

# AVERAGE TEMPERATURES HAVE RISEN SINCE 1980

# WARMER WINTER NIGHTS MEAN MORE RAIN, LESS SNOW

Jackson Hole's climate has been changing. NASA reports that global average temperatures in 2023 were  $1.8^{\circ}$ F ( $1.0^{\circ}$  C) higher than the average from 1950-1981, but local changes are not always the same as global averages.

Jackson Hole is unique. Our weather has tracked the global trends in surprising ways that is already affecting this iconic landscape. The Nature Conservancy's Wildflower Watch, building on the pioneering observations of Frank Craighead, has found that flowers in Jackson Hole are blooming three weeks earlier now than in the 1970s. Our weather stations help to show why.

# What trends do Jackson Hole weather stations show?

Weather stations in Jackson, Moran, and Moose show that greenhouse gases have limited the cooling that we usually feel once the Sun goes down. The gases warm the Earth by preventing heat from escaping into space, particularly at night. Daytime high temperatures have been variable because of factors like cloud cover and damp soils, but nighttime low temperatures have been rising.

In Jackson, most years since 1990 have seen above average nighttime low temperatures, even though daytime temperatures have been below average since the early 2000s.

Daytime warming in Moose confirms that the recent pattern of cool days only affects some places, but nighttime warming affects the whole region. Different color lines on the graphs below show the average high and low temperatures from each of these stations.



#### Figure 1.

Yearly average maximum (daytime) and minimum (nighttime) temperatures for the three Jackson Hole stations show weather daytime variability, but longterm warming at night.

The graphs show the annual departure from the long-term average across all years.



Center for Climate, Water, and People







# Why do nighttime temperatures matter?

Nighttime warming also affects the surrounding region. Temperatures in Bondurant, Darwin Ranch, Driggs, Alta and the Snake River station north of Jackson Lake have climbed at least as much as in Jackson Hole.

The low temperatures that determine the likelihood of frost or dew have been rising year-round, but they have risen fastest in Spring. Spring nights have warmed by 3°F (1.6°C) since 1950 in Jackson Hole and 5.2°F (2.9°C) in surrounding areas. Truly crisp Spring nights and early mornings have been infrequent since the 1990s.

The loss of overnight cooling creates other significant risks. Warm nights allow Spring and Fall precipitation to fall as rain instead of snow. At the same time, snow on the ground does not refreeze overnight as often as in the past. Together these patterns reduce the Spring snowpack and cause snowmelt to occur weeks earlier than in past decades, which is why Spring flowers now bloom earlier.

The shift also lowers the flow of water into streams and rivers later in the summer. The low flows combine with warm nights to warm the stream water, favoring algal blooms and harming fish like trout. Warm nights also increase wildfire risks by limiting the dew and frost critical to keeping forest fuels moist.



## How do we know?

The U.S. Historical Climatology Network, a subset of NOAA's weather station network, tracks daily temperatures around the country. The most consistent measurements began in 1948 after World War II, but some stations have records extending to 1920 or earlier. Tracking the changes using these publicly available measurements can help anticipate changes and risks to come.

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