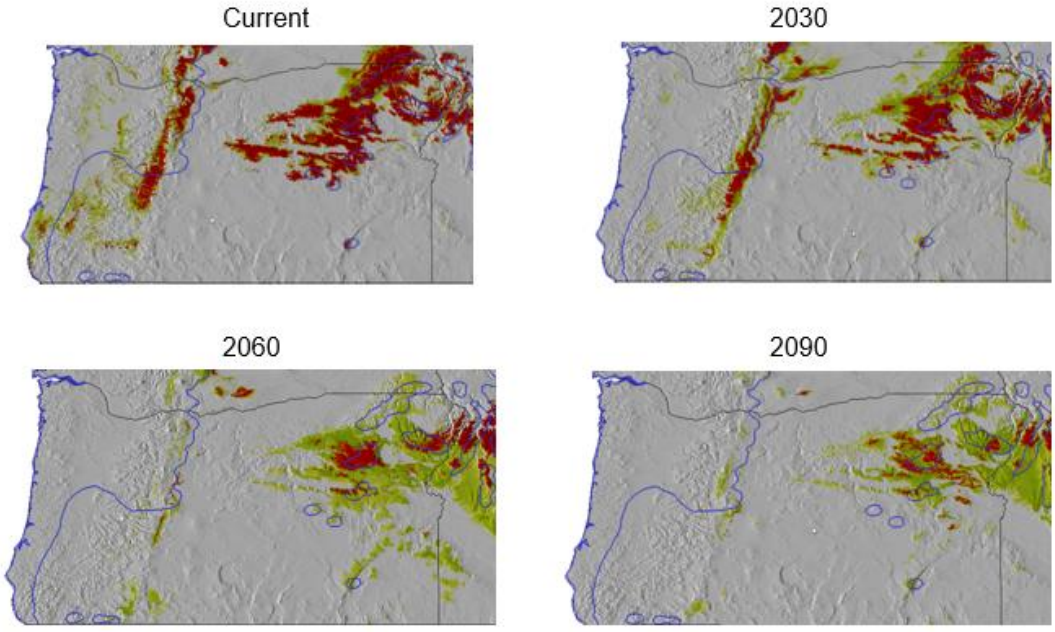

Figure 14 Grand fir (*Abies grandis*) Current and Projected Distributions
http://forest.moscowfsl.wsu.edu/climate/species/index.php

Agriculture and Livestock

Agriculture and livestock production are likely to be negatively affected by climate change. Because climate change, as discussed earlier, is expected to increase temperatures in the region over the next century, lengthen the summer drought period, and reduce winter snowpack and the winter chill period, it will likely become increasingly difficult for farmers to grow certain crops, while yields will inevitably decrease. Some orchard crops, such as pears, require a lengthy winter chill period in order for them to thrive. Furthermore, many crops grow in a restricted temperature range, and increasing temperatures may make Oregon's 2nd Congressional District a less favorable place for these crops over the century. Irrigation is largely what makes livestock and hay production possible in this region of Oregon, and an increasing summer drought period will likely result in even scarcer summer water in the coming decades

Wine

The predominant wine varietals in this area are Pinot Gris, Syrah, Merlot, Cabernet Sauvignon, Pinot Noir, and Chardonnay. Figure 15 depicts the growing season optimal temperatures for varietals grown in the region. Color overlays, inserted by Alan Journet, indicate specific temperature ranges predicted with RCP8.5 for the Rogue Basin, a popular area for wineries within Congressional District 2. Historic temperatures are indicated in blue, while red highlights projected temperatures from 2035-2045, and purple highlights temperatures projected for 2075-2085. While many of the grape varietals grown in this area seem reasonably well-adapted to mid-century growing season temperatures, even some of the warm climate varietals could be compromised by late century. However, of particular note are the cooler growing season varietals of the region (especially Illinois Valley wines) such as Pinot gris, and Gewürtstraminer, which could be severely compromised even by mid-century.

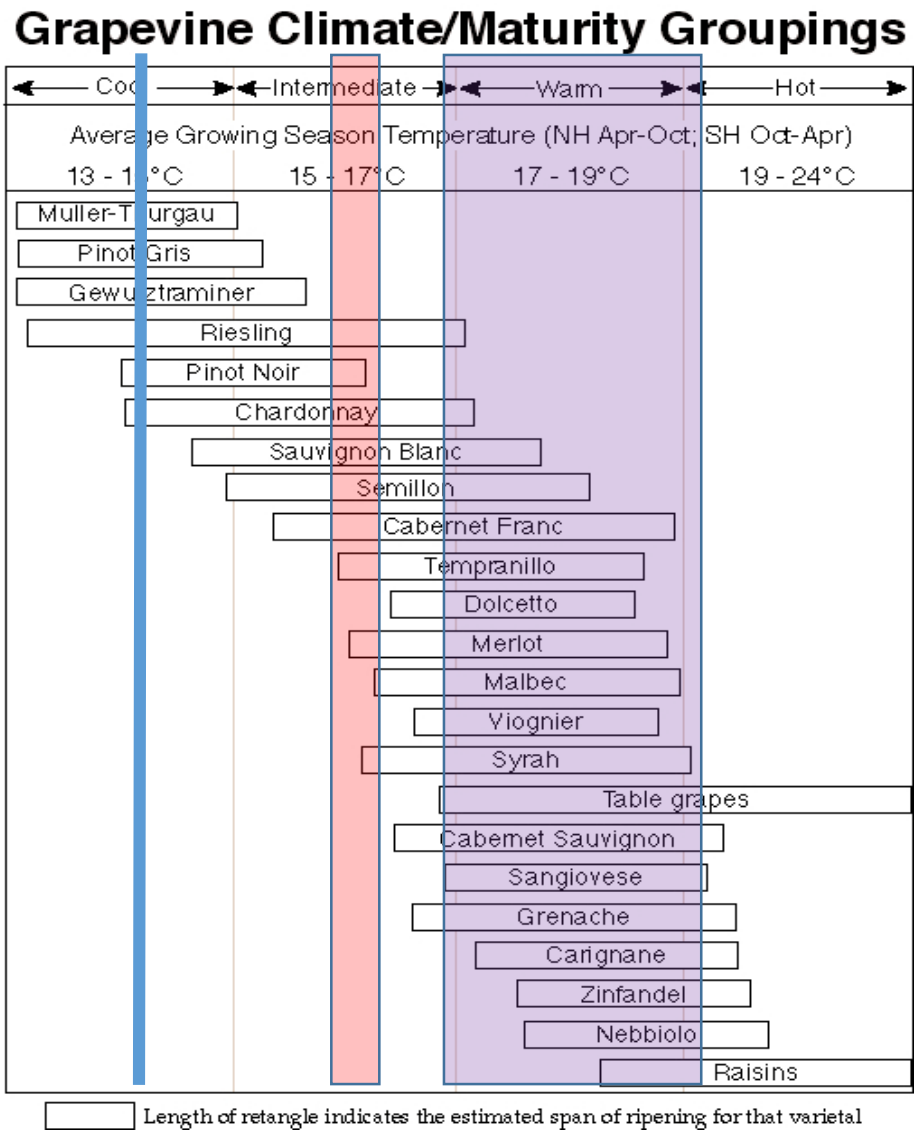

Figure 15. Grape varietal optimum growing season temperatures.

http://www.sou.edu/envirostudies/gjones_docs/GJones%20Climate%20Change%20Geoscience%20Canada.pdf

Recreation

Outdoor recreation is also an important part of Oregon's 2nd Congressional District's economy. Recreation is extremely dependent on the natural resource base and the weather. Impacts from climate change will vary among leisure activity. The region boasts over 300 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, downhill 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.

An economic study for Oregon Department of Fish and Wildlife and Travel Oregon found that in 2008, expenditures on fishing, hunting, and wildlife viewing exceeded $300 million within the 2nd Congressional District. The ongoing health of our natural ecosystems is pertinent to retain that revenue stream. Many plant and animal species will likely be unable to quickly adapt to changing climates and may become extinct or extirpated. Hunters and wildlife enthusiasts will may 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

As mentioned in the economic discussion above, Oregon's 2nd Congressional District has become increasingly popular as a retirement location. Climate change can impact the health of the most vulnerable segments of the population. The Oregon Health Authority conducted a recent study to determine impacts of climate on health. Consequences depicted below in Table 2 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, and the wave of retirees that have recently bolstered the economy may diminish. Not only will the projected climate change be negative for our economy, it will also change the lives of people in the 2nd Congressional District.

Table 2. 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	

It's not a question of if climate change will negatively affect the 2nd 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.

Renewable resources

This region of Oregon contains a sustainable, renewable geothermal power source which is little affected by climatic conditions

Underlining the potential for renewable energy production in the region, several wind farms exist in the District. Shepherd Flat (Gilliam County), Biglow Canyon and Klondike (Sherman County), Vansye and Stateline (Umatilla County) are the largest such ventures in Oregon. These facilities supply non-polluting greenhouse gas emissions free electricity augmenting the generation capacity of hydroelectric dams on the Columbia River. Promoting renewable energy would assist companies such as these to increase operations, helping to sustain a regional economy through the century.

A Timeline For Action

Based on the projected consequences of a warming climate, the United Nations Framework C Convention on Climate Change (UNFCCC 2015) established 2°C as a limit beyond which we should not allow the global temperature to climb. The agreement also suggested that 1.5°C would be a more reasonable goal and urged efforts to achieve that lower limit. The 2°C limit was previously endorsed by the World Bank (2012, 2013, 2014) and the International Energy Agency (IEA 2009).

The trends and consequences discussed here are based on readily available data. An overall summary of our global temperature trajectory is depicted in Table 3 (from Quick M 2014) This shows that emissions of greenhouse gases to date have induced a temperature rise and inevitable continued rise totaling 1.5°C to 1.6°C (2.7 - 2.9°F) (Dixon 2001). If we wish to avoid an increase over 2°C the math tells us that we can only allow another 825 gigatons (billions of tonnes) of Carbon dioxide and equivalent emissions. Given that the current annual rate of global emissions is 37 gigatons (Le Quéré *et al.* 2014) and assuming the 'business as usual' scenario of accelerating emissions is followed into the future as it has been to date, we will exhaust this budget in about 17 years. Unfortunately, if known and suspected fossil fuel reserves were extracted and burned, the temperature impact would be far in excess of that agreed 2°C upper limit. In relation to shooting beyond 2°C, the World Bank (2012) acknowledged there is: "no certainty that adaptation to a 4°C world is possible."

Table 3. Carbon Dioxide Emissions and Temperature Consequences

Emissions	**Gigatons CO_2 added to atmosphere**	**Temperature increase**
1850 – 2000	1035	0.8°C
2000 – Now	440	1.5°C
Allowed	825	2°C
Fossil Fuel Reserves	725	3 - 4°C
Accessible Reserves	780	5 - 6°C
Additional Reserves	1280	??

If climate trends continue as projected, Oregon's 2nd Senate District will experience considerable natural and economic disruption. In order to sustain a vibrant economy, the region will find it necessary to adapt. Avoiding the worst case scenario depicted in these projections will require

the concerted effort of elected leaders at all levels of government, regional, national, and international

It would behoove governments and representatives throughout the district to be aware of the threat that climate change poses to the traditional economy of North Central and Northeastern Oregon, to initiate steps to prepare for these changes, and to promote efforts at all levels of government to minimize the threat that climate change poses by encouraging renewable energy and discouraging carbon emissions.

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

Contact Representative Greg Walden

DC Address: The Honorable Greg Walden
United States House of Representatives
2185 Rayburn House Office Building
Washington, D.C. 20515-3702

DC Phone: 202-225-6730

DC Fax: 202-225-5774

Contact Representative Walden: https://walden.house.gov/?sectionid=117§iontree=7117

WWW Homepage: *http://walden.house.gov/*

Twitter: *@repgregwalden*

Fulltime District Offices:

14 North Central Avenue, Suite 112 Medford, OR 97501	**Voice:** 800-533-3303 **FAX:** 541-779-0204
1211 Washington Avenue La Grande, OR 97850	**Voice:** 541-624-2400 **FAX:** 541-624-2402
1051 NW Bond Street, Suite 400 Bend, OR 97701	**Voice:** 541-389-4408 **FAX:** 541-389-4452

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