Climate Impacts in the Pacific Northwest and Oregon's History of Work to Reduce Greenhouse Gas Emissions

November 13, 2017

Joint Meeting of the Senate Interim Committee on Environment and Natural Resources and the House Interim Committee on Energy and the Environment

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Climate Impacts in Oregon – Emerging Science

Refining and down-scaling of climate models leads information about specific places and processes:

- Temperature
- Precipitation
- Snowpack and Hydrology
- Wildfire
- Vegetation Change

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Climate Impacts in Oregon – Temperature

Some Basic Terms

- RCP: Representative Concentration Pathways (concentrations of GHGs in the atmosphere)
- RCP 4.5: Emissions peak in 2040, then decline.
- RCP 8.5: Emissions continue rising throughout 21st century.

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Climate Impacts in Oregon – Temperature

	2050s		2080s	
	Low	High	Low	High
Annual	**3.6°F** (1.8, 5.4)	**5.0°F** (2.9, 6.9)	**4.6°F** (2.1, 6.7)	**8.2°F** (4.8, 10.7)
Winter (DJF)	**3.3°F** (1.6, 5.1)	**4.5°F** (2.4, 6.5)	**4.2°F** (1.8, 6.5)	**7.4°F** (4.2, 9.8)
Spring (MAM)	**3.1°F** (1.4, 5.0)	**4.1°F** (2.0, 5.9)	**3.8°F** (1.7, 6.0)	**6.7°F** (3.8, 9.2)
Summer (JJA)	**4.5°F** (2.2, 6.8)	**6.3°F** (3.6, 8.9)	**5.5°F** (2.7, 8.3)	**10.2°F** (6.5, 13.9)
Fall (SON)	**3.7°F** (1.5, 5.4)	**5.2°F** (2.6, 7.0)	**4.7°F** (2.0, 6.9)	**8.6°F** (4.6, 11.4)

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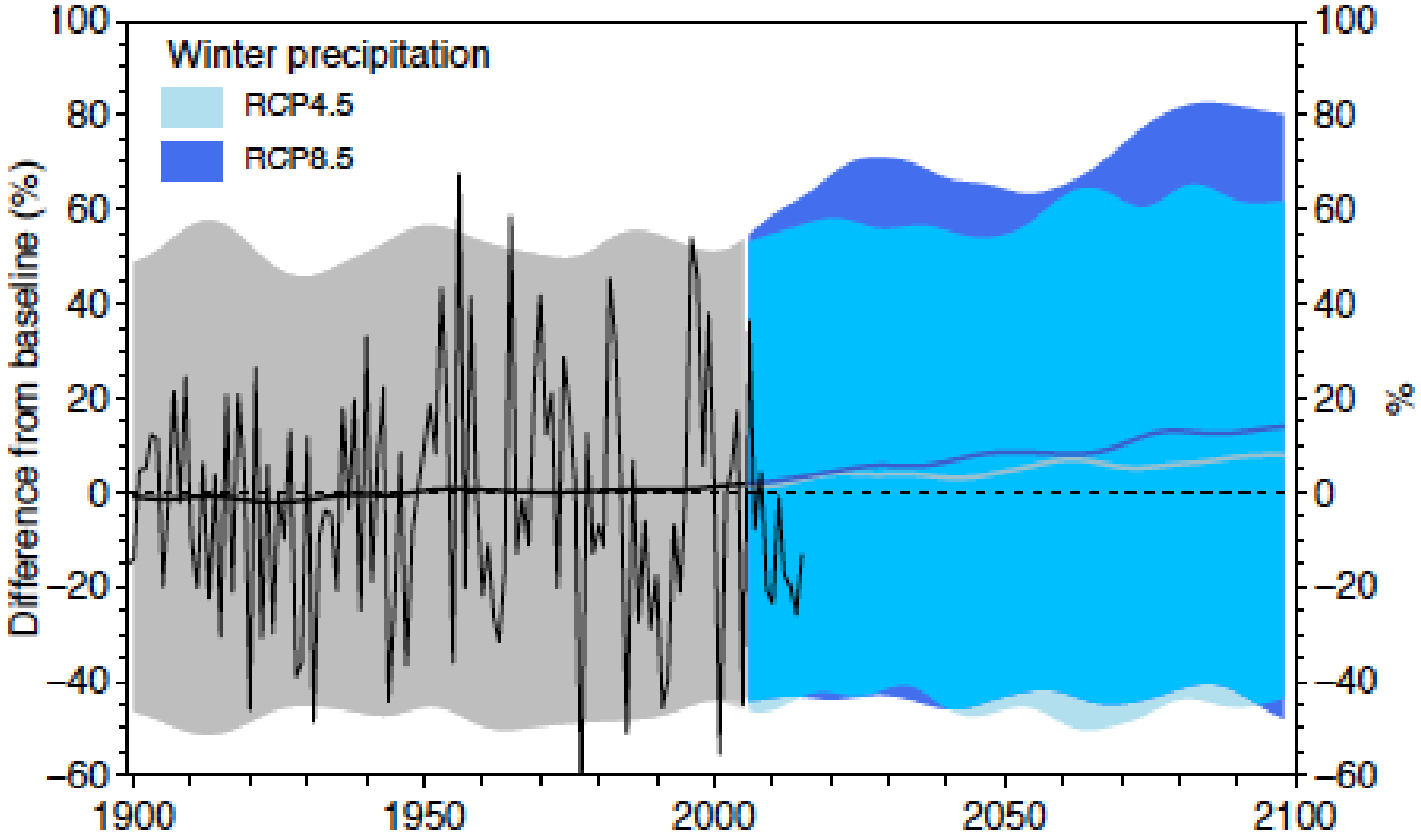
Climate Impacts in Oregon – Precipitation



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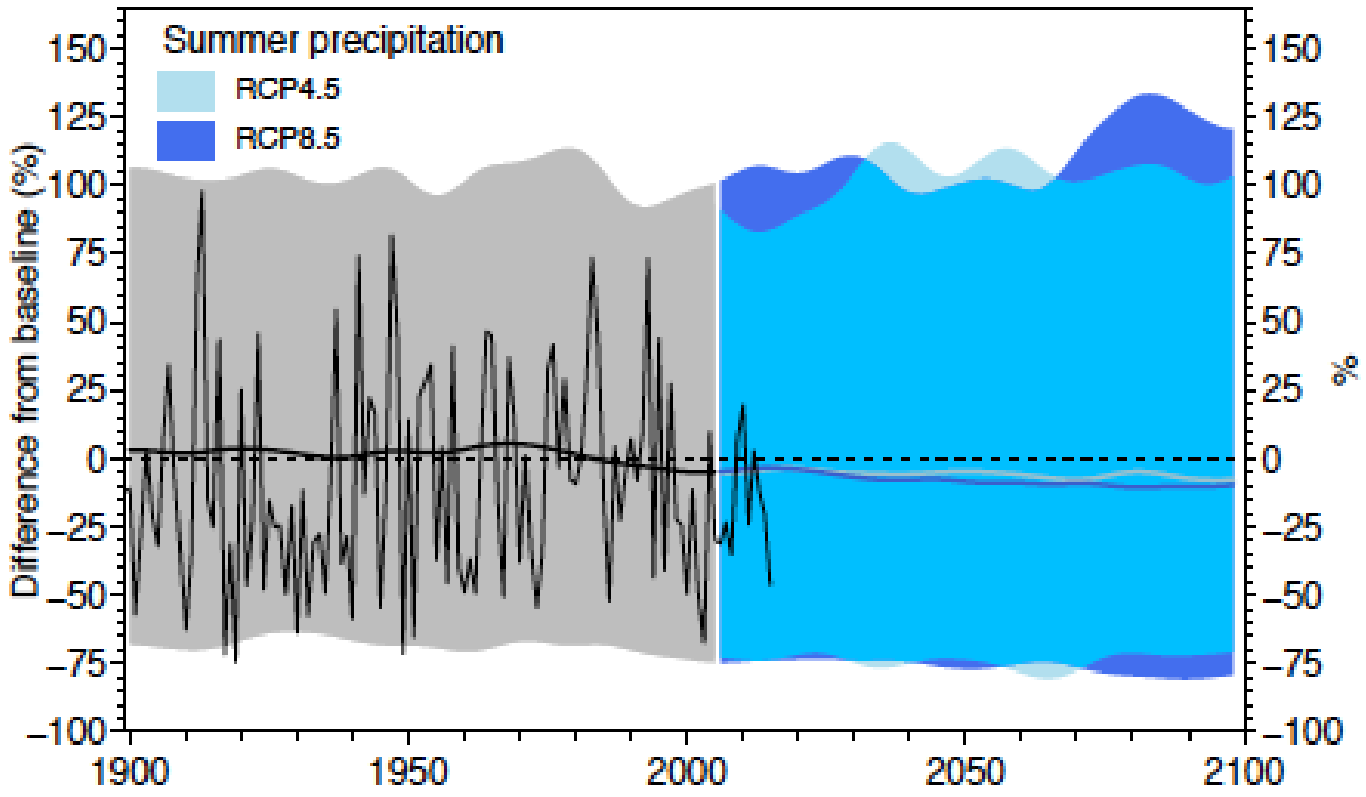
Climate Impacts in Oregon – Precipitation



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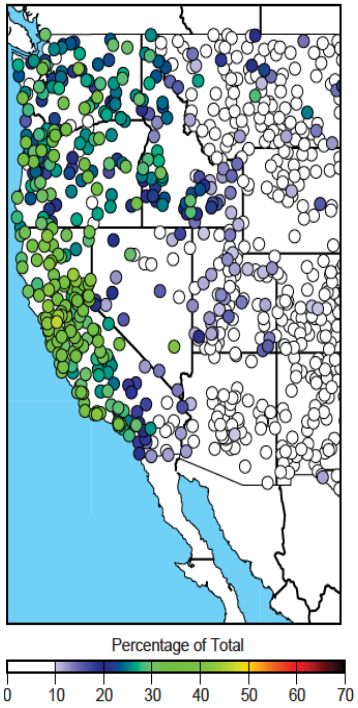
Climate Impacts in Oregon – Precipitation

Key Finding 5

The frequency and severity of landfalling "atmospheric rivers" on the U.S. West Coast (narrow streams of moisture that account for 30%–40% of the typical snowpack and annual precipitation in the region and are associated with severe flooding events) will increase as a result of increasing evaporation and resulting higher atmospheric water vapor that occurs with increasing temperature (*medium confidence*).



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Climate Impacts in Oregon – Snowpack and Hydrology

Projected changes in western U.S. winter snow-related hydrology at the middle and end of this century

Mountain Range	Snow Water Equivalent (% Change)	
	2050	2100
Cascades	–41.5	–89.9
Klamath	–50.75	–95.8
Rockies	–17.3	–65.1
Sierra Nevada	–21.8	–89.0
Wasatch and Uinta	–18.9	–78.7
Western USA	**–22.3**	**–70.1**

Projections are for RCP8.5. **USGCRP**, 2017: *Climate Science Special Report: Fourth National Climate Assessment*

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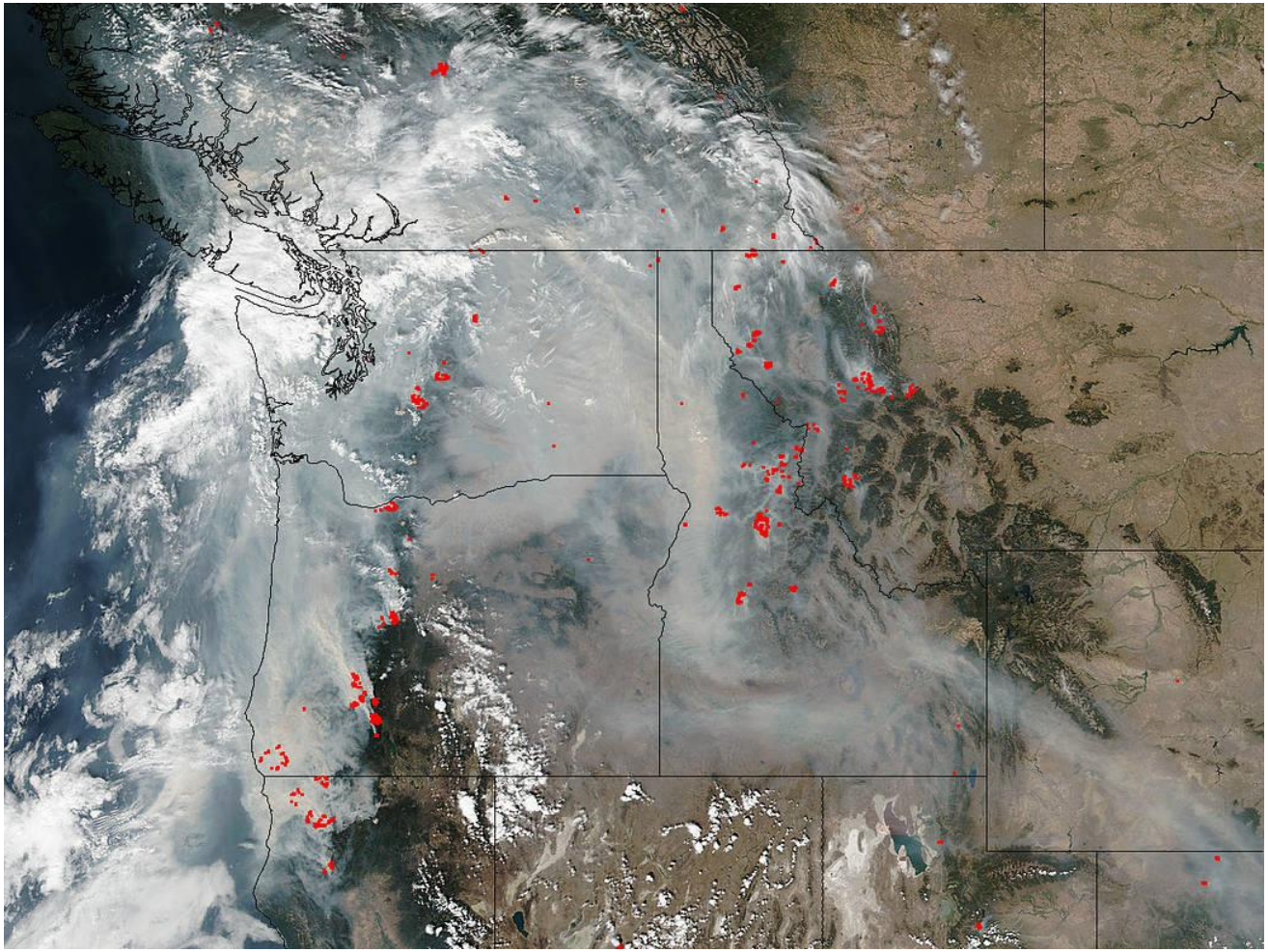
Climate Impacts in Oregon – Wildfire



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Climate Impacts in Oregon – Wildfire

"Human-caused climate change is now a key driver of forest fire activity in the western United States.

* * *

"Across wide swaths of public lands, there is little evidence to suggest that recent upward trends in area burned are driven primarily by past forest management."

B. Harveya, Proceedings of the National Academy of Sciences, Vol. 113, no. 42 (October 2016).

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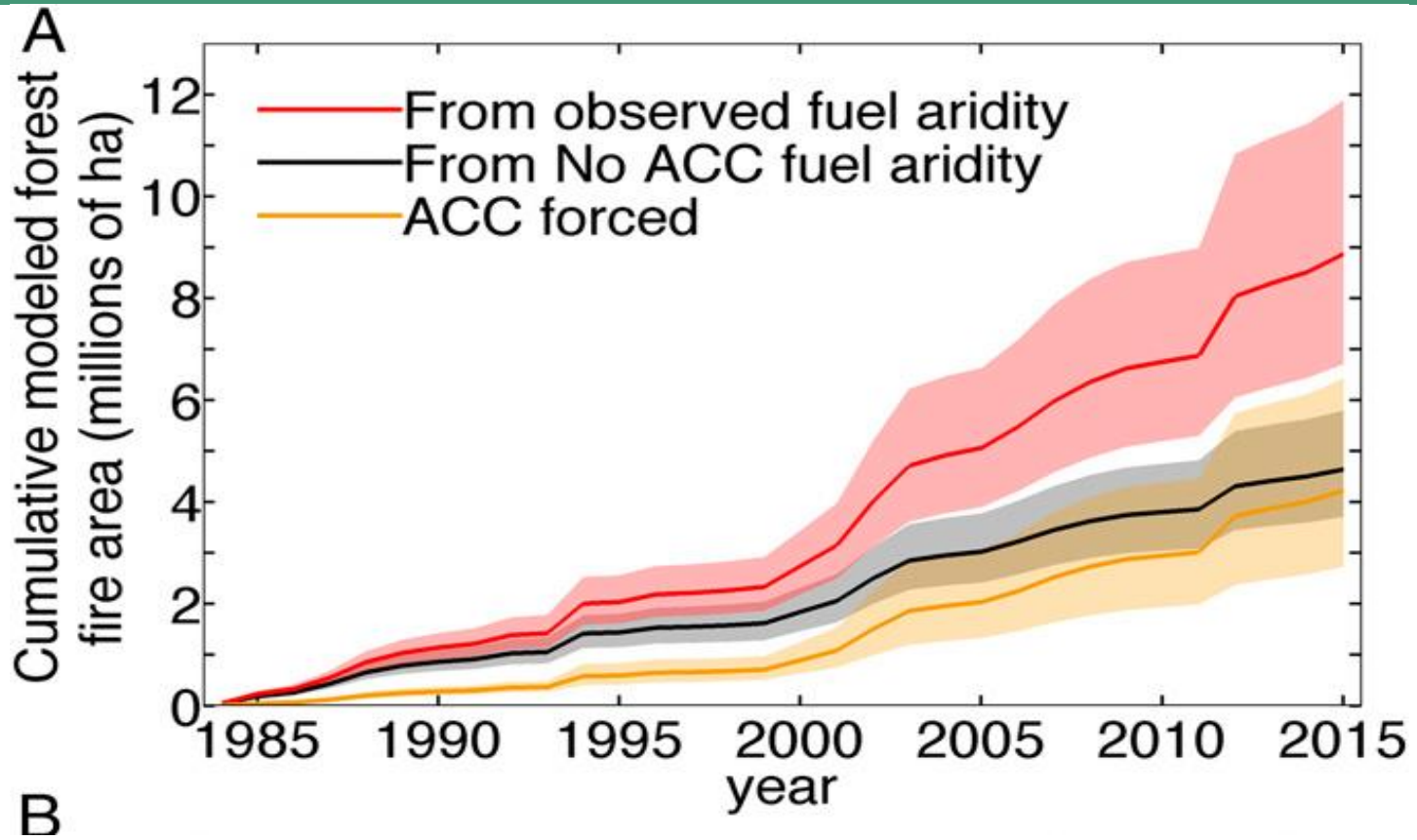
Climate Impacts in Oregon – Wildfire



Impact of anthropogenic climate change on wildfire across western US forests, J. Abatzogloua, and A. Williams, Proceedings of the National Academy of Sciences, Vol. 113, No. 42 (October 2016).

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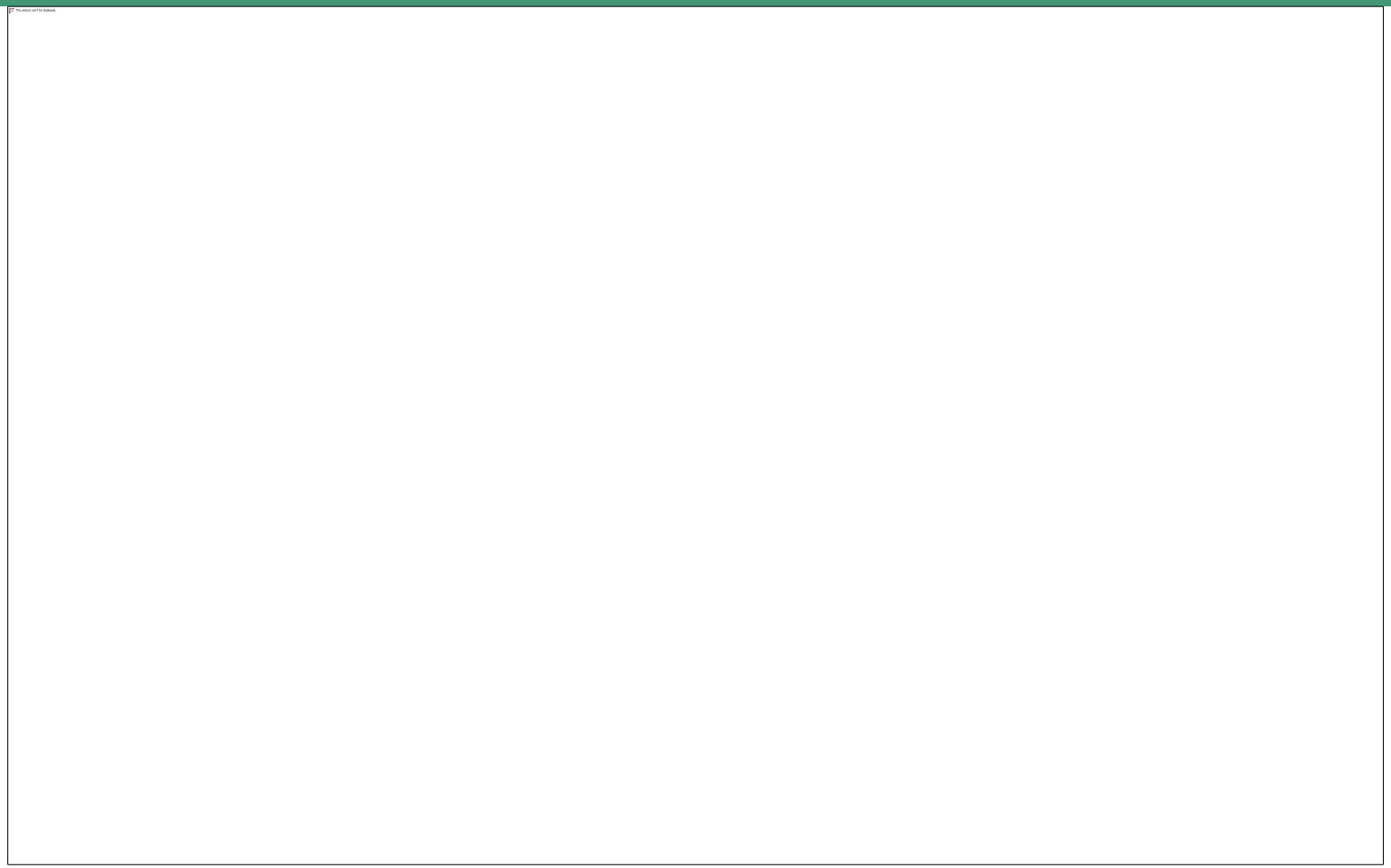
Climate Impacts in Oregon – Wildfire



Policy Analysis Group, University of Idaho, Research Report No. 37, August 2017

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Climate Impacts in Oregon – Vegetation Change

Projected major fire and vegetation changes in the Pacific Northwest of the conterminous United States under selected CMIP5 climate futures

T. Sheehan*, D. Bachelet, K. Ferschweiler

Ecological Modelling 317 (2015) 16–29

Increased water deficit decreases Douglas fir growth throughout western US forests, Restainoa, Peterson, and Littell; Proceedings of the National Academy of Sciences, Vol 113, No. 34, August 2016

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Climate Impacts in Oregon – Vegetation Change

Some models suggest that forests west of the Cascade Range may shift from conifer to a mixed conifer forest in the future due to increased wildfires driven by climate change (Sheehan et al., 2015) (fig. 5.6).

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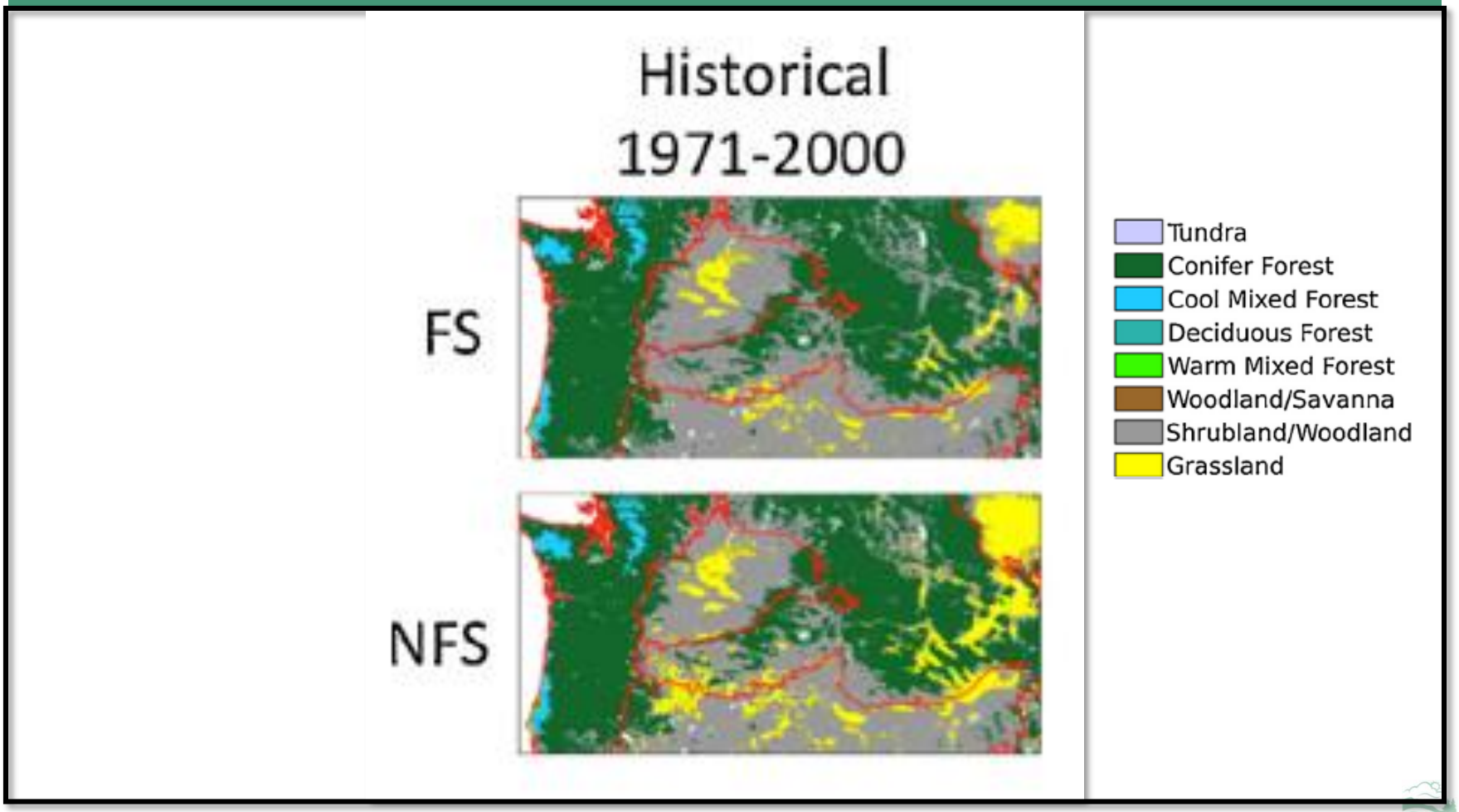
Climate Impacts in Oregon – Vegetation Change



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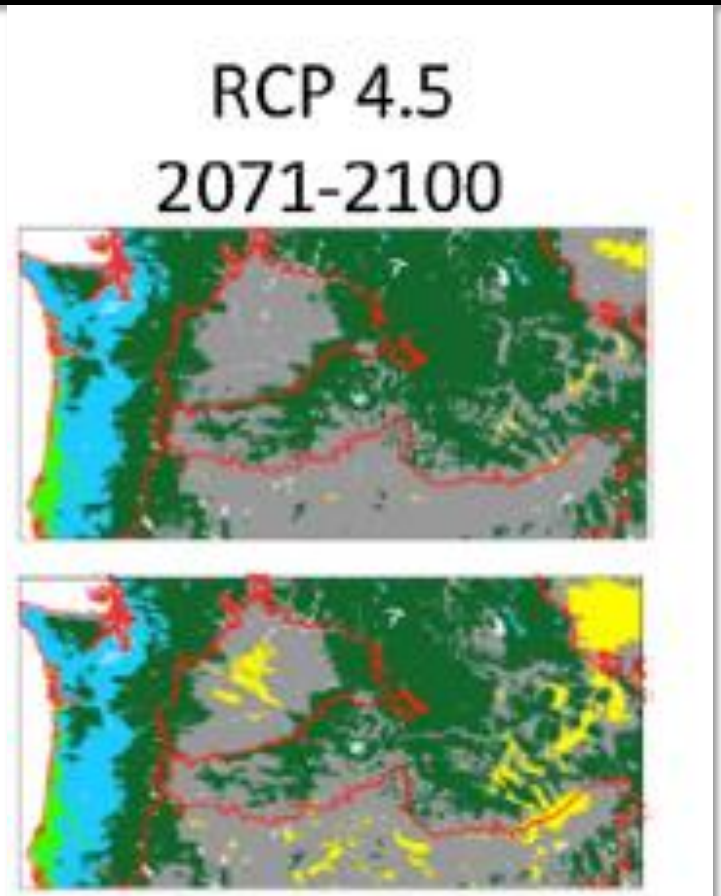
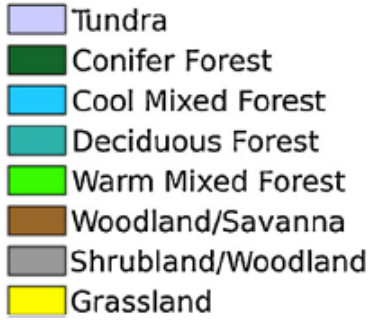
Climate Impacts in Oregon – Vegetation Change





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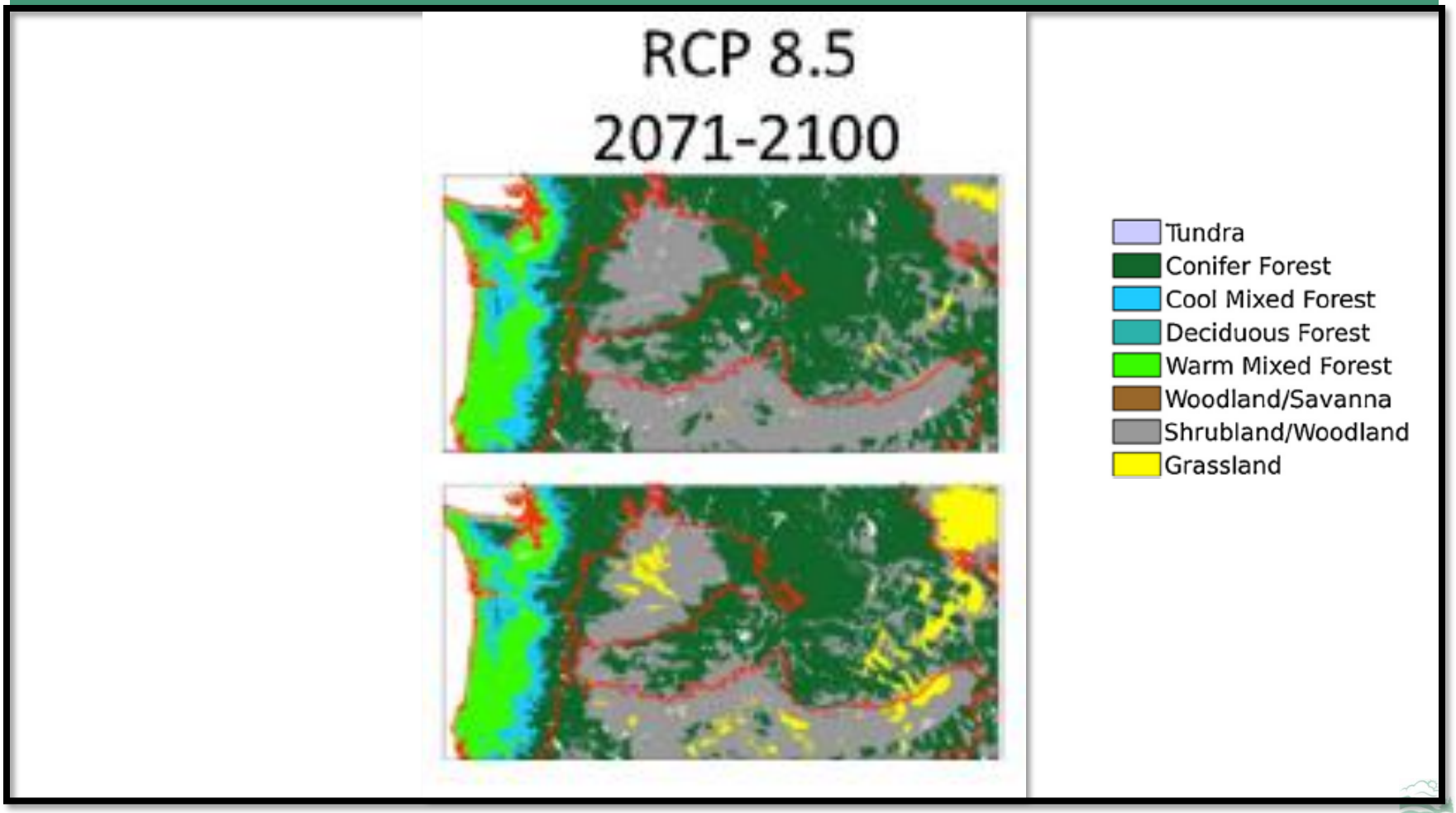
Climate Impacts in Oregon – Vegetation Change



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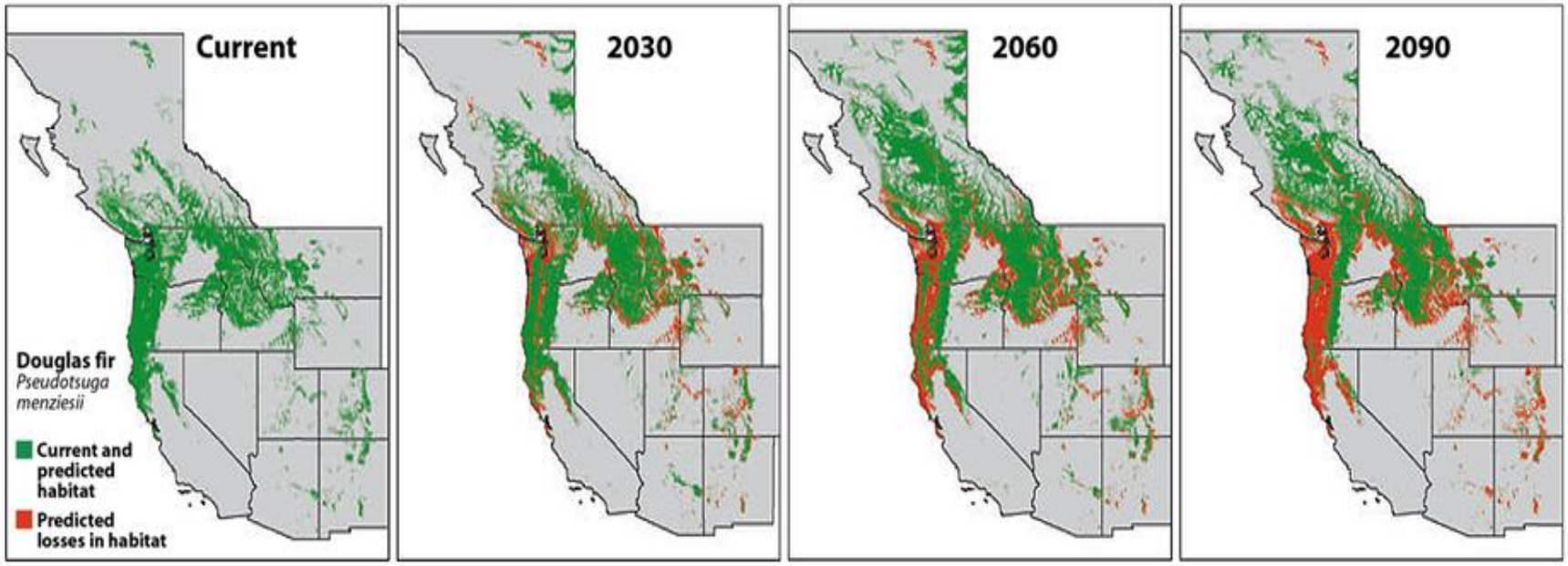
Climate Impacts in Oregon – Vegetation Change



As the climate in western North America gets warmer and drier, the Douglas fir's range is expected to shrink and shift inland

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Climate Impacts in Oregon – Vegetation Change

Location	Current	2030	2060	2090
British Columbia	180,357	355,286	533,979	487,183
United States	789,101	713,534	639,467	446,854
Total	969,458	1,068,820	1,173,446	934,037

Tab 2 Predicted current and future area (km^2) of potential Douglas-fir habitat by location using the developed random forest model and the Canadian Center for Climate Modeling and Analysis general circulation model under the A2 emissions scenario.

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Climate Impacts in Oregon – Ocean Acidification

Key Finding 3

The world's oceans are currently absorbing more than a quarter of the CO_2 emitted to the atmosphere annually from human activities, making them more acidic (*very high confidence*), with potential detrimental impacts to marine ecosystems. In particular, higher-latitude systems typically have a lower buffering capacity against pH change, exhibiting seasonally corrosive conditions sooner than low-latitude systems. Acidification is regionally increasing along U.S. coastal systems as a result of upwelling (for example, in the Pacific Northwest) (*high confidence*), changes in freshwater inputs (for example, in the Gulf of Maine) (*medium confidence*), and nutrient input (for example, in agricultural watersheds and urbanized estuaries) (*high confidence*). The rate of acidification is unparalleled in at least the past 66 million years (*medium confidence*). Under the higher scenario (RCP8.5), the global average surface ocean acidity is projected to increase by 100% to 150% (*high confidence*).

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Climate Impacts in Oregon – Bottom Line Consequences

- Public health (smoke, heat and disease)
- Private and public property damage (fire and floods)
- Economic implications of less productive and more fire-prone forests, particularly for rural communities
- Economic implications of less productive shellfish and crab industries
- Significant reduction in water supplies during the summer and early fall – economic implications for agriculture
- Deteriorating water quality and aquatic habitat (algal blooms)
- Impacts to resources will affect rural communities disproportionately
- Intergenerational equity

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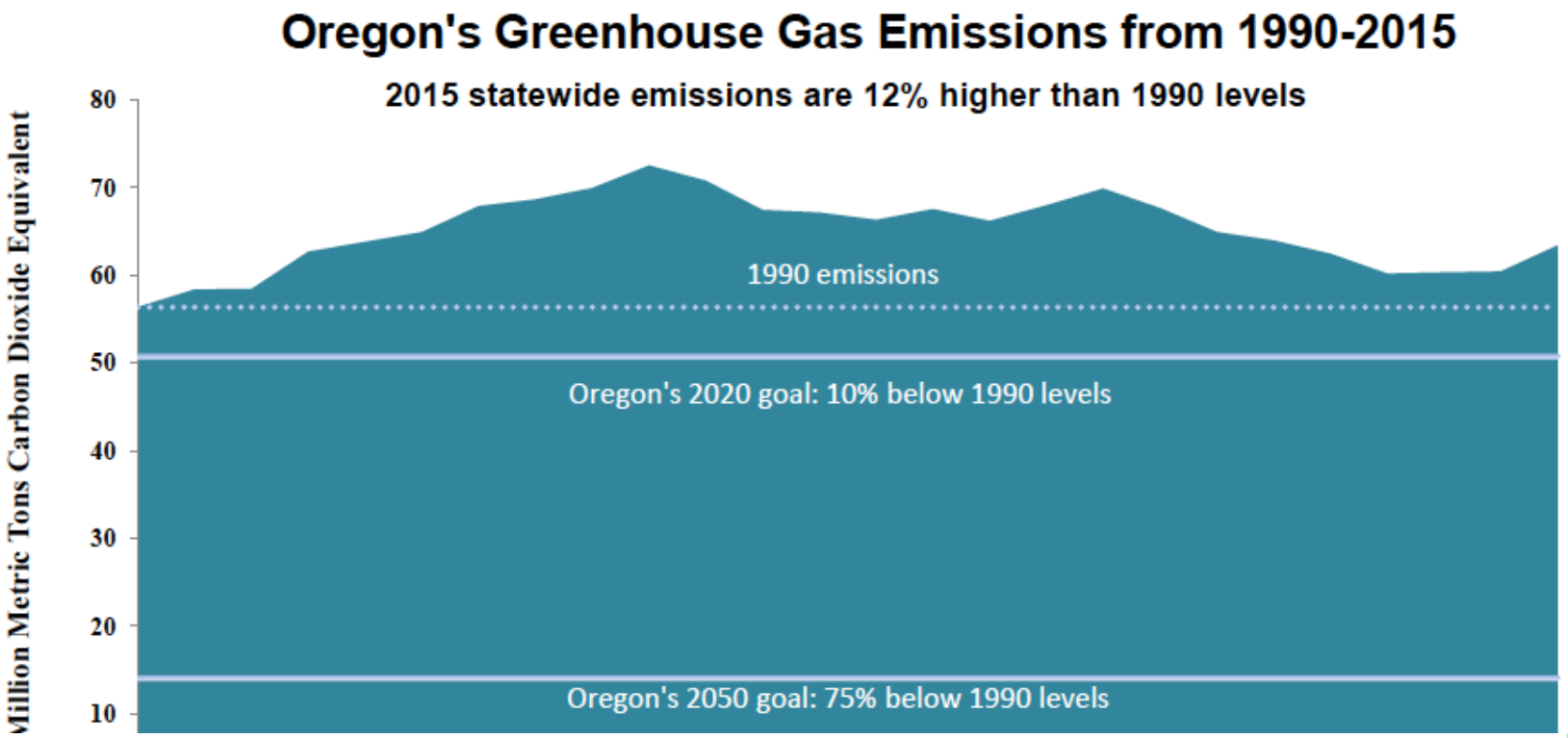
Greenhouse Gas Emissions in Oregon – How Are We Doing?



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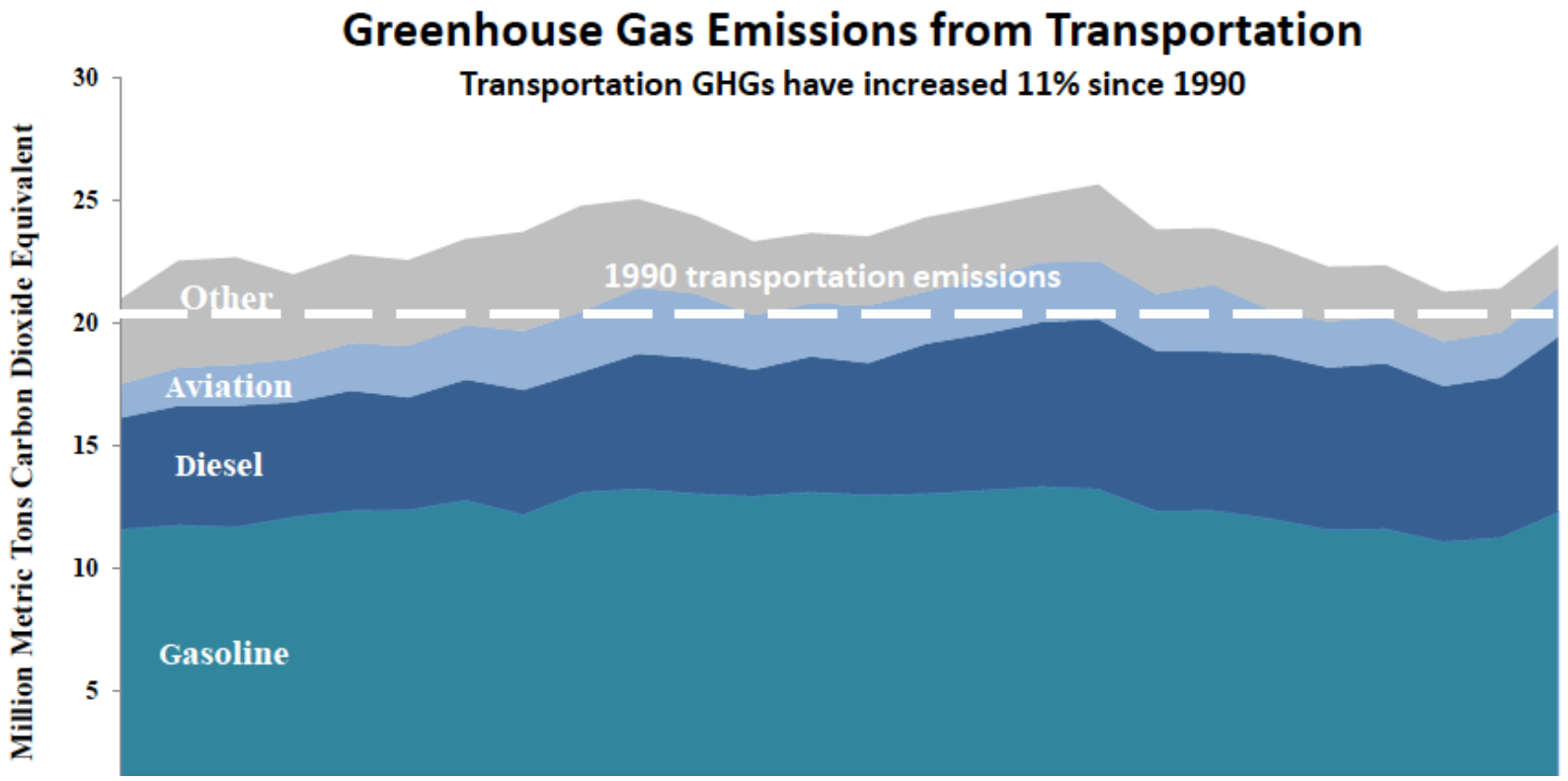

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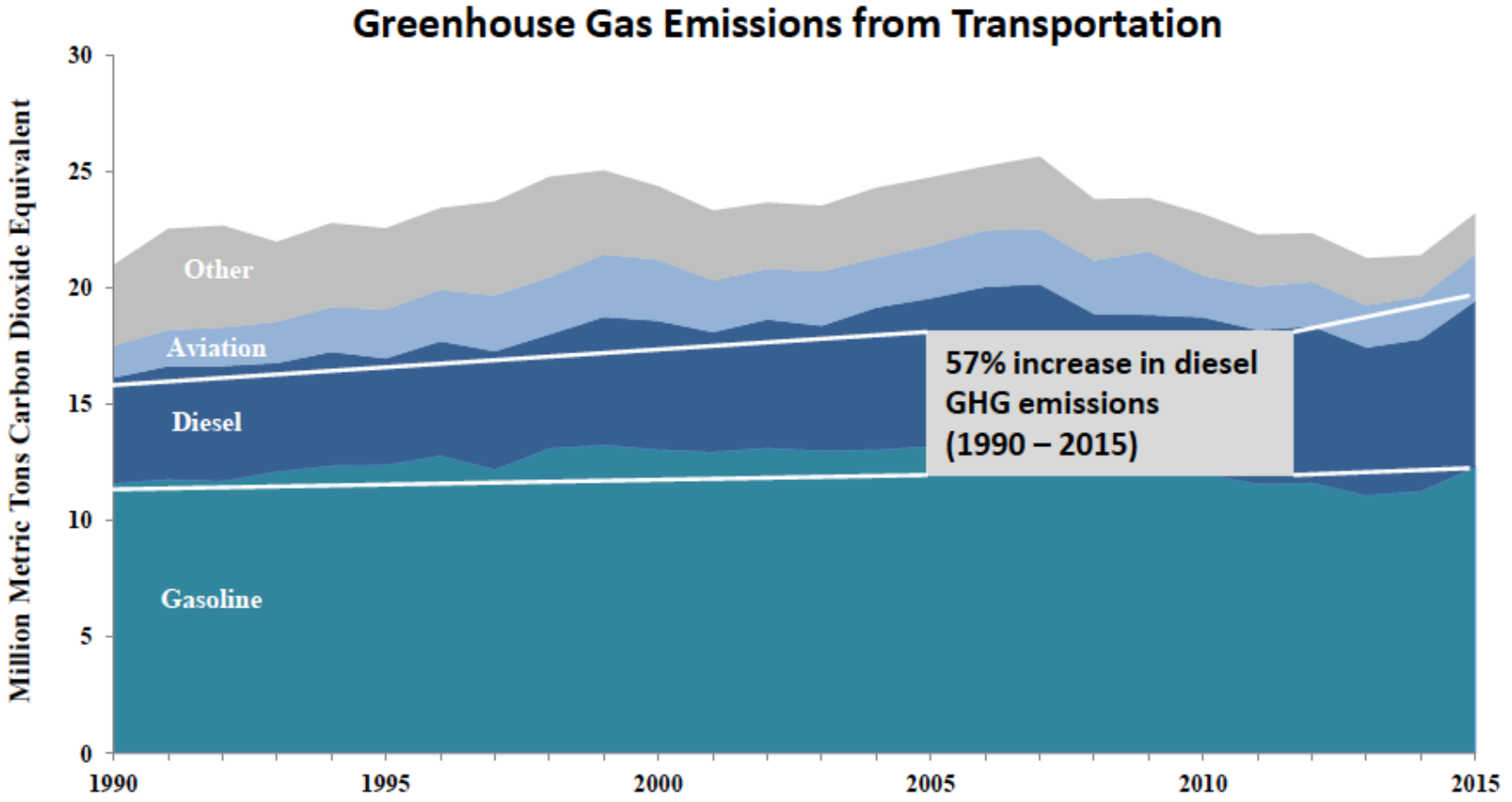
Greenhouse Gas Emissions in Oregon – How Are We Doing?



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Greenhouse Gas Emissions in Oregon – What Are We Doing Now?

- **GHG Reduction Goals** (2007 HB 3543)
  - 10% by 2020
  - 75% by 2050
- **ZEV/LEV vehicle standard**s (2005-2013 EQC Rules) and EV Incentives (2017 HB 2017)
- **Coal to Clean** (2016 SB 1457)
  - Transition off of coal by 2030 (currently 30%)
  - **Renewable Portfolio Standard** (50% renewable by 2040)
- **Clean Fuels** (2009 HB 2186) - A market-based program to achieve 10% reduction in carbon intensity by 2025
- **Oregon Sustainable Transportation Initiative** (2010 SB 1059) – A program to reduce ghg emissions from vehicles, particularly in urban areas
- **Mandatory GHG Reporting** (2008 and 2010 EQC rules)

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