



NEWS IN PHOTOS

# Chameleon Wishes Environment Would Occasionally Adapt To Him

Yesterday 8:00am •



# OCCRI history and function

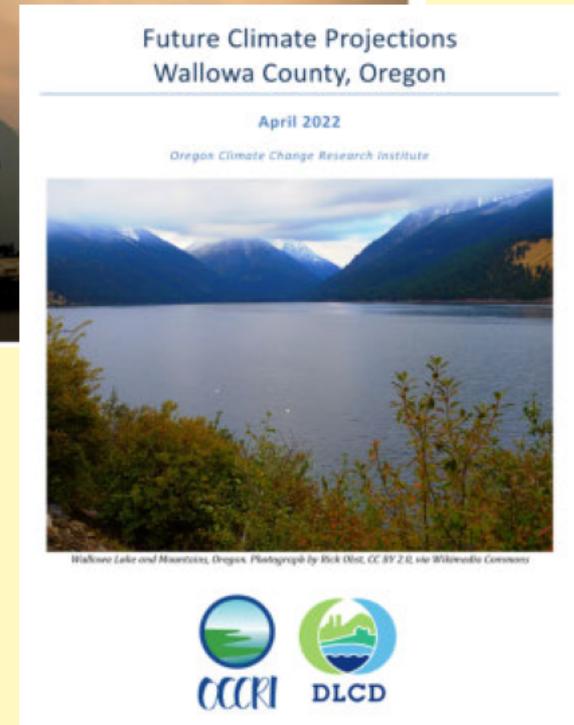


Dudley Chelton

- Established by Oregon House Bill 3543 in 2007
- Facilitate research by public universities on climate change and effects on humans and nature
- Technical support to Oregon Global Warming Commission, agencies

# OCCRI history and function

- County-level projections of future climate to inform mitigation of natural hazards
- Provide information to the public in integrated and accessible formats
- Presentations, media interviews, education



# Oregon Climate Service

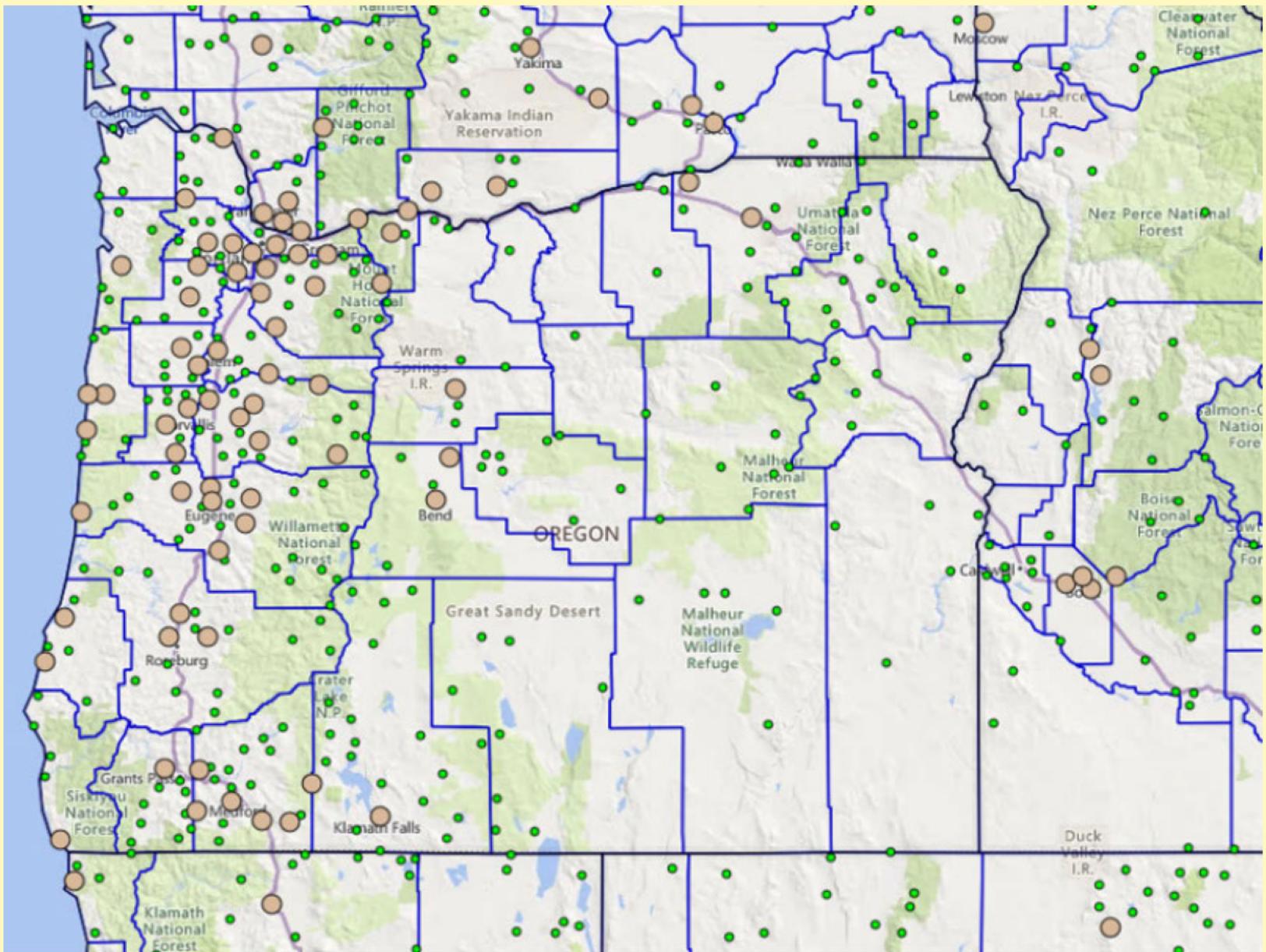


- Research and monitor state and regional climate
- Chair Oregon Drought Monitor Advisory Committee; serve on Oregon Water Supply Availability Committee, Drought Readiness Council, Climate Extremes Committee
- Financial consequences of drought declarations

# Best science available

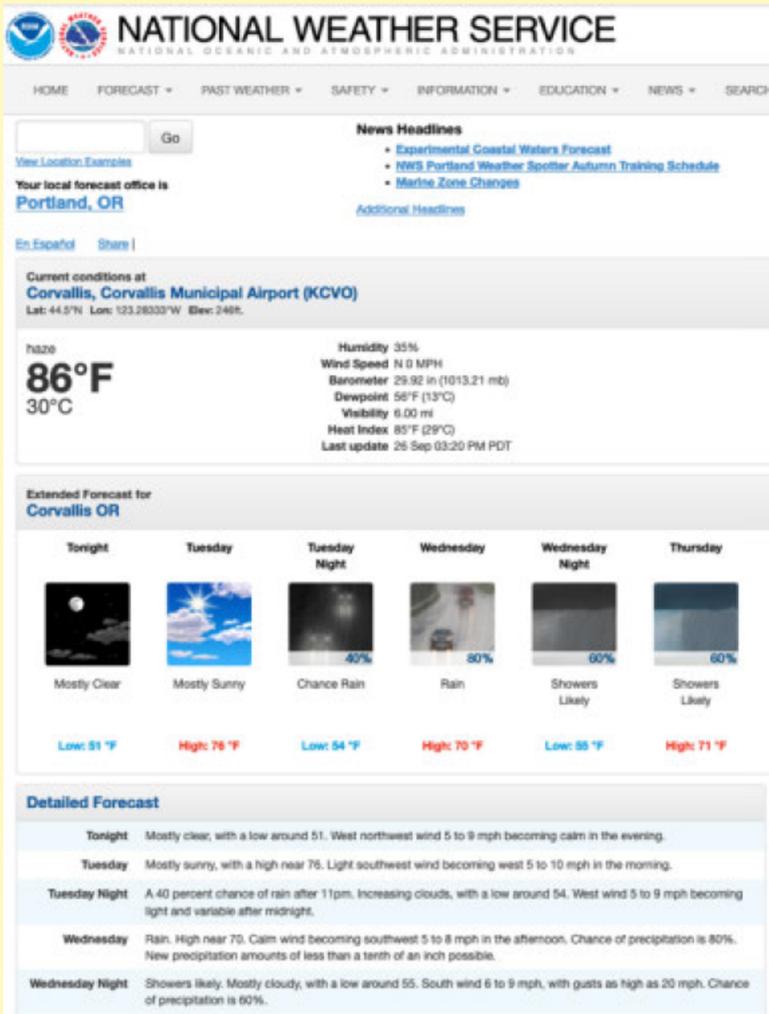
- Interagency Panel on Climate Change, National Climate Assessment
- Use of ensembles
- Uncertainties acknowledged and standardized
- Methods clear and repeatable, data and analytical code available
- Projections, methods, and inferences evolve





Stations at which precipitation is measured during all seasons. Large symbols: clusters of stations. Courtesy Chris Daly.

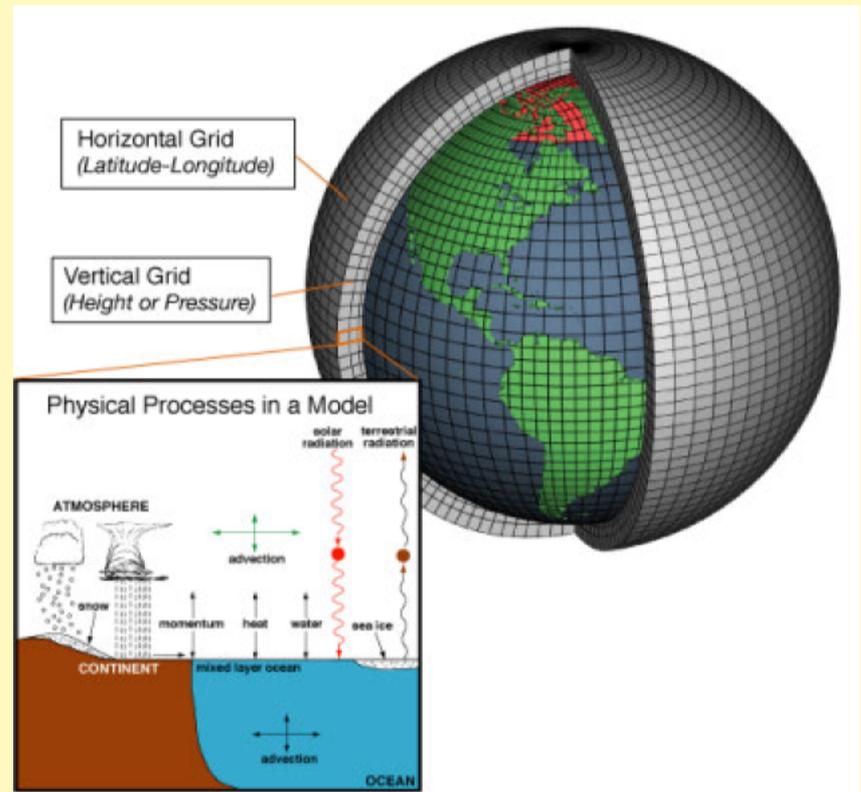
# Climate data



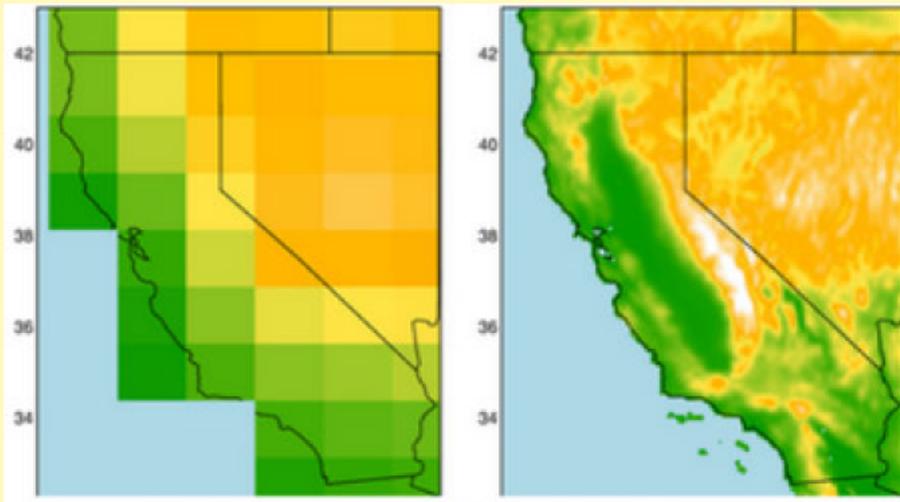
- **Weather:** atmospheric phenomena over min to days
- **Climate:** the statistics of weather; weeks or longer
- **Commonly measured variables:** precipitation, temperature, wind, humidity
- Values of variables respond to topography, vegetation cover, soil conditions

# Climate models

- Represent well-understood physical drivers of climate: interactions among atmosphere, oceans, land
- Make statistical projections at coarse resolution (about 60 miles)
- Future projections make assumptions about human behavior (emissions)



# Downscaling



usgs.gov

- Deriving fine-resolution estimates from a coarse-resolution model
- Examine statistical relations between observations and global climate model outputs
- Not a prediction for a given location

# Attribution



- Evaluating the relative contributions of multiple causes, with formal assessment of confidence
- Can apply to changes in annual or seasonal means
- Can apply to magnitude or likelihood of individual events or classes of such events
- See Congressional Research Service 2023 report R47583

# Trends and mechanisms

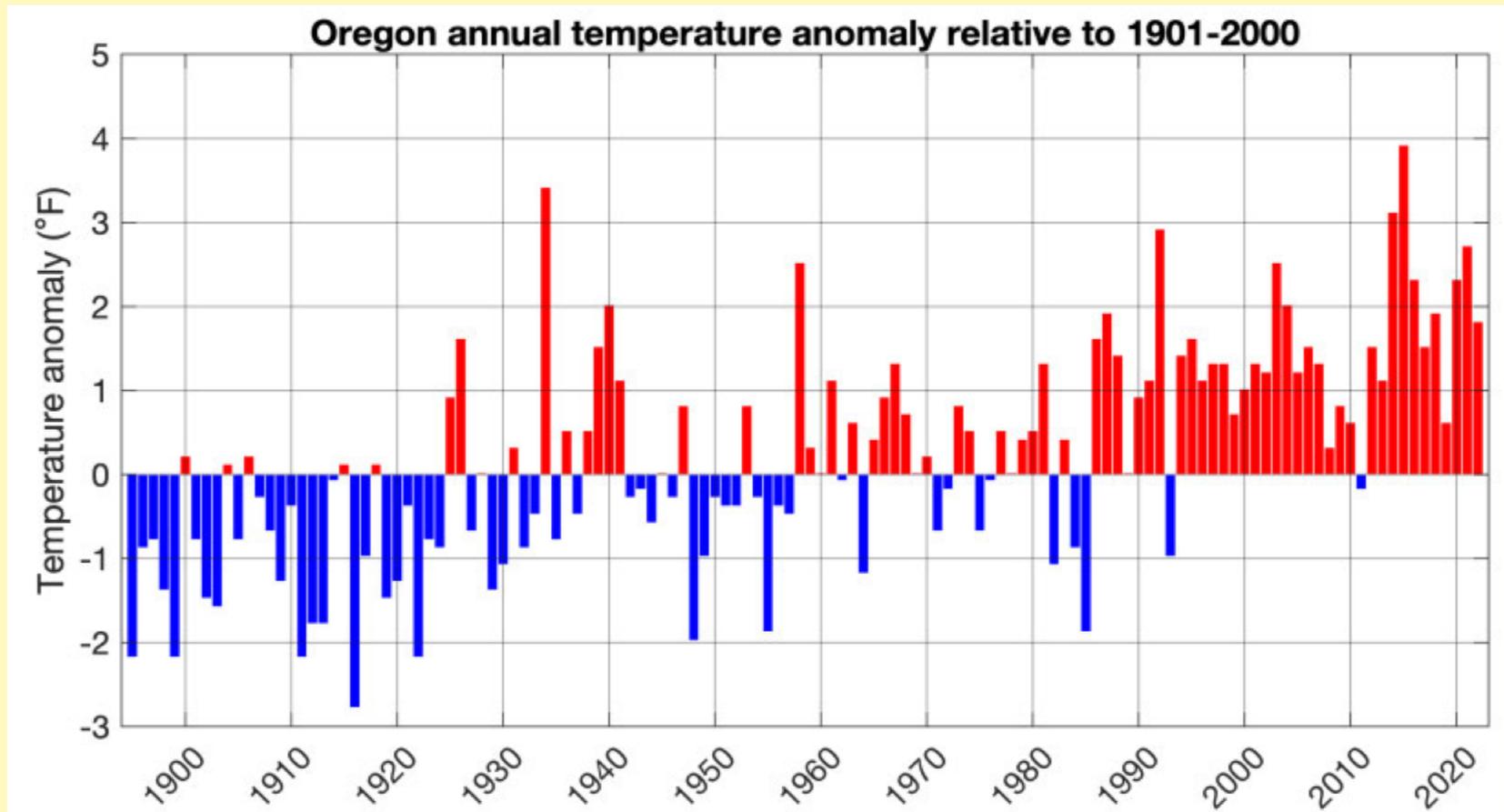
- Heat
- Seasonality and type of precipitation
- Aridification
- Wildfire
- Air quality
- Sea level rise
- Inequitable effects



Dudley Chelton

# Annual temperature

Above-average annual temperatures in 34 of the 37 years since 1985

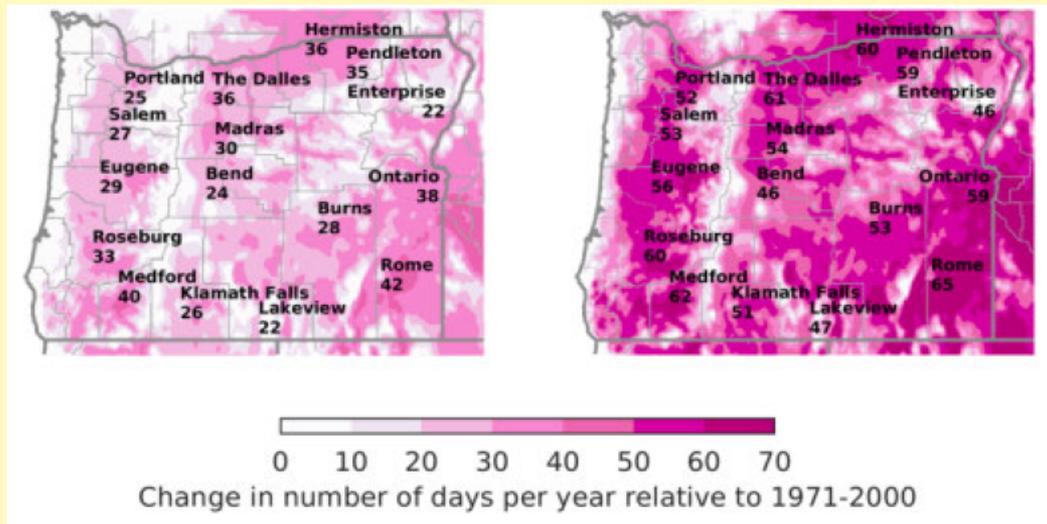


Data source: NOAA National Centers for Environmental information

# Extreme temperatures

2040–2069

2070–2099



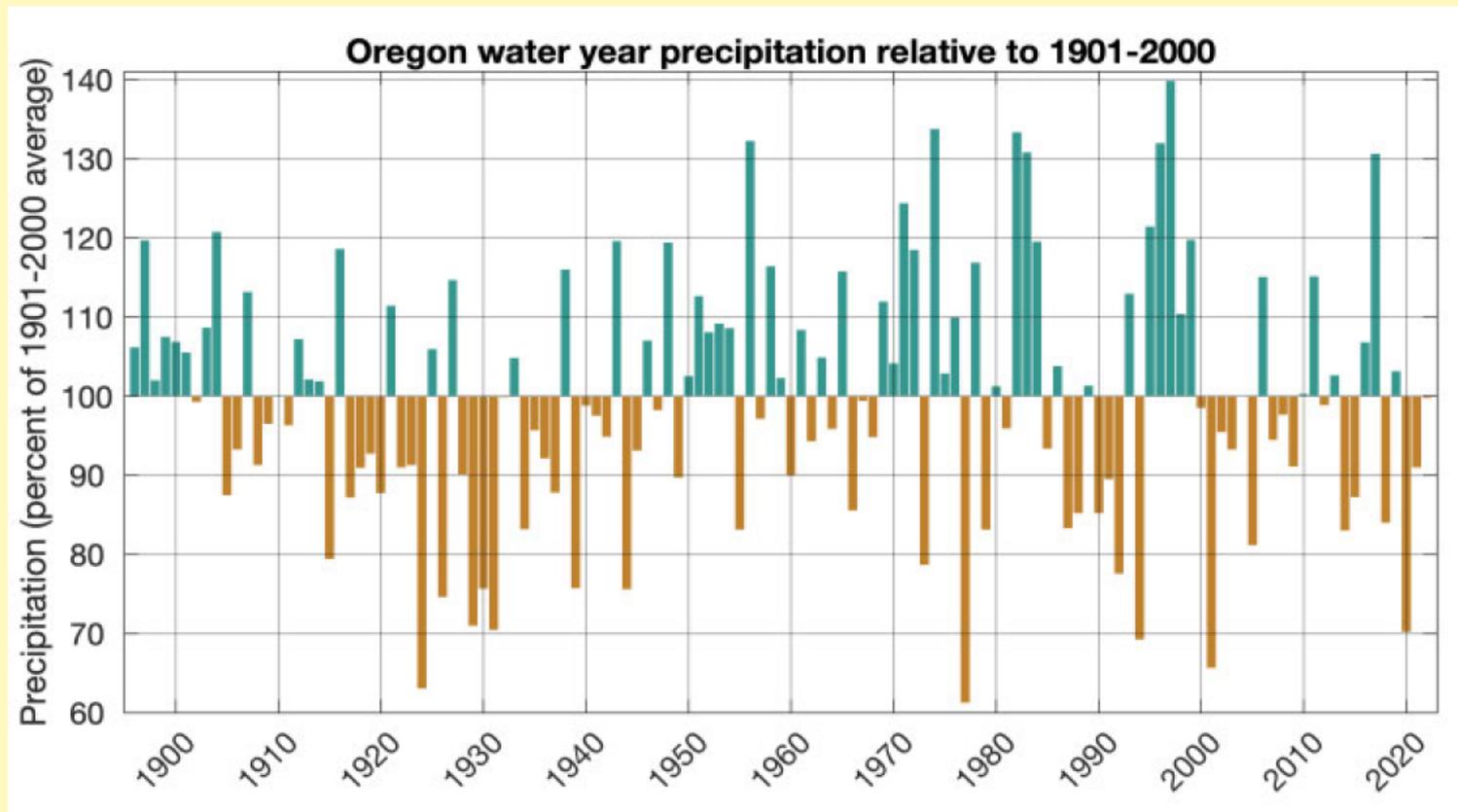
Assumes continued increase in emissions

- Warm nights affect health more than warm days
- Heat index: perceived temperature when relative humidity combined with air temperature
- Exposure at a given level increased in past 40 years
- High temperatures are the main driver

# Annual precipitation

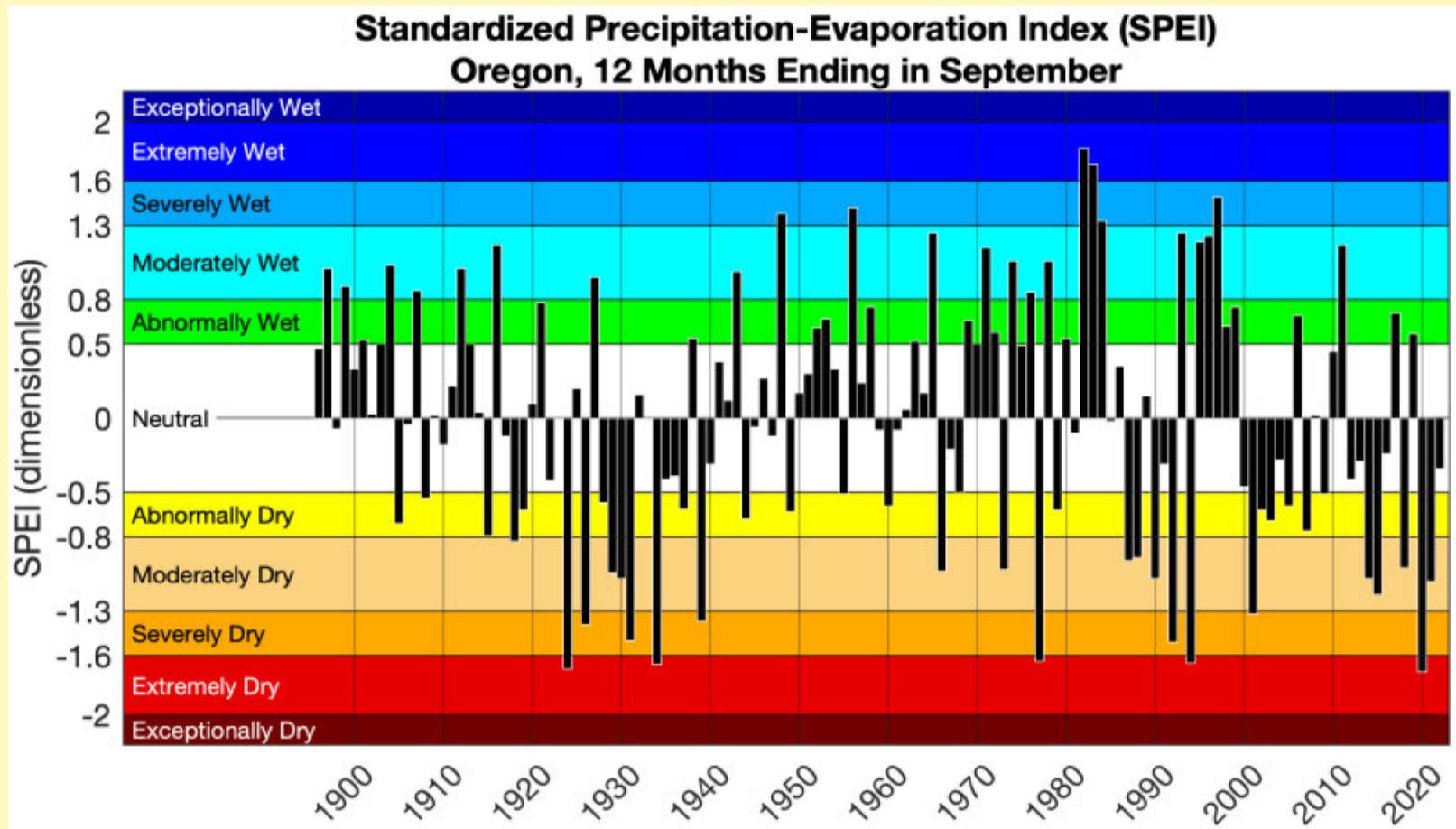
Below-average annual precipitation in 16 of the past 22 years

Drought becoming more common, more severe, and longer lasting



# Oregon drought history

Low precipitation and high evaporation from 2020–2022 led to the worst drought in Oregon's recorded history

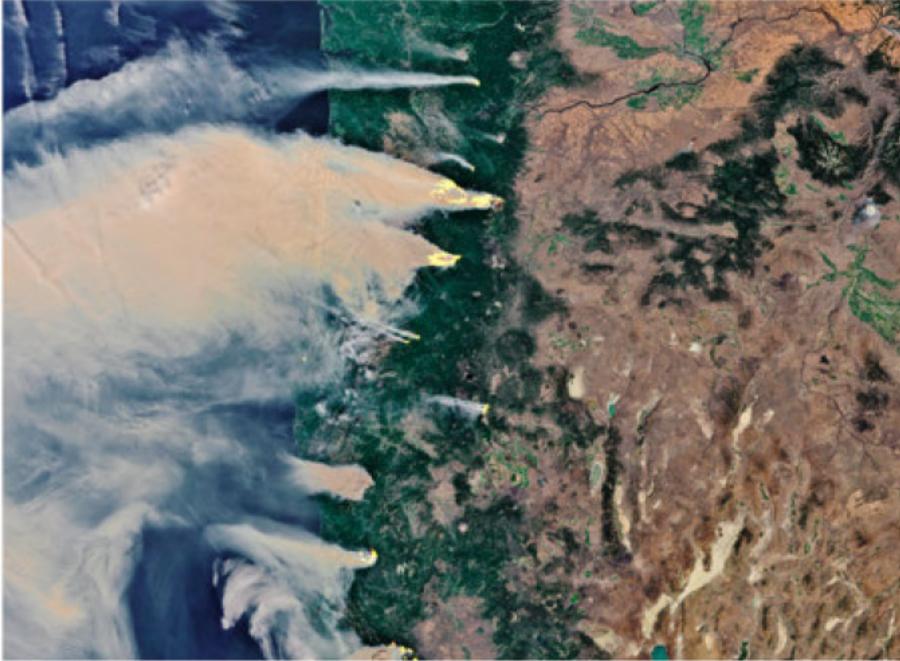


# Heat reduces water availability

- Total precipitation relatively stable
- More rain, less snow
- Earlier peak snowpack and snowmelt, fewer days with snow cover, less reliable snowpack
- More and earlier evaporation



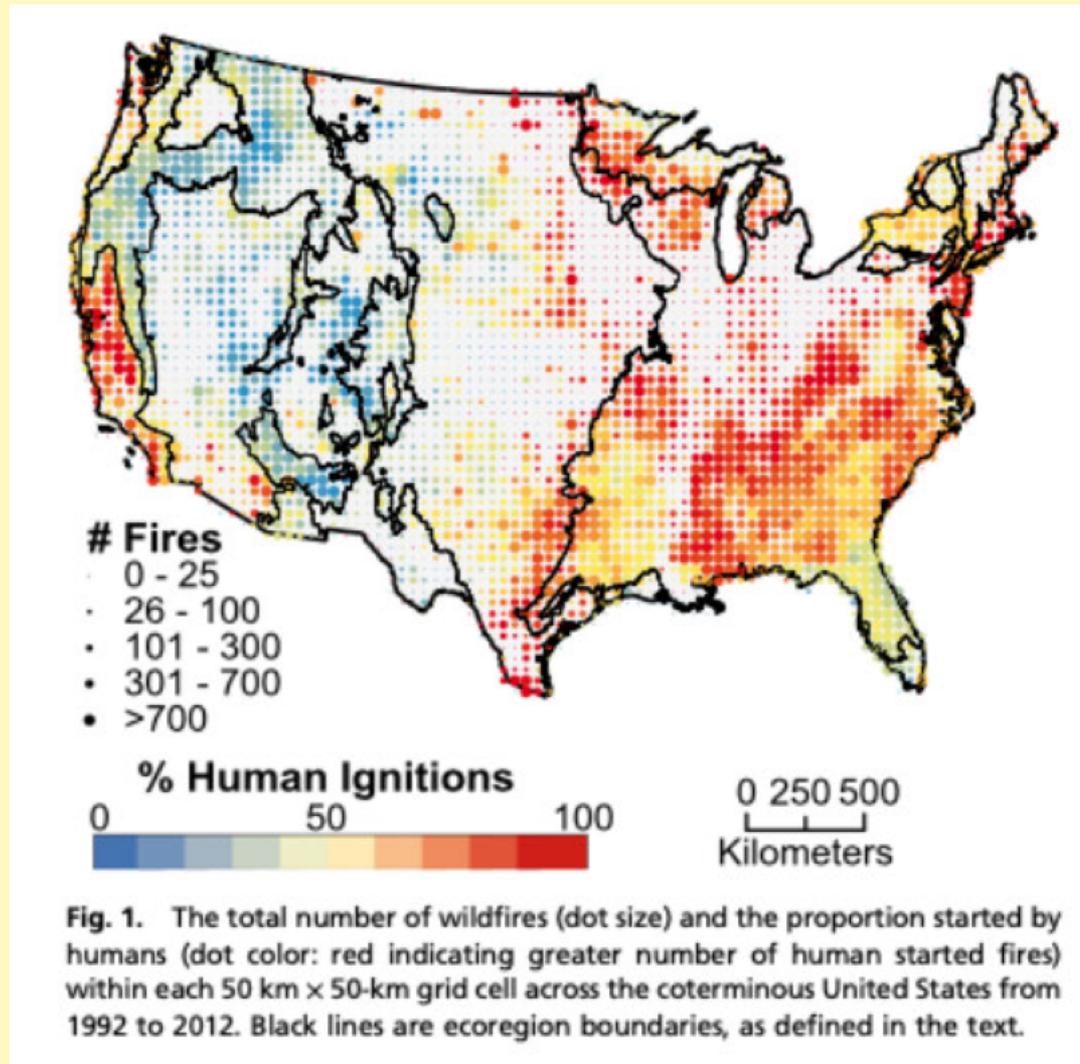
# Aridity and wildfires



Western Oregon from the Sentinel satellite, captured on September 8, 2020 (Image Credit: Pierre Markuse [[https://www.flickr.com/photos/pierre\\_markuse/50323276167/](https://www.flickr.com/photos/pierre_markuse/50323276167/)].)

- Aridity and heat make vegetation drier
- Wildfire more likely to ignite and spread, especially in high wind
- Number of large fires increasing more than number of small fires
- Wildfire elevation increasing

# Can't start a fire without a spark





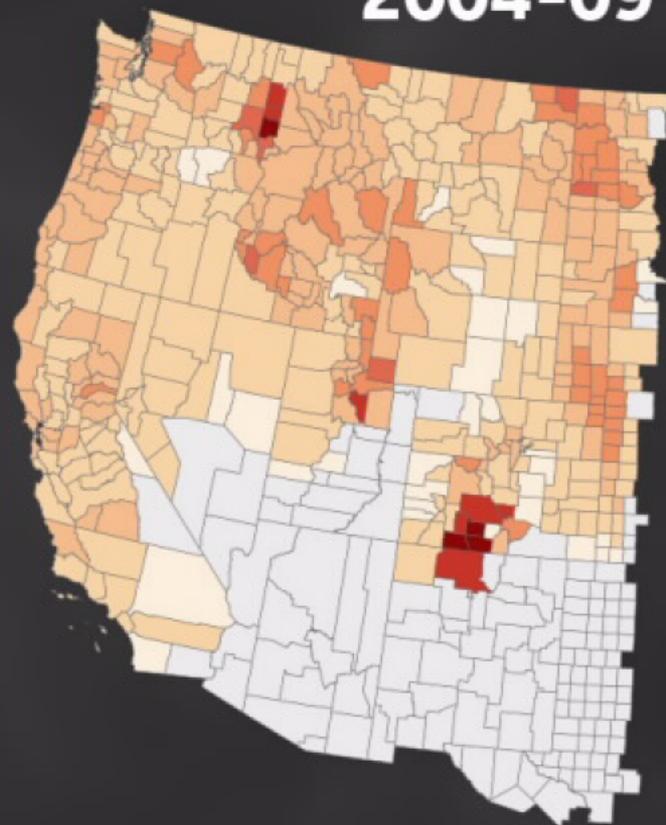
Pierre Markuse



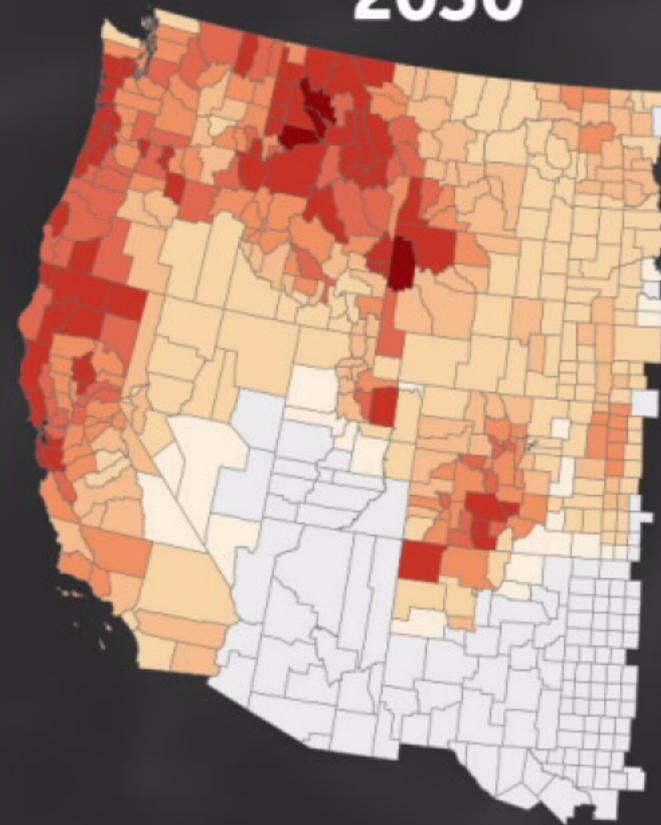
Oregon Public Broadcasting



**2004-09**



**2050**



Smoke wave day = a day with PM<sub>2.5</sub> concentration of at least 20  $\mu\text{g}/\text{m}^3$   
Average smoke wave intensity ( $\mu\text{g}/\text{m}^3$ )  
Source: Liu et al. 2016

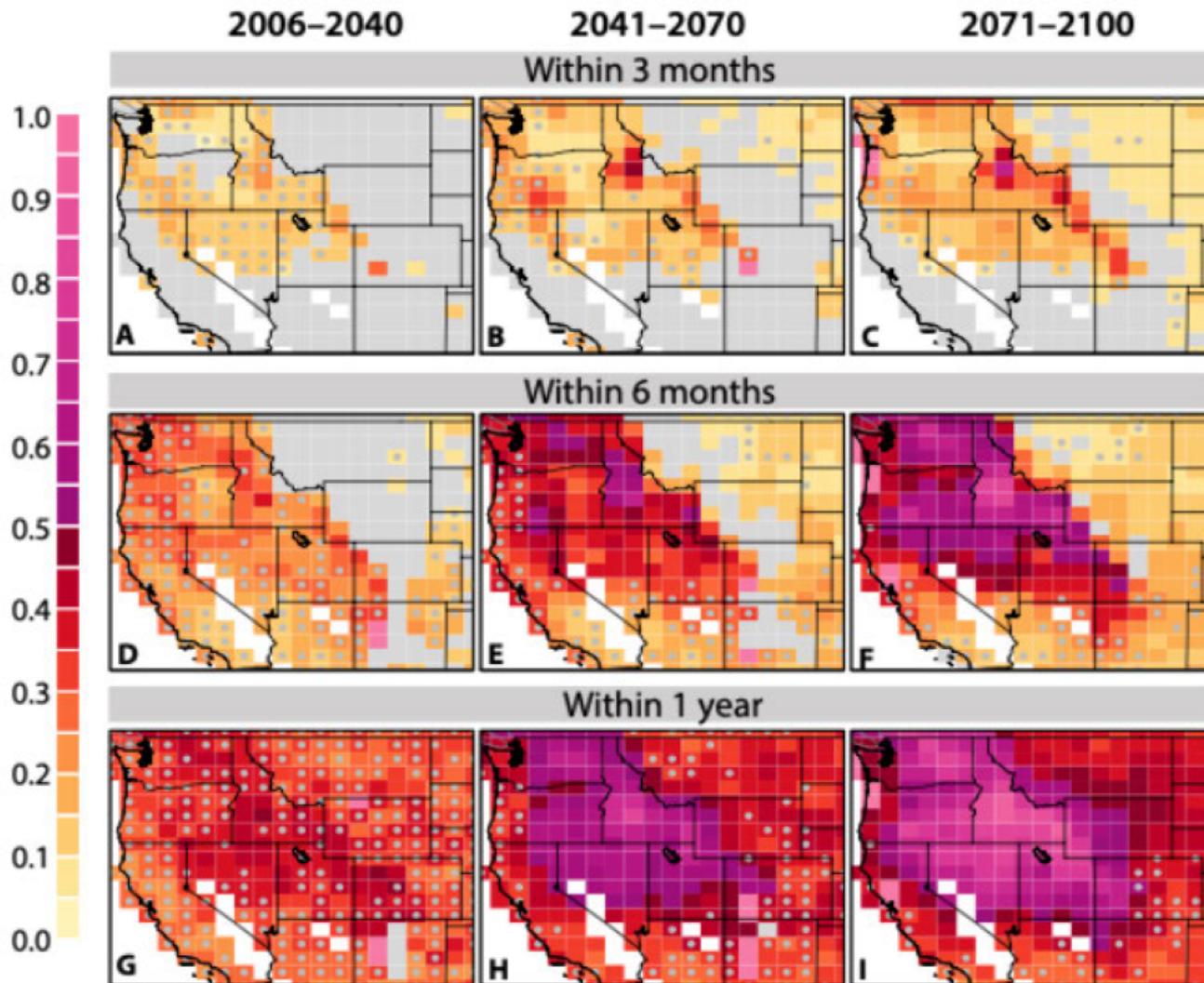
# Stresses on health care systems



Associated Press / Gerald Herbert

- Surges due to heat or smoke reduce capacity to provide other care
- Needs lag behind smoke
- An 11-day stretch of unhealthy air quality is likely to create substantial strain on Oregon's hospitals

# Fraction of extreme fire weather events followed by extreme rainfall events



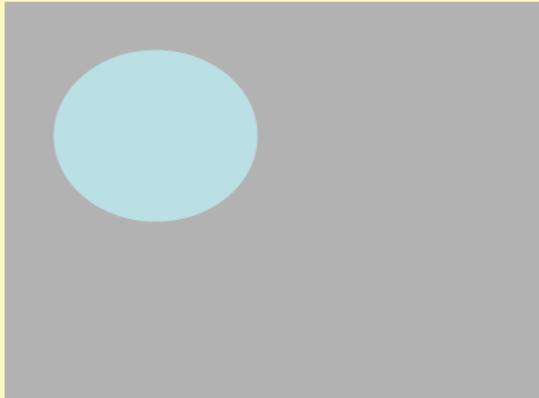
# Natural systems



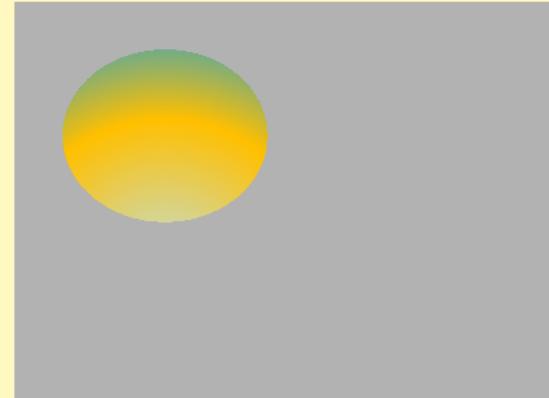
David Shaw

- Most projections of ecological responses don't consider potential for physical, behavioral, or genetic adaptation
- Relations among species also are influential
- Land cover and climate change interact

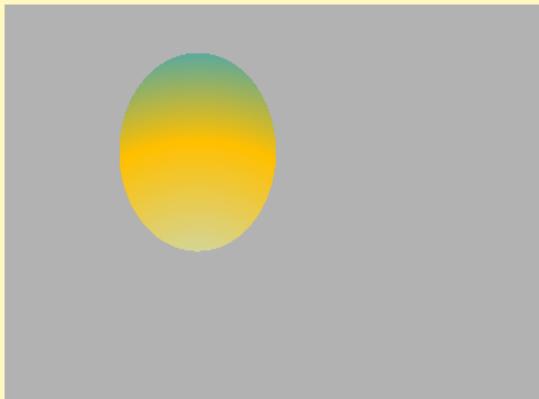
# Oversimplification of climate envelope modeling



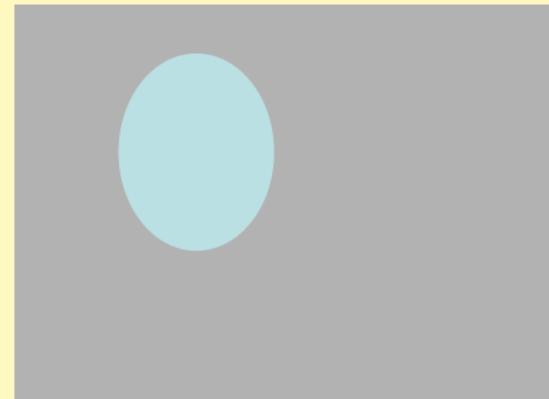
1. Delineate current range of species X



2. Characterize climate in current range



3. Project where that climate will be located in the future



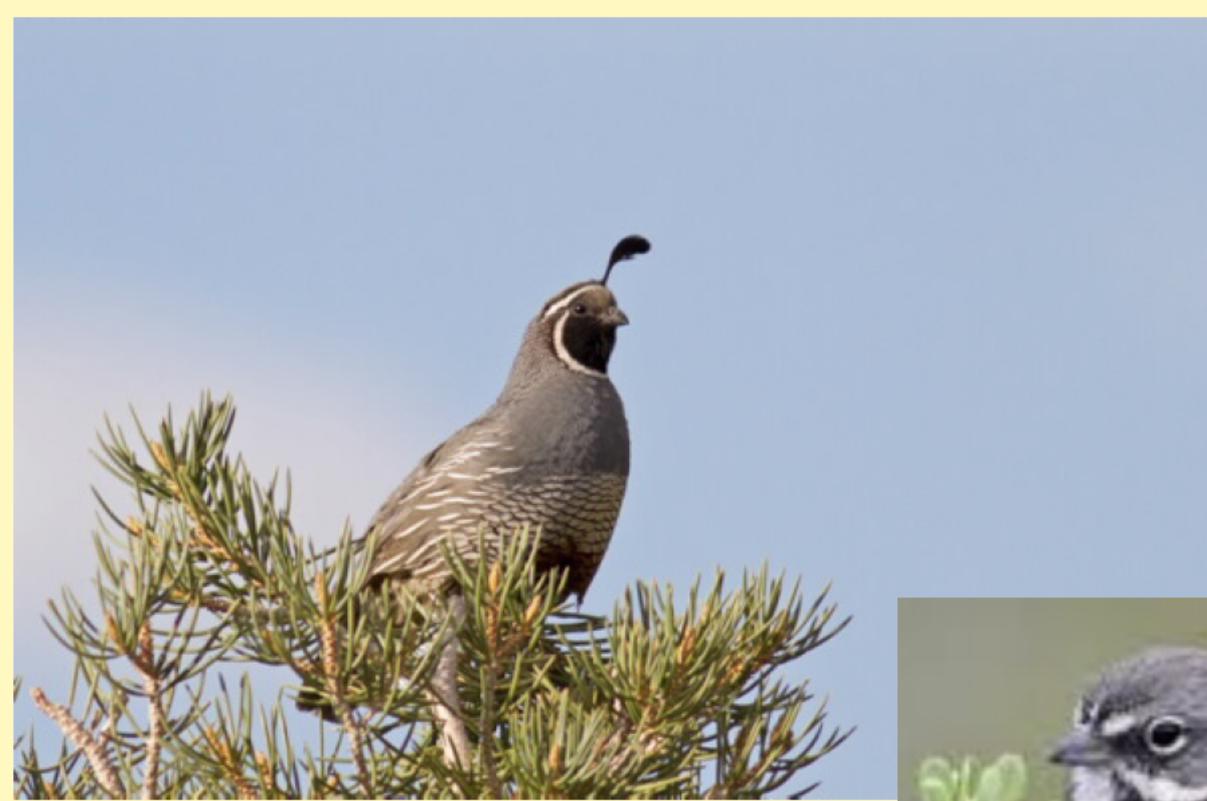
4. Assume the species will occur there

Is your behavior today a response to mean  
October temperature?



L.L. Bean

Increase (one standard deviation) in winter precipitation: 40% increase in relative abundance



California Quail • David Pavlik

Increase (one standard deviation) in spring temperature: 18% decrease in relative abundance



Bell's Sparrow • Cornell Lab of Ornithology

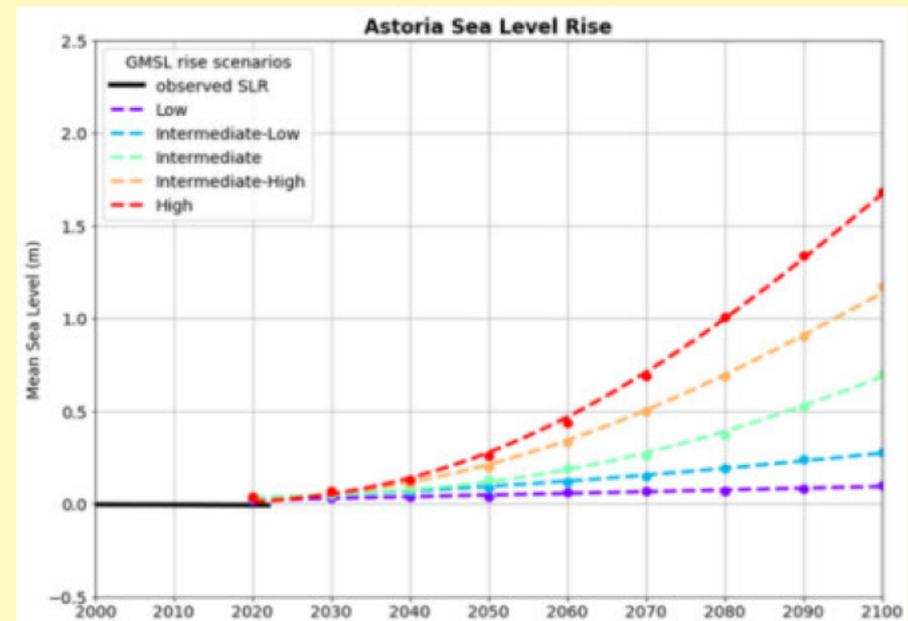
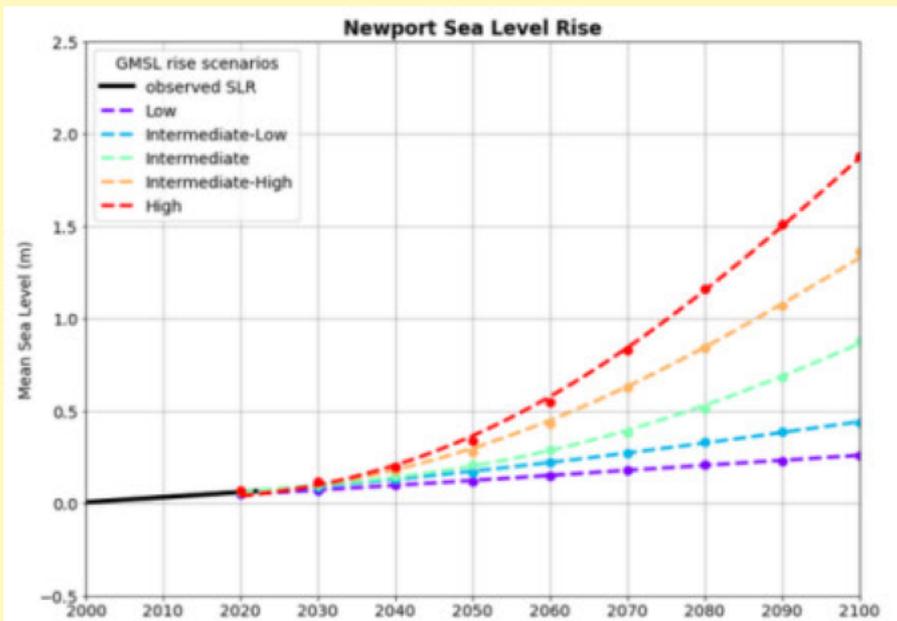
# Sea level rise



NOAA

- Global mean sea level: 7–8" increase since 1900
- Expected global increase of 1–4' by 2100
- As water level rises, flooding risk increases
- 2.1" rise roughly doubles the probability of exceeding the current 50-year flood level (2% chance per year)

Observed and projected regional sea-level rise at two tide gauges in Oregon demonstrate the variability in sea-level rise rates due to local tectonic and hydrodynamic processes



## INEQUITIES

Placeholder for discussion / example of social vulnerability and wildfire exposure: publication embargo until 20 September



Please stay in touch