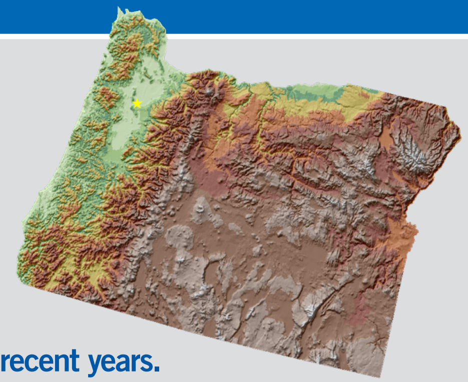
OREGON



Key Messages

Temperatures in Oregon have risen about 2.5°F since the beginning of the 20th century. Winter warming has been characterized by rising nighttime temperatures, with the number of very cold nights falling below average during recent years. Under a higher emissions pathway, historically unprecedented warming is projected during this century.

Snowpack plays a critical role in spring and summer water supplies. Projected rising temperatures will lead to more precipitation falling as rain instead of snow and earlier melting of the snowpack, both of which could have negative impacts on critical sectors.

Precipitation in Oregon varies greatly both across the state and throughout the year. Projected increases in winter precipitation and decreases in summer precipitation will change the dry season availability of water, leading to challenges for water management. Both the frequency and severity of wildfires are projected to increase in Oregon.

Oregon's climate varies widely from the eastern to western regions of the state. On the western side, temperatures are generally mild due to the Pacific Ocean's moderating effect. The Pacific Ocean also provides abundant moisture, causing frequent precipitation west of the Cascade Mountains from October to May. Temperatures in the central and eastern portions of the state exhibit a greater annual and diurnal range, and since the Cascades block the flow of moisture, it is much drier in the eastern part of the state. Oregon seldom experiences severe thunderstorms, compared to other states in the nation.

Temperatures in Oregon have risen about 2.5°F since the beginning of the 20th century, and temperatures in the 1990s and 2000s were higher than any other historical period (Figure 1). The year 2015 was the warmest year since records began in 1895 and 2014 was the 3rd warmest (1934 was the 2nd warmest). During the 2005–2009 and 2015–2020 periods, the state experienced the highest number of extremely hot days in the historical record (Figure 2). In addition to the overall trend of higher average temperatures, the state has experienced below average numbers of very cold nights since 1990 (Figure 3). The number of freezing days has been near or below average since 1995, and the 2000–2004 period had the lowest multiyear value (Figure 4a). The state rarely experiences warm nights due to the moderating effects of the Pacific Ocean in the west and low humidity east of the Cascades (Figure 4b).

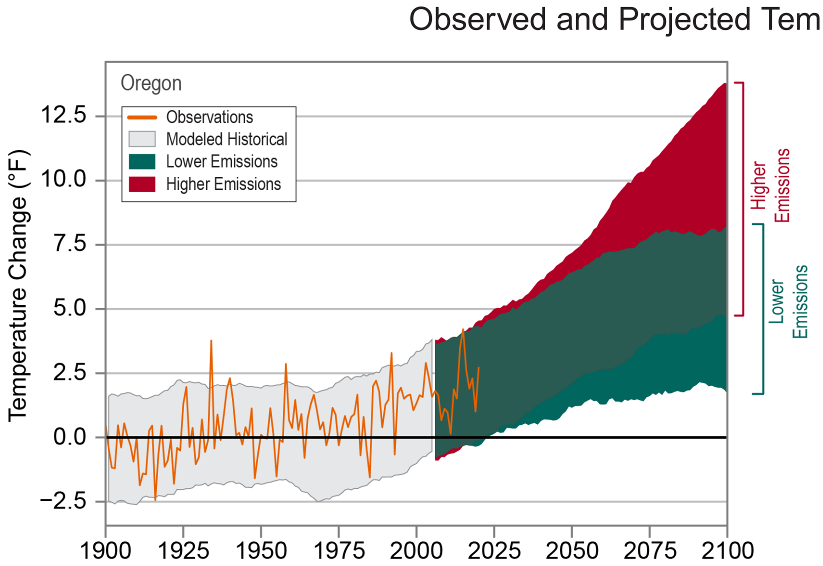


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Oregon. Observed data are for 1900–2020. Projected changes for 2006–2100 are from a suite of global climate model simulations for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). The shading indicates the range of projected temperature increases from all model simulations and provides a measure of uncertainty in projections. Temperatures in Oregon (orange line) have risen about 2.5°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during this century. Less warming is expected under a lower emissions future (the coldest end-of-century projections being about 1°F warmer than the historical average; green shading) and more warming under a higher emissions future (the hottest end-of-century projections being about 10°F warmer than the hottest year in the historical record; red shading). Sources: CISESS and NOAA NCEI.

Precipitation varies widely across the state and from year to year, with areas west of the Cascades also experiencing a large variation in rainfall amounts across the seasons. Portions of the Coast Range receive more than 100 inches of precipitation annually, while some of the desert areas in the eastern part of the state receive less than 10 inches. Statewide total annual precipitation has ranged from a low of about 22 inches in 1930 to a high of about 49 inches in 1996, and precipitation can fluctuate greatly between years. The driest consecutive 5-year interval was 1928–1932, with an annual average of 26.2 inches, and the wettest was 1995–1999, with an annual average of 39.5 inches (Figure 4c). Long-term periods of wet and dry spells can have critical impacts on water supplies.

Unlike many areas of the United States, Oregon has not experienced an upward trend in the frequency of extreme precipitation events (Figure 4d). The number of 2-inch extreme precipitation events has been highly variable over the historical record (since 1900) and mostly below normal since 2000. Since 1990, the 5-year periods with the highest and lowest frequency of extreme precipitation events (1995–1999 and 2000–2004, respectively) have occurred.

Under a higher emissions pathway, historically unprecedented warming is projected during this century (Figure 1). Even with the lower emissions pathway, statewide annual average temperatures are projected to most likely exceed historical record levels by the middle of this century. However, a large range of temperature increases is projected in both emission scenarios. In the lower emissions pathway, only a few projections are warmer than historical records (Figure 1).

Projected rising temperatures will raise the snow line—the average lowest elevation at which snow falls. **This will increase the likelihood that precipitation will fall as rain instead of snow, reducing water storage in the snowpack, particularly at lower elevations that are now on the margins of reliable snowpack accumulation.** While a few areas in eastern Oregon experience a primary or secondary peak in precipitation in May, most areas of Oregon receive the bulk of their annual precipitation during the winter months; thus, the snowpack at higher elevations is an important source of water during the drier summer months (Figure 5). Higher spring temperatures will also result in earlier melting of the snowpack, further decreasing water availability for critical sectors such as agriculture and recreation.

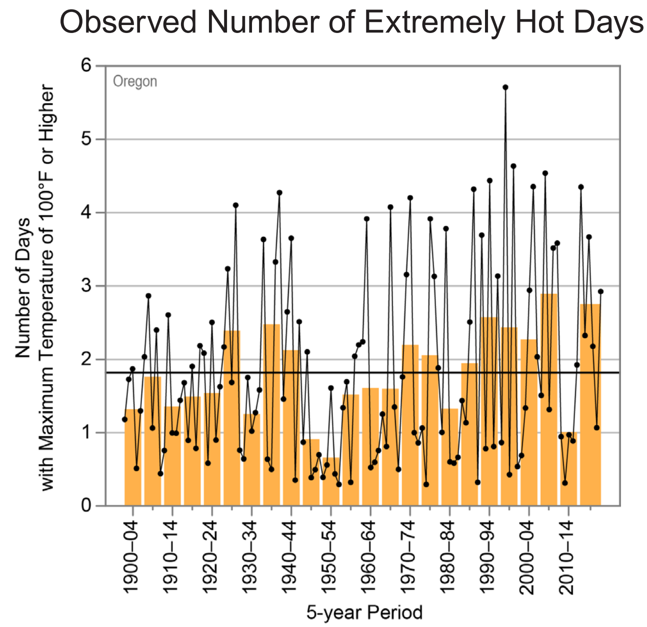


Figure 2: Observed annual number of extremely hot days (maximum temperature of 100°F or higher) for Oregon from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 1.8 days (note that the average for individual stations varies greatly because of the state's large elevation range). The number of extremely hot days has been mostly above the long-term average since the late 1980s, reaching historic peaks in 2005–2009 and 2015–2020. However, the number was well below average during the 2010–2014 period. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 14 long-term stations.

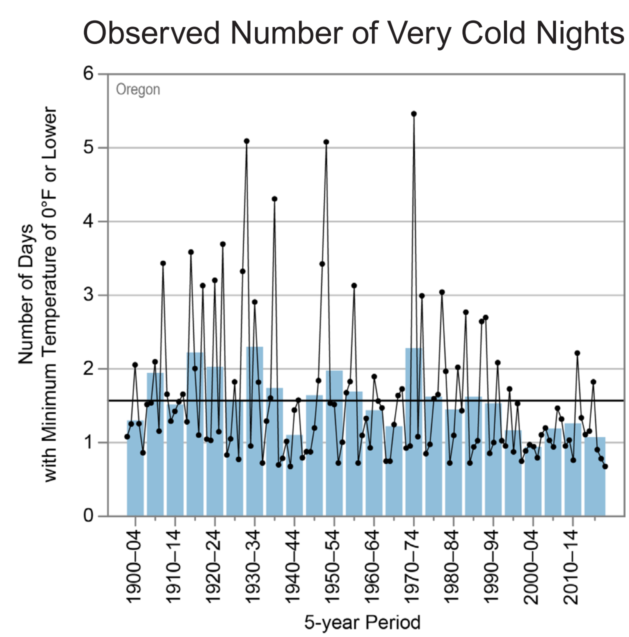


Figure 3: Observed annual number of very cold nights (minimum temperature of 0°F or lower) for Oregon from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year period). The horizontal black line shows the long-term (entire period) average of 1.6 nights (note that the average for individual stations varies greatly because of the state's large elevation range). Since 1995, Oregon has experienced a below average number of very cold nights, indicative of the winter warming occurring in the region. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 14 long-term stations.

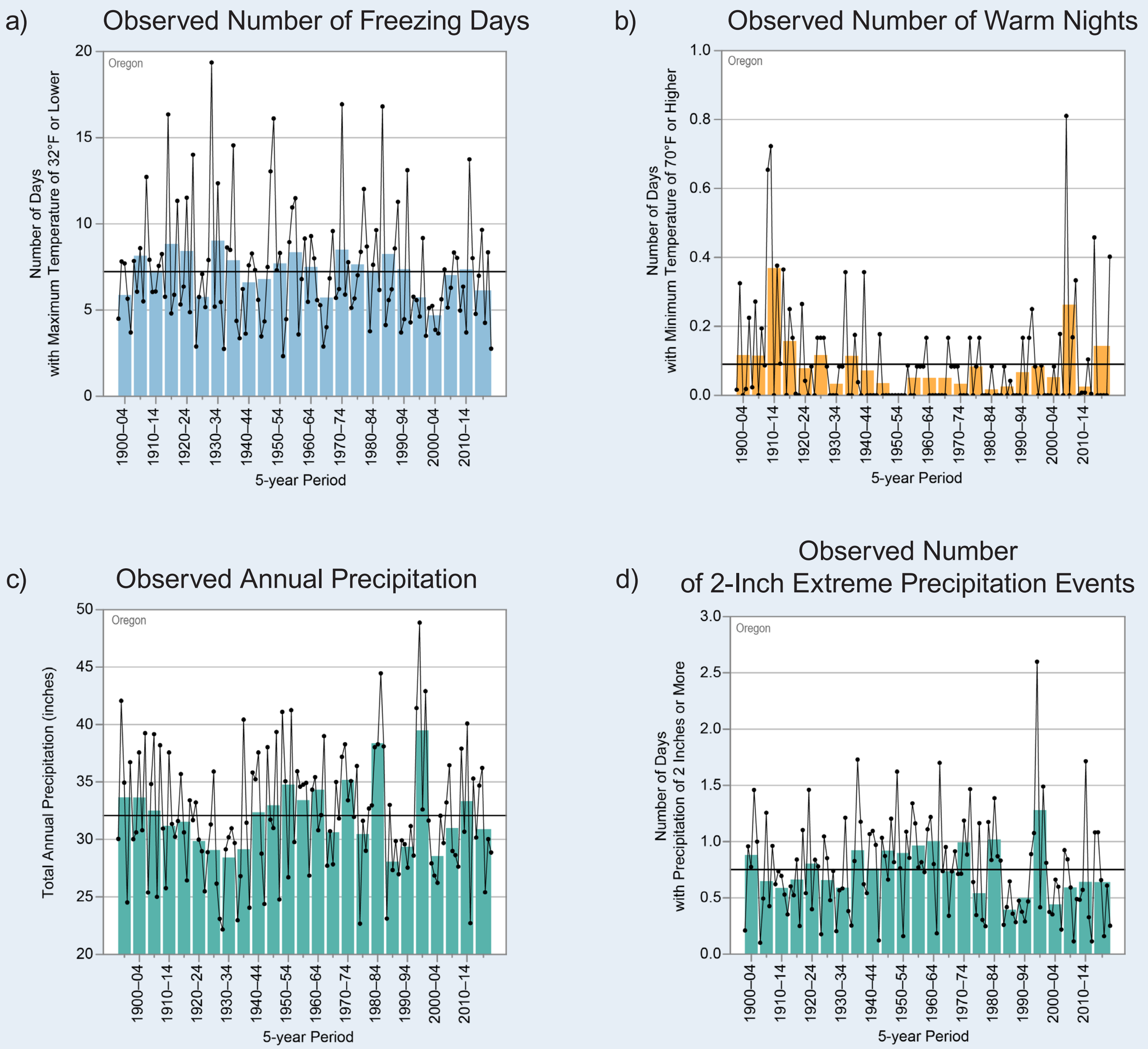


Figure 4: Observed (a) annual number of freezing days (maximum temperature of 32°F or lower), (b) annual number of warm nights (minimum temperature of 70°F or higher), (c) total annual precipitation, and (d) 2-inch extreme precipitation events (days with precipitation of 2 inches or more) for Oregon from (a, b, d) 1900 to 2020 and (c) 1895 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black lines show the long-term (entire period) averages: (a) 7.2 days, (b) 0.1 days, (c) 32.1 inches, (d) 0.8 days. (Note that for Figures 4a, 4b, and 4d, the average for individual reporting stations varies greatly because of the state's large elevation range.) Since 1995, the number of freezing days has been mostly below average. The observed number of warm nights does not exhibit a trend, although the 2005–2009 period experienced the second highest number on record. Annual precipitation varies widely and was below average during the 2015–2020 period. A typical reporting station experiences a 2-inch extreme precipitation event every 1 to 2 years on average. The last three decades have seen 5-year periods with both the highest (1995–1999) and lowest (2000–2004) frequency of extreme precipitation events. Sources: CISESS and NOAA NCEI. Data: (a, b) GHCN-Daily from 14 long-term stations; (c) nClimDiv; (d) GHCN-Daily from 16 long-term stations.

Although projections of overall annual precipitation are uncertain, winter precipitation is projected to increase (Figure 6) **and summer precipitation is projected to decrease.** More precipitation is expected to fall as rain instead of snow, which will decrease the amount of water from snowmelt available during the dry season and pose challenges for water management. These changes are of particular concern for areas that rely on hydroelectric power and regions that depend on the availability of irrigation water from snowmelt-fed basins. For example, the 2015 snow drought caused hundreds of millions of dollars in crop losses and negatively impacted local fish populations.

Wildfires are also of particular concern for the state and have become more severe and costly in recent years. The Long Draw fire in 2012 was the state's largest wildfire since the 1860s, burning more than half a million acres in southeastern Oregon. The combined Labor Day fires of 2020 were even larger, resulting in historic levels of wildfire damage with more than 2,000 structures burned. **The combination of drier summers, higher temperatures, and earlier melting of the snowpack is projected to increase the frequency and severity of wildfires.**

Increasing temperatures raise concerns for sea level rise in coastal areas. Since 1900, global average sea level has risen by about 7–8 inches. It is projected to rise another 1–8 feet, with a likely range of 1–4 feet, by 2100 as a result of both past and future emissions from human activities (Figure 7). Due to the movement of tectonic plates on the ocean floors, the Oregon coast is rising, a phenomenon known as "uplift." In some parts of the Oregon coast, the uplift is exceeding the rate of sea level rise; consequently, sea level has dropped in these locations. However, by the middle of this century, the rate of sea level rise is projected to exceed the rate of uplift along the entire Oregon coast, resulting in sea level rise for all locations. Nuisance floods are events in which water levels exceed the local threshold (set by NOAA's National Weather Service) for minor impacts. These events can damage infrastructure, cause road closures, and overwhelm storm drains. Nuisance flooding events in Oregon are likely to occur more frequently as global and local sea levels continue to rise.

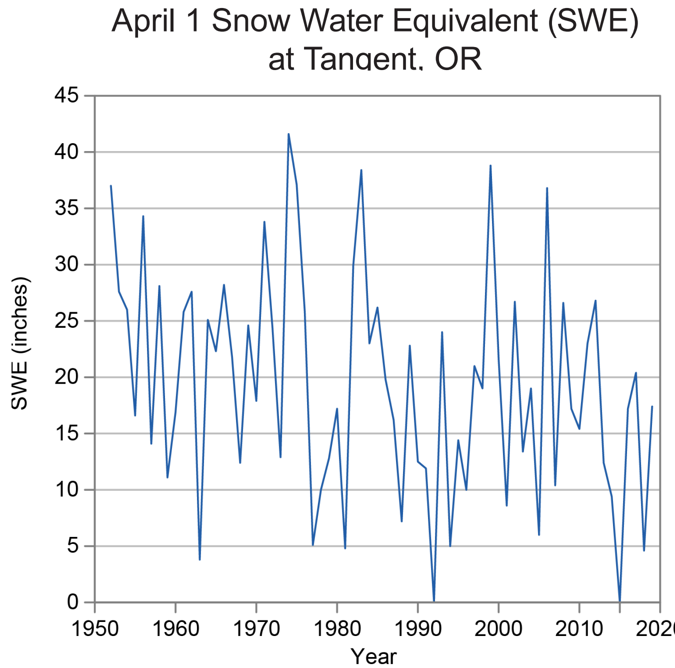


Figure 5: Variations in the annual April 1 snow water equivalent (SWE) at the Tangent snow course site, located near Bend, Oregon, from 1952 to 2020. SWE, the amount of water contained within the snowpack, is highly variable from year to year and there is an overall downward trend. There was no snowpack in 2015 due to unusually low precipitation and warm temperatures during the first three months of the year. Source: NRCS NWCC.

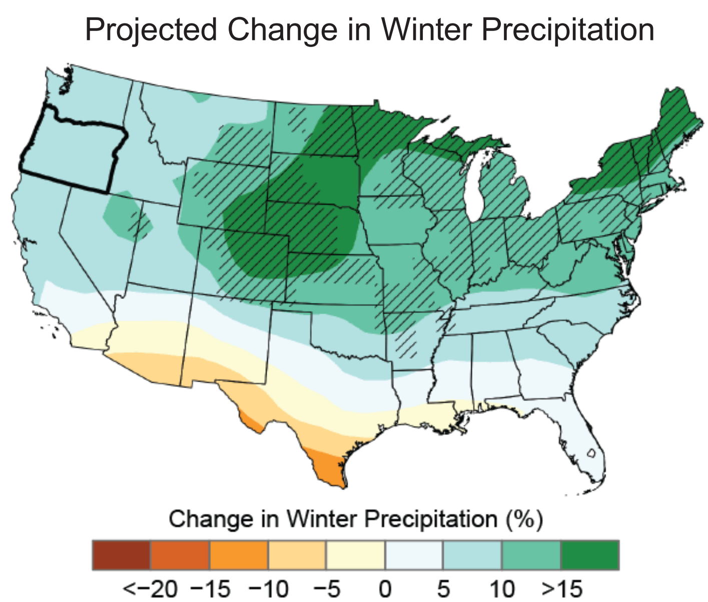


Figure 6: Projected changes in total winter (December–February) precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. Precipitation in the winter is projected to increase across the entire state of Oregon. Sources: CISESS and NEMAC. Data: CMIP5.

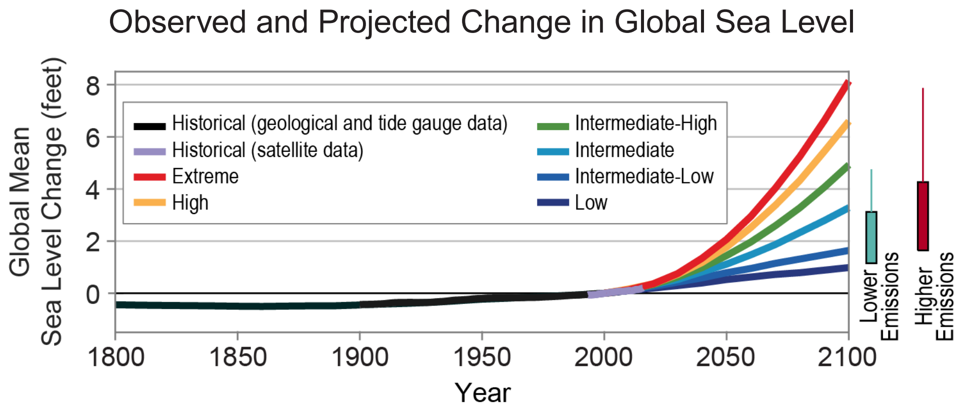


Figure 7: Global mean sea level (GMSL) change from 1800 to 2100. Projections include the six U.S. Interagency Sea Level Rise Task Force GMSL scenarios (Low, navy blue; Intermediate-Low, royal blue; Intermediate, cyan; Intermediate-High, green; High, orange; and Extreme, red curves) relative to historical geological, tide gauge, and satellite altimeter GMSL reconstructions from 1800–2015 (black and magenta lines) and the very likely ranges in 2100 under both lower and higher emissions futures (teal and dark red boxes). Global sea level rise projections range from 1 to 8 feet by 2100, with a likely range of 1 to 4 feet. Source: adapted from Sweet et al. 2017.

Technical details on observations and projections are available online at https://statesummaries.ncics.org/technicaldetails.

WWW.NCEI.NOAA.GOV | HTTPS://STATESUMMARIES.NCICS.ORG/CHAPTER/OR/ | LEAD AUTHORS: REBEKAH FRANKSON, KENNETH E. KUNKEL
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