PublicService Commission <psc@utah.gov>

Comment to IRP Docket 25-035-22

1 message

Joan Entwistle <joan.entwistle@gmail.com> Wed, Nov 12, 2025 at 8:20 PM
To: psc@utah.gov

To the Commissioners:
I recently commented at the public meeting on October 29 on the Rocky Mountain Power 2025 IRP.
Attached the documents that I referenced in my comment:
Hotaling, S. & Becker, K. M. L., (2024). *Recent climate change in Utah*, 18070-2023 [Fact sheet]. Utah State University Extension.
Hotaling, S. & Becker, K. M. L., Narine L.K., Ulrich-Schad, J. D., McCann, R., & Howe, P. D.,(2025). *What do Utahns think about global warming and climate change?* [Fact sheet]. Utah State University Extension.

Thank you for the opportunity to comment on this proceeding.

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2 attachments

Recent Climate Change in Utah 1870-2023.pdf
1528K

What Do Utahns Think About Global Warming and Climate Change_.pdf
1267K

Climate Resiliency FACT SHEET Extension UtahStateUniversity

Recent Climate Change in Utah, 1870–2023

Scott Hotaling, Ph.D.[1,2], Kendall Becker, Ph.D.[1,2]

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Climate change is impacting Utah. Forty-five years of temperature data show that Utah is steadily warming which, in turn, is driving declines in winter snowpack, shifting the timing and amount of available water, increasing fire risk, and causing ecological change. This link between warming and natural resources stems from the fundamental connection in mountain regions between temperature, precipitation, and water supply. In winter, Utah receives a considerable amount of precipitation, which primarily falls as snow. Snowpack seasonally accumulates at higher elevations, then melts in spring and summer. By acting as a natural water reservoir that is seasonally replenished, snowpack buffers the landscape against dry conditions. Snow cover also acts as a large-scale control on plant growth and animal movement, influencing local ecology. Thus, current and projected shifts in Utah's temperature and precipitation regimes due to climate change will continue to impact its water supply, wildfire risk, and ecosystems.

Utah's snowpack acts as a natural water reservoir, accumulating in winter and melting in spring and summer.

Temperature

Ambient temperatures strongly influence many aspects of modern life, natural resources, and ecosystems. In a dry state like Utah, annual and seasonal temperatures are closely tied to water demand and availability. Warmer summers increase demand for water. Warmer winters cause more precipitation to fall as rain instead of snow, resulting in a shallower snowpack that contains less water and melts out earlier. Together, warmer summers and winters exacerbate water supply issues, particularly in late summer when water is most needed. Over the past four decades, the annual mean temperature in Utah has increased by around 0.4 °F per decade (Figure 1). This trend is driven by rising summer temperatures and is projected to continue; winter temperatures are also projected to increase (Hegewisch & Abatzoglou, n.d.-a, n.d.-b).

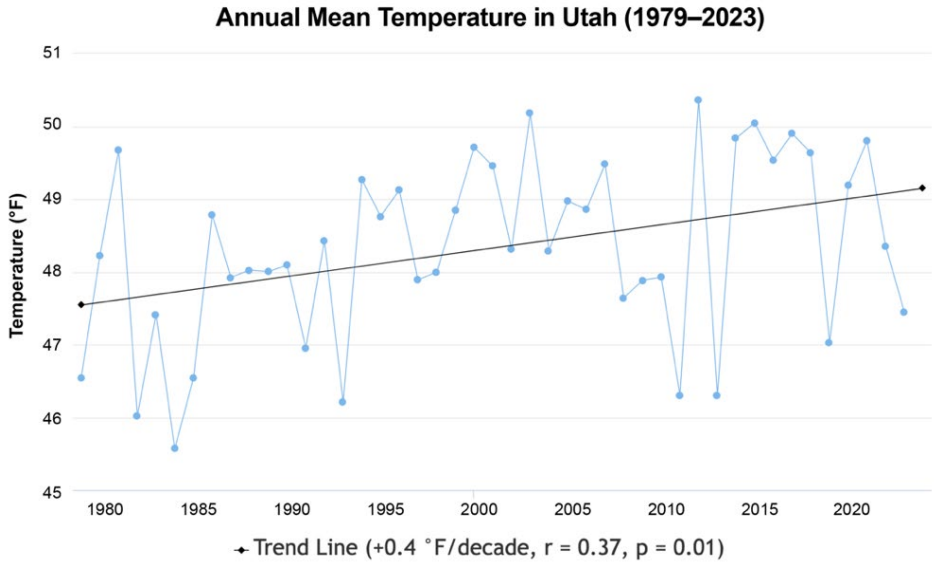

Figure 1. *Annual Mean Temperature in Utah Is Increasing, 1979–2023*

Source: Hegewisch & Abatzoglou, n.d.-a., CC BY 4.0

Summer temperatures — In Utah, July temperatures are rising faster than any other month, increasing by nearly 1 °F per decade since 1979 (Figure 2). This warming parallels global patterns of increasing temperatures caused by anthropogenic greenhouse gas emissions, particularly carbon dioxide (Crowley, 2000). Because future greenhouse gas emissions depend on policies and actions, scientists consider a range of future greenhouse gas concentration scenarios to predict future climates. Two common scenarios are RCP 4.5 and RCP 8.5, where RCP 4.5 is a "lower emissions" scenario based on a future where the concentration of greenhouse gases in the atmosphere stabilizes before 2100. RCP 8.5 is a "higher emissions" scenario where greenhouse gas concentrations continually increase. Looking ahead to 2100, under RCP 4.5 and RCP 8.5, summer temperatures in Utah are expected to rise by 3.4 °F and 9.0 °F, respectively (Figure 3).

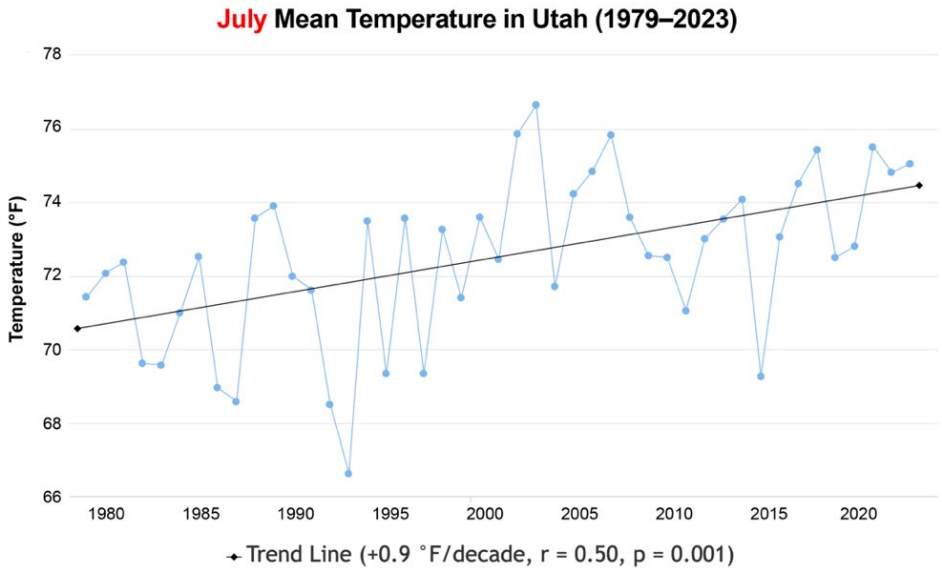

Figure 2. *July Mean Temperature in Utah Is Increasing, 1979–2023*

Source: Hegewisch & Abatzoglou, n.d.-a., CC BY 4.0

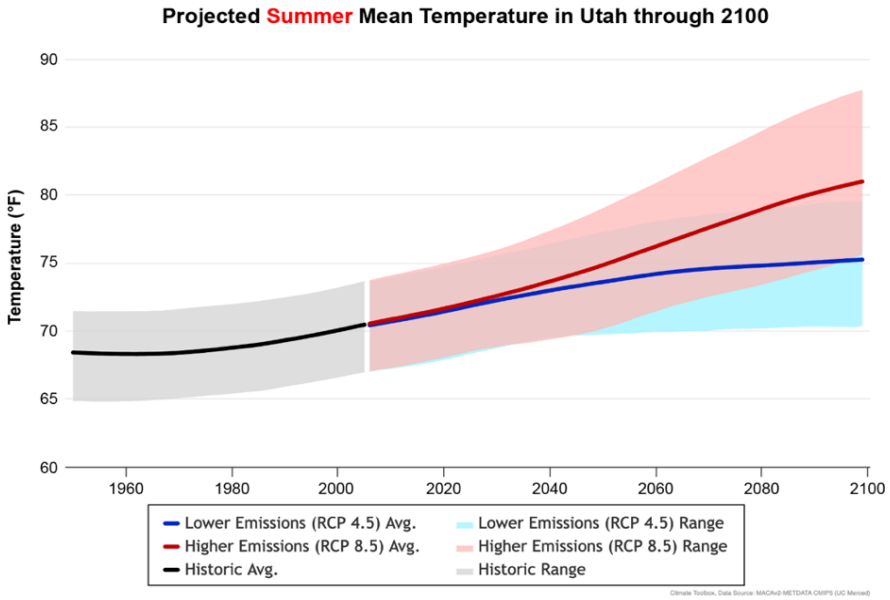

Figure 3. *Summer Mean Temperature in Utah Is Projected to Rise Through 2100 Under "Lower" (RCP 4.5) and "Higher" (RCP 8.5) Emissions Scenarios*

Note. RCP refers to Representative Concentration Pathway; 4.5 and 8.5 refer to the warming influence expected in 2100 from the projected greenhouse gas concentrations.

Source: Hegewisch & Abatzoglou, n.d.-b., CC BY 4.0

Winter temperatures — Temperatures in winter also appear to be rising, though not as rapidly as summer temperatures. The trend for January mean temperature in Utah indicates an increase of about 0.7 °F per decade since 1979, but these data are more variable, and the trend is not statistically significant (*P* = 0.12). More warming, however, is anticipated. By 2100, under the RCP 4.5 and RCP 8.5 emissions scenarios, winter temperatures in Utah are expected to rise by 3.8 °F and 8.2 °F, respectively (Figure 4).

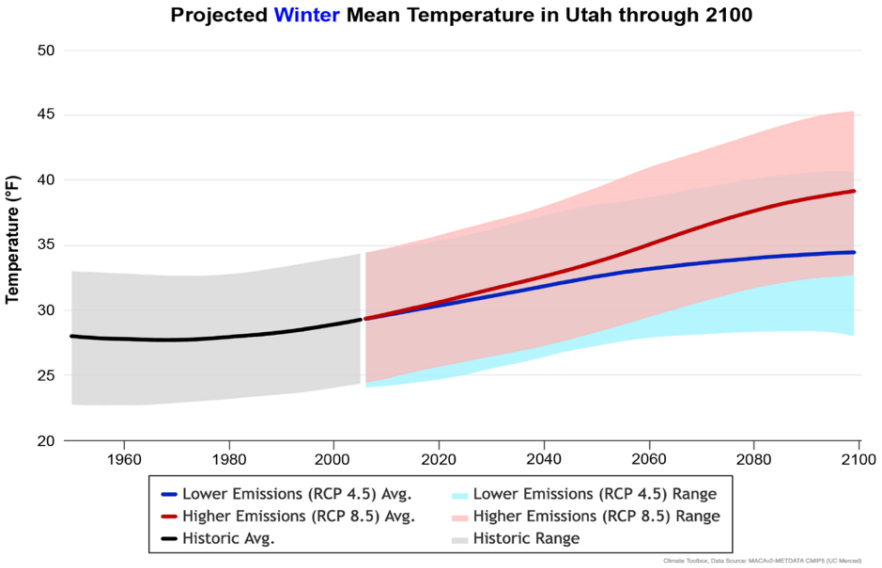

Figure 4. *Winter Mean Temperature in Utah is Projected to Rise Through 2100 Under "Lower" (RCP 4.5) and "Higher" (RCP 8.5) Emissions Scenarios*

Source: Hegewisch & Abatzoglou, n.d.-b., CC BY 4.0

Precipitation and Snowpack

The amount of winter precipitation falling in Utah has not meaningfully changed in the last 40 years, nor is it projected to (Figure 5; Hegewisch & Abatzoglou, n.d.-b). However, rising temperatures are impacting Utah's water supply by increasing the percentage of winter precipitation falling as rain rather than snow. Between 1960 and 2010, the proportion of winter precipitation falling as snow declined by about 9% (Gillies et al., 2012), contributing to a 16% decline in peak snowpack statewide from 1979 to 2023 (Figure 6, top). Here, snowpack refers to snow water equivalent—a standard measure that corresponds to the amount of liquid water the snow would yield when melted.

Projections indicate that by 2062, Utah will start seeing years where seasonal snowpack does not accumulate.

The timing of snowpack accumulation is also changing. Since 1979, the date of peak snowpack in Utah has advanced by roughly 9 days (Figure 6, bottom). Looking ahead, projections indicate that by 2062, the Upper Colorado Basin, which includes much of eastern Utah, will begin seeing years where seasonal snowpack does not accumulate, i.e., less than 10% of the current typical spring snow water equivalent is expected (Siirila-Woodburn et al., 2021). This lack of snowpack will remove the massive natural, frozen reservoir that steadily melts, filling lakes and keeping streams flowing in late summer.

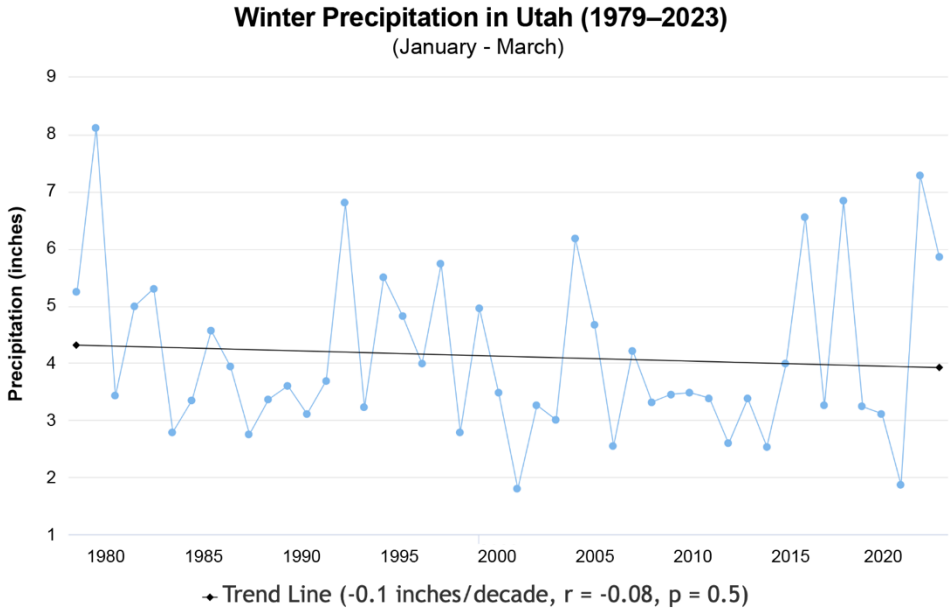

Figure 5. *Winter Precipitation in Utah Is Not Significantly Increasing or Decreasing, 1979–2023*

Source: Hegewisch & Abatzoglou, n.d.-a., CC BY 4.0

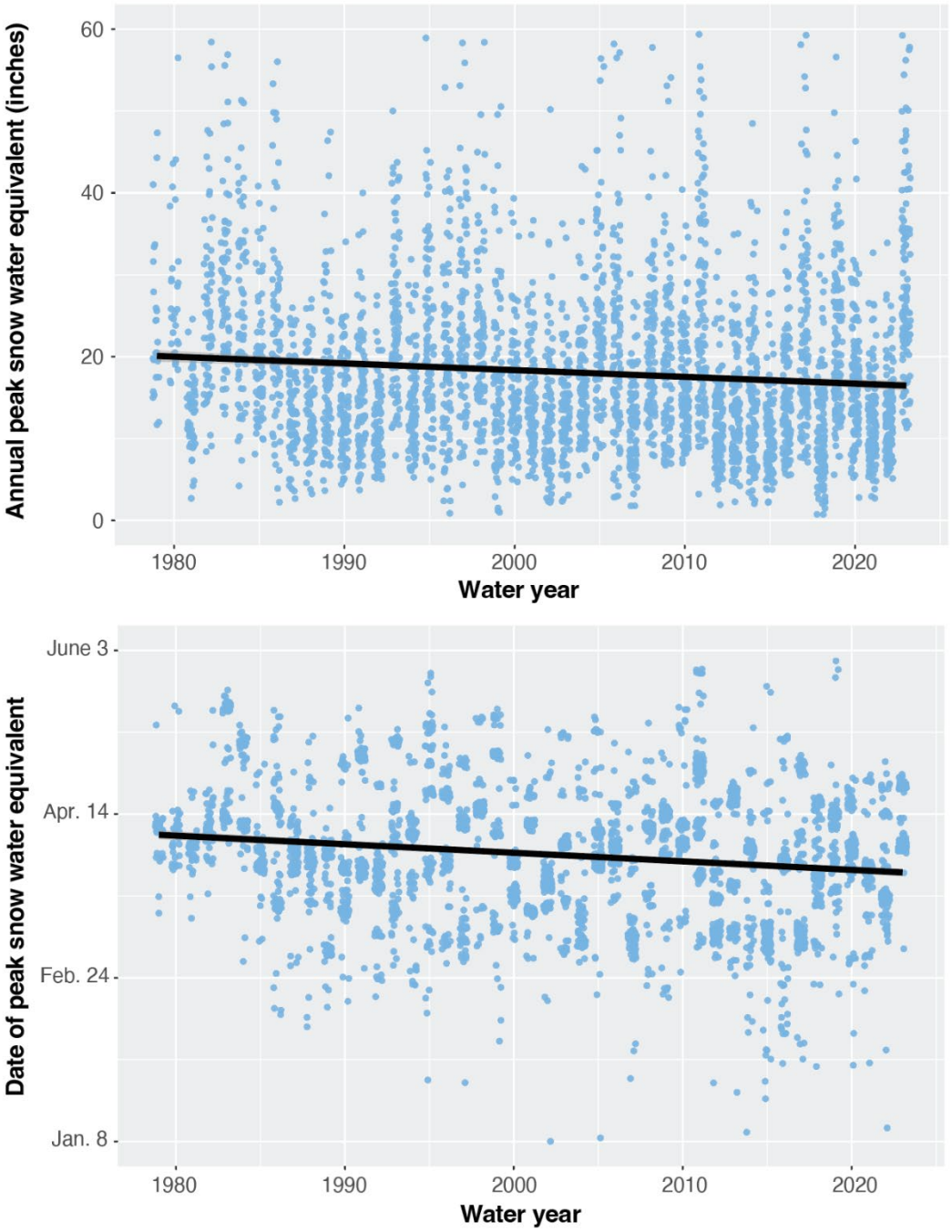

Figure 6. *(top) Peak Snowpack in Utah Is Declining, 1979–2023, and (bottom) Date of Peak Snowpack in Utah Is Earlier, 1979–2023*

Notes. A water year begins on October 1 of the previous year and ends on September 30 of the named year. Each circle represents one water year of data for a SNOpack TELemetry (SNOTEL) station in Utah.

Data sources: Natural Resource Conservation Service (NRCS) and National Water and Climate Center, n.d.; NRCS, n.d.

Streamflow

In mountain regions, summer streamflows are linked to the amount of snowpack that accumulated during the preceding winter and the timing of snowmelt. Thus, reduced peak snowpack and shifts toward an earlier peak—a response to warmer temperatures—can change stream baseflows. For example, August discharge in northern Utah's Logan River has declined since 1979 (Figure 7). While this decline has not been directly attributed to climate change, it parallels expectations that consider regional temperature increases and snowpack declines during this period (Figures 2 and 6).

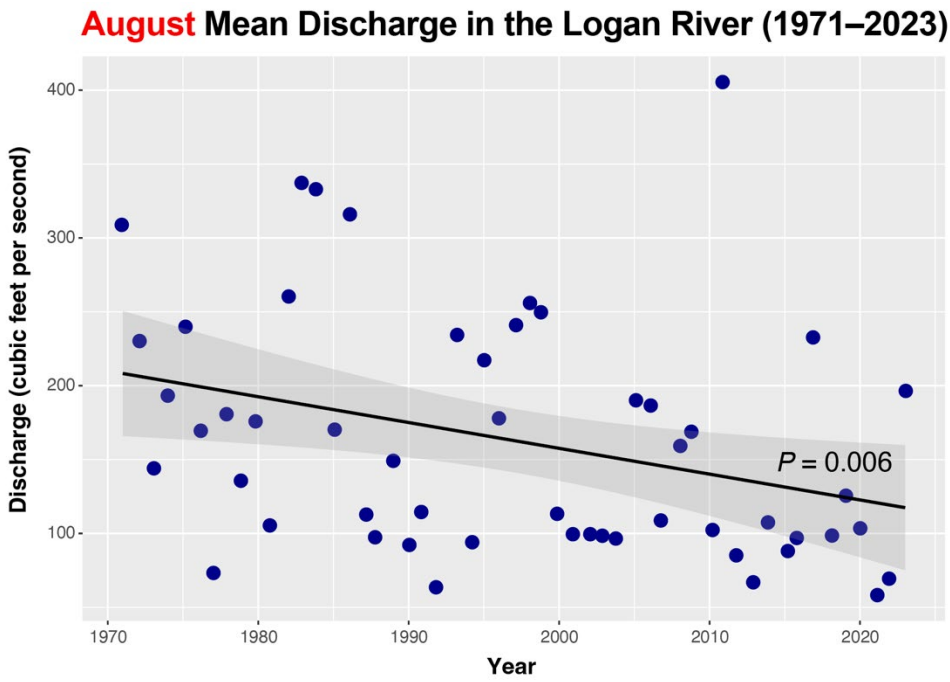

Figure 7. *August Mean Discharge in Utah's Logan River Is Declining, 1971–2023*

Data source: U.S. Geological Survey, n.d.

The Colorado River (Figure 8)—one of the most iconic and influential rivers in the American West—is also impacted by climate change. From 1916 to 2014, streamflow in the Upper Colorado River Basin, which includes eastern Utah, declined by over 16% despite a slight increase in precipitation over the same period (Xiao et al., 2018). Over half of the decline (about 9%) was directly attributed to warming in the region.

Figure 8. *The Colorado River Flowing Through Glen Canyon*

Photo credit: Adrille, 2007, CC BY-SA 3.0

In the central Rocky Mountains, an analysis of August discharge for 153 streams from 1950 to 2008 found that 89% of all nonregulated streams are experiencing declines. Furthermore, "pristine" sites—those without

diversions or land-use change during the study period—are experiencing the most rapid decline, with an average 23% decline in August discharge (Leppi et al., 2012). Reduced streamflow can transform streams from perennial, where they flow all year, to ephemeral, where they only flow intermittently, thereby altering the communities of plants, animals, and other organisms the streams can support.

Wildfire

In addition to reducing water availability, higher temperatures affect fire risk by increasing vapor pressure deficit, which draws moisture out of fuel, making it more flammable (Figure 9). Across the western United States, contemporary climate change accounted for about 55% of the observed increase in fuel aridity from 1979 to 2015 (Abatzoglou & Williams, 2016). In July 2007, the largest wildfire in Utah's recent history occurred—the Milford Flat Fire. The fire was ignited by lightning and, in less than two weeks, burned about 363,000 acres. As temperatures continue to rise and fuel becomes drier, the frequency and severity of large fires in Utah will likely increase. Changes in fire regime affect habitat by altering the structure and type of vegetation (Agee, 1993).

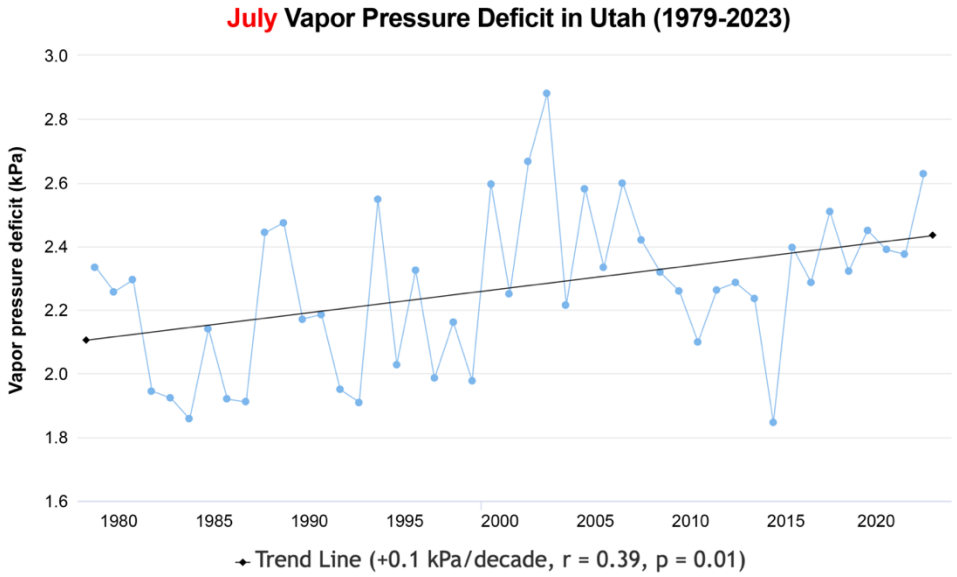

Figure 9. *July Vapor Pressure Deficit in Utah Is Increasing, 1979–2023*

Source: Hegewisch & Abatzoglou, n.d.-a, CC BY 4.0

Ecological Change

Climate change is also driving ecological changes in Utah; however, given the long timescale of the change and the difficulty of collecting long-term data, specific examples for Utah are rare. Using repeat photographs spanning 131 years (1870–2001), Munroe (2003) documented a roughly 100-meter uphill shift of tree line in the Uinta Mountains (Figure 10). When tree lines shift uphill, which can occur in response to climate warming, alpine habitats shrink. Warmer temperatures can also threaten species diversity. In northwestern Montana, warming mountain streams are driving a rise in hybridization between non-native rainbow trout and native westslope cutthroat trout (Mulhfeld et al., 2014). Given the similar dynamics between non-native rainbow trout and Bonneville cutthroat trout in Utah (e.g., Meyer et al., 2022), climate change may also contribute to hybridization of these species in local fisheries.

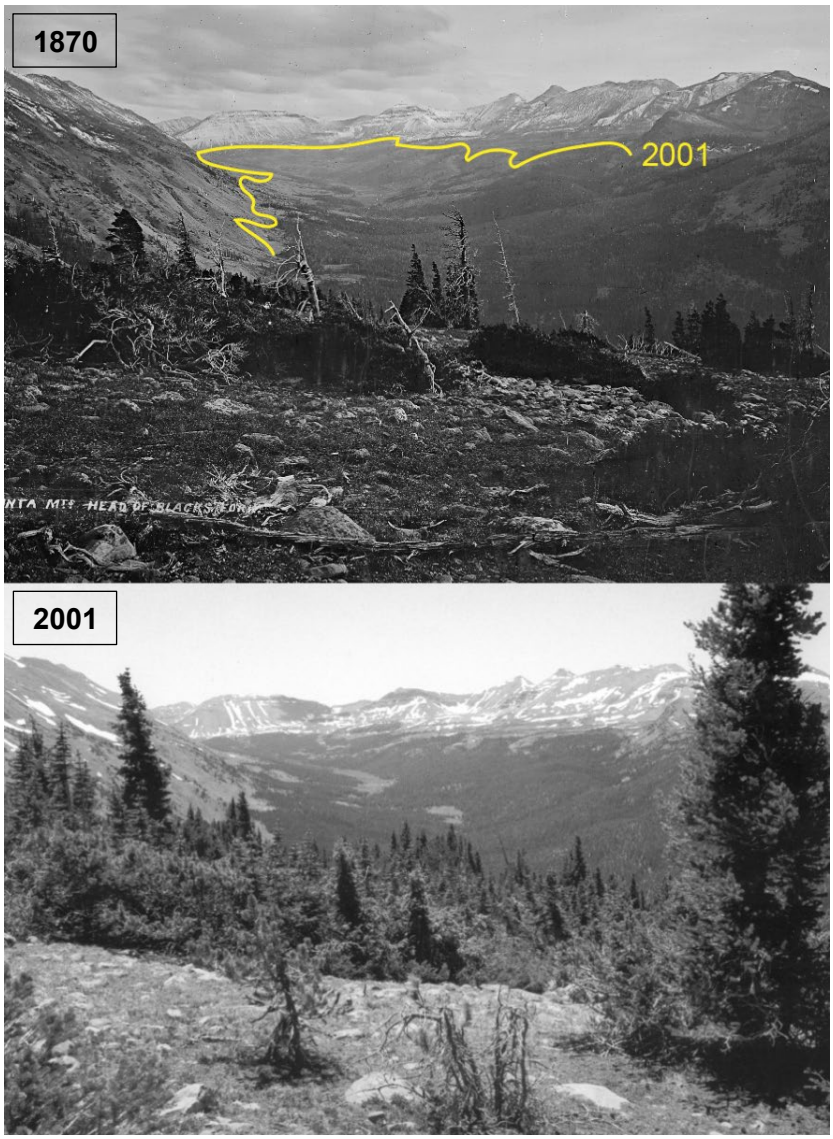

Figure 10. *(top) Historical (1870) and (bottom) Modern (2001) Repeat Photographs of the Little East Fork Blacks Fork, Uinta Mountains*

Note. The yellow line on the 1870 photograph shows that tree line moved 100 m uphill by 2001, reducing alpine habitat.

Photo credits: (top) Jackson, W. H., 1870, and (bottom) Munroe, J. S., 2003, used with permission

Generally, higher temperatures, declining snowpack, and reduced late-summer streamflow in Utah will alter the mosaic of existing habitats. For instance, these conditions will likely extend the Great Basin desert to higher elevations and expand its geographic range. At the same time, habitats above tree line will contract as downslope tree species shift uphill. Long-term data sets are needed to track these changes and their effects.

Acknowledgments

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August 2024
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Climate Resiliency FACT SHEET Extension UtahStateUniversity

What Do Utahns Think About Global Warming and Climate Change?

Scott Hotaling[1], Kendall M. L. Becker[1], Lendel K. Narine[2], Jessica D. Ulrich-Schad[3], Roslynn McCann[4], Peter D. Howe[4]

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Anthropogenic climate change—long-term changes in temperature and weather patterns driven primarily by human activities since the 1800s—is the most pressing economic, social, and environmental issue in the 21st century. Addressing climate change requires coordinated efforts to mitigate its causes and adapt to changes at local, regional, national, and global scales (U.S. Global Change Research Program, 2023). However, the degree to which successful policies and actions can be implemented depends, in part, on public opinion.

In the western United States, climate change is driving snowpack decline (Siirila-Woodburn et al., 2021), which puts Utah's water supply at risk. From 2010–2020, Utah was the fastest-growing state in the nation (Kem C. Gardner Policy Institute, 2021). It is also one of the driest, with a population that relies heavily on a declining seasonal snowpack for its drinking water, irrigation, and recreation (Hotaling & Becker, 2024). The degree of climate impacts in Utah will depend on residents' perceptions of climate change and support for implementing policies to help the state adapt to warmer temperatures, more extreme weather events, and other associated changes. Here, we integrate multiple data sources to summarize the status and trends of Utahns' opinions on climate change.

Highlights

- In Utah, there is consensus (68%) that global warming is happening, and the strength of this consensus has been steadily rising since 2010.
- Utahns' support for policy actions that would mitigate global warming is even higher.
- For instance, 78% of Utahns support funding research into renewable energy.
- 71% believe tax rebates should be available for people who purchase energy-efficient vehicles or solar panels.
- 70% believe CO_2 should be regulated as a pollutant.

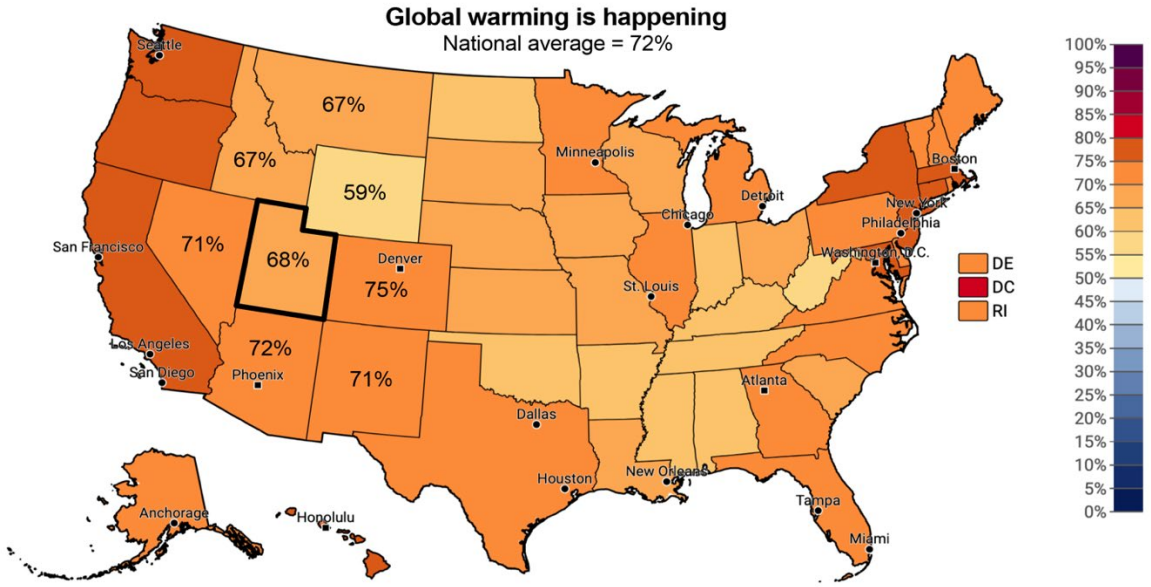

Figure 1. *Percentages of People in Utah and Surrounding States That Agreed With the Statement "Global Warming Is Happening" in 2023 (based on national survey data)*

Source: Marlon et al., 2025

Recent Climate Change in Utah: Water and Snowpack

Utah is a chronically dry state in the western U.S. that relies on a declining seasonal snowpack for the bulk of its water supply (Hotaling & Becker, 2024). While these factors pose environmental challenges for the state, they also make it easier for the effects of global warming and climate change to be directly observed. For instance, the amount of peak snowpack in Utah has declined by 16% since 1979 when large-scale monitoring was first initiated in the western U.S. (Hotaling & Becker, 2024). Less snow means less water is available in late summer for agriculture, household use, and the Great Salt Lake. The decline in snowpack is already reducing revenue for the state's approximately $2 billion ski industry (Wilkins et al., 2021). Thus, global warming is changing Utah's climate in ways that impact water supply and economic well-being. Looking ahead, Utahns' beliefs about global warming and climate change will influence state- and community-level policies as well as individual actions to mitigate global warming and adapt to new and changing conditions (Figure 1).

Global Warming Versus Climate Change: A Key Distinction

Climate change refers to long-term changes in temperature and weather patterns worldwide. Global warming refers specifically to the earth's surface getting warmer, which is caused by increasing amounts of greenhouse gases, such as carbon dioxide (CO_2) and methane, in the atmosphere. Global warming directly causes the many shifts in weather patterns (e.g., extreme drought and precipitation events) that constitute climate change. Here, we focus on opinions about global warming, the root cause of climate change.

The Data

To summarize Utahns' opinions about global warming, we used three data sets:

1. **Yale Climate Opinion Maps (*N* > 31,000; 2010–2023)**, hereafter "**Yale survey**." This data set provides estimates of climate change beliefs, perceptions, and policy preferences at national, state, and county scales for the U.S. The estimates are derived from a statistical model based on a large national multi-

year survey using probability sampling methods. A map of the opinions is available online, with additional information in Howe et al., (2015) and Marlon et al., (2022).

2. **Utah State University (USU) Extension Climate Change Assessment (*N* = 73; 2024)**, hereafter "**Extension survey**." In October 2024, USU Extension faculty and staff were surveyed regarding their opinions and needs related to climate change.

3. **USU Climate Adaptation Intern Assessment (*N* = 30; 2024–2025)**, hereafter "**CAIP survey**." In 2024 and 2025, undergraduate participants in the USU Climate Adaptation Intern Program (CAIP) were surveyed regarding their opinions and knowledge about climate change.

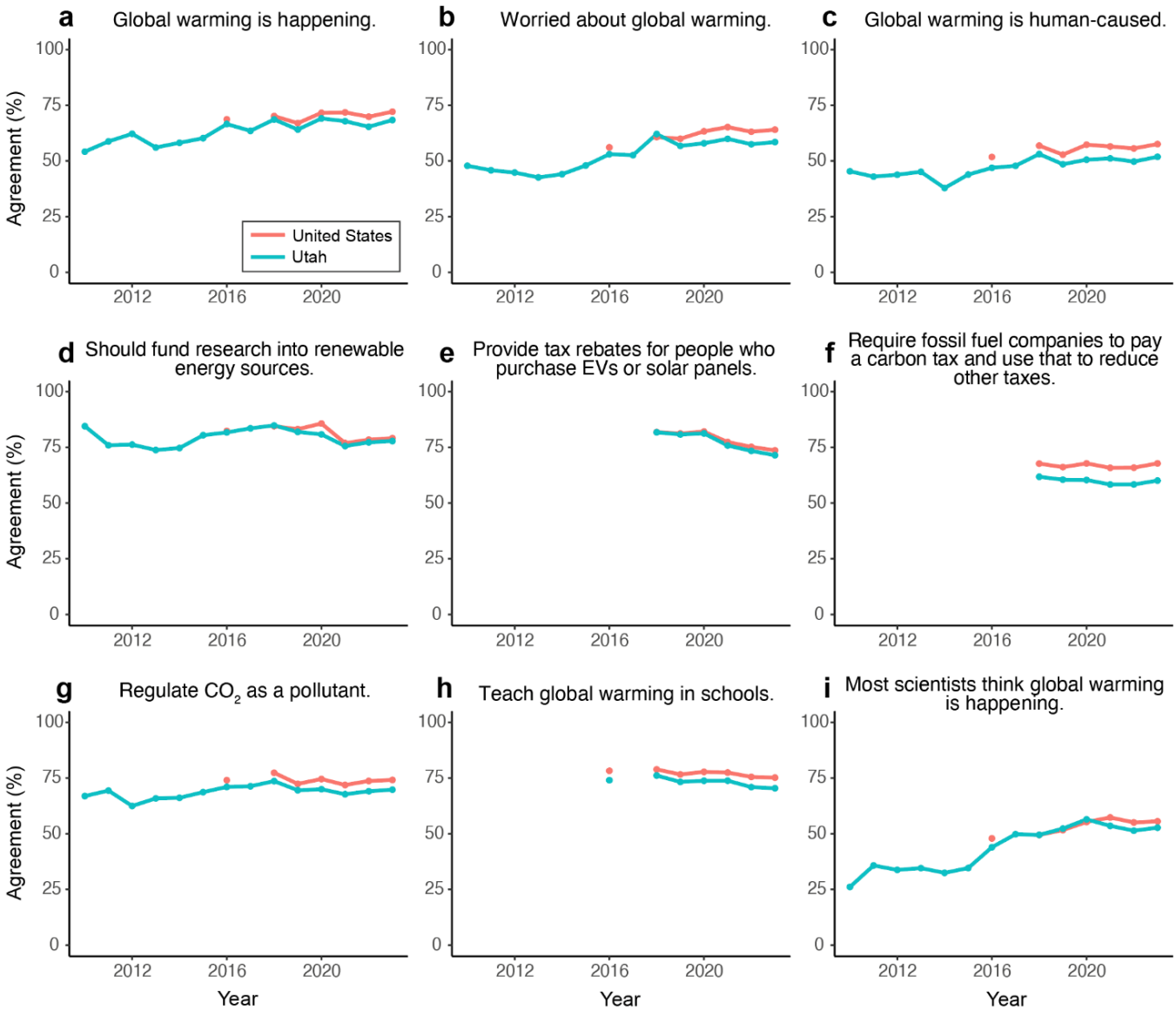

Figure 2. *Utahns' Opinions About Global Warming and Related Policies Over Time Versus the U.S. Average*

Data source: Marlon et al., 2025

Utahns' Opinions About Global Warming: Past and Present

Public opinion can have considerable influence on public policy (Burstein, 2003). The importance of an issue—its *salience*—can also enhance the impact of public opinion on policy outcomes (Burstein, 2003). Generally, state-level opinions are reflected in state policy (Lax & Philips, 2012). That is, if there is widespread support for a particular issue and it is salient for voters, then policy change in the direction of the majority is likely to follow.

As of 2023, more than two-thirds of Utahns (68%) agreed with the statement that global warming is happening (Figure 1). This percentage has increased by 14% since 2010, the first year that state-level data were available (Figure 2a). In 2023, Utahns also ***increasingly agreed*** that:

- They are worried about global warming (59% in 2023, up from 48% in 2010; Figure 2b).
- Global warming is human-caused (52% in 2023, up from 45% in 2010; Figure 2c).
- Most scientists think global warming is happening (53% in 2023, up from 26% in 2010; Figure 2i).

Agreeing with the statement that most scientists think global warming is happening represents the most striking shift from 2010 to 2023. For this question, Utahns' agreement has more than doubled from 26% in 2010 to 53% in 2023 (Figure 2i).

In 2023, more Utahns agreed that global warming is happening and why. While support for policies that would mitigate global warming has stayed the same or declined since 2010, it remains generally higher than the consensus that global warming is happening.

In Utah, support for policies that represent responses to climate change is substantially higher than the consensus that global warming is happening. However, support for these policies—though still high—has mostly declined or stayed the same in recent years. For instance, as of 2023, agreement has ***declined*** for the following statements:

- Research into renewable energy sources should be funded (78% in 2023, down from 85% in 2010; Figure 2d).
- Tax rebates should be available for people who purchase energy-efficient vehicles or solar panels. In 2018, the first year the question was asked, 82% of Utahns agreed that these rebates should be available. By 2023, that number had fallen to 71% (Figure 2e).
- Global warming should be taught in public schools (70% in 2023, down from 74% in 2016; Figure 2h).

Agreement has stayed largely ***unchanged*** for two policy-related statements in our subset of the Yale survey:

- CO_2 should be regulated as a pollutant (70% in 2023, up from 67% in 2010; Figure 2g).
- Fossil fuel companies should be required to pay a carbon tax which would then be used to offset other taxes by an equal amount (60% in 2023, down from 62% in 2018; Figure 2f).

How Often Do Utahns Discuss Global Warming or Hear About It in the Media?

Conversations and media exposure shape how opinions change over time. While agreement with statements about global warming is generally lower in Utah relative to the U.S., Utahns track the national average regarding communication around global warming (Marlon et al., 2025). According to the Yale survey, Utahns are ***slightly less*** likely to discuss global warming at least occasionally (35%) relative to the rest of the U.S. (36%) and are ***slightly more*** likely to hear about global warming in the media (33%) relative to the U.S. (32%).

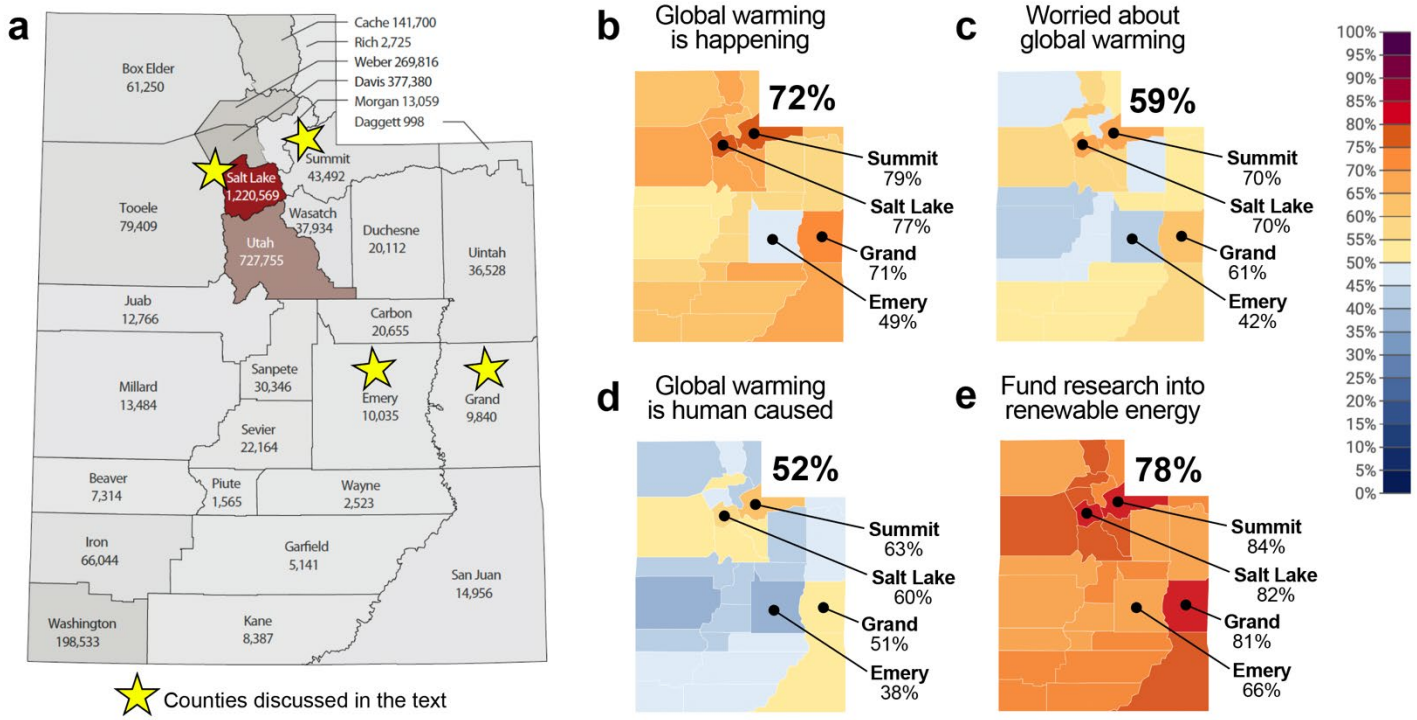

Figure 3. ***(a)*** *Populations of Utah's Counties in 2023 (with yellow stars indicating the four counties highlighted in b–e and the text);* ***(b–e)*** *Utahns' Beliefs, Risk Perception, and Policy Support in 2023*

Sources: (a) Harris, 2023; (b–e) Marlon et al., 2025

In Terms of Global Warming Beliefs and Perceptions, Is Utah a Monolith?

Like many states in the western U.S., Utah's population is not uniformly distributed across the state, nor do all Utahns have a common life experience. Rather, about 80% of Utahns live in populous urban centers along the Wasatch Front (e.g., Salt Lake County; Figure 3a). Thus, we would expect a "rural–urban divide" to exist in Utah. This concept is a powerful theme in American policymaking where people living in rural areas have different opinions from those in urban areas (Brown et al., 2021). And, in many ways, the rural–urban divide *does* exist in Utah. For example, Utahns living in rural areas were less likely to adopt preventive behaviors in response to the COVID-19 pandemic versus their urban counterparts (Ulrich-Schad et al., 2023). But when it comes to beliefs about global warming, the opinions of Utahns, according to the Yale survey, did not cleanly align with a rural–urban divide. We illustrate these differences using four counties: Salt Lake, Summit, Grand, and Emery (Table 1). These counties represent two regions in Utah, vary in population density, and had relatively high and low agreement with global warming statements (Figure 3).

Table 1. *Demographic and Socioeconomic Data for Four Counties in Utah*

County (Major city)	Rural vs. urban	Median household income in 2023	Common industries relative to the rest of Utah
Salt Lake (Salt Lake City)	Urban	$94,013	Finance and insurance, real estate
Summit (Park City)	Rural	$139,848	Entertainment, real estate
Grand (Moab)	Rural	$67,360	Entertainment, hospitality
Emery (Huntington)	Rural	$68,823	Utilities, oil, gas, and mining

Sources: Fisk & Ulrich-Schad, 2024; Statistical Atlas, n.d.; Utah Department of Workforce Services, 2025

Three counties in Utah—Salt Lake, Summit, and Grand—had high agreement that global warming is happening (Figure 3b), they are worried about global warming (Figure 3c), global warming is human-caused (Figure 3d), and research into renewable energy should be funded (Figure 3e). Emery County, in contrast, had lower agreement with these statements. This contrast does not strictly follow rural–urban nor geographic lines. Salt Lake County is urban, while Summit, Grand, and Emery counties are rural (Table 1). Moreover, Grand and Emery counties, despite their differences in climate opinions, are neighbors (Figure 3b).

County-level differences in opinions also do not strictly align with socioeconomic differences. While counties along or near the Wasatch Front, such as Salt Lake and Summit, have some of the highest median household incomes in Utah, Grand County is not among that group (Table 1; Utah Department of Workforce Services, 2025). Rather, of Utah's 29 counties, Grand County ranks 20th for median household income, below Emery County, which is 18th (Utah Department of Workforce Services, 2025).

Local industries and political views, however, may help explain differences of opinion (Hazboun et al., 2020; Mayer et al., 2021). Residents of Emery County are more likely to be employed by companies in the utility and oil, gas, and mining sectors compared with Utah on average (Table 1; Statistical Atlas, n.d.). In contrast, employment in Salt Lake, Summit, and Grand counties is higher in the finance and insurance, real estate, entertainment, and hospitality sectors compared to Utah on average (Table 1; Statistical Atlas, n.d.). Salt Lake, Summit, and Grand counties were also the only three counties in Utah to vote for a Democratic Party presidential candidate in 2020 and 2024 (The New York Times, 2024).

Differences in Opinion Among Groups

In Utah, opinions about global warming also differ among subsets of the population. Among the general population, as represented in the Yale survey, 59% of Utahns agreed that they are worried about global warming, 40% thought it will harm them personally, and 65% thought this harm will also extend to plants and animals (Figure 4). In 2024, 79% of Extension professionals at USU (N = 73) were worried about global warming (+20% over the statewide average; Figure 4a), and 65% expected global warming to harm them personally (+25% over the statewide average; Figure 4b). Compared to those populations, undergraduate

participants in the USU Climate Adaptation Intern Program (CAIP; *N* = 30) had even higher rates of agreement across these three questions. Indeed, 97% of this student group was worried about global warming (Figure 4a), 83% expected it to harm them personally (Figure 4b), and 100% of the group expected global warming to harm plants and animals (Figure 4c).

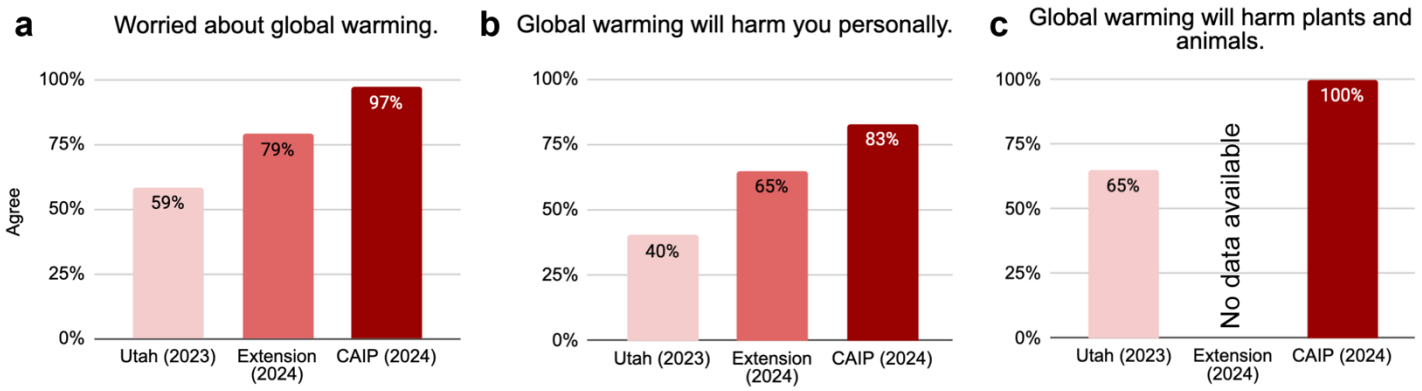

Figure 4. *Opinions About Global Warming for Different Groups in Utah Based on the Yale Survey (Utah), Extension Survey (USU Extension professionals), and CAIP Survey (USU Climate Adaptation Intern Program participants)*

Data source: Marlon et al., 2025

Conclusion

Global warming and climate change are widely considered the most important contemporary environmental issues facing humanity, yet they are also some of the most polarizing politically (Fisher et al., 2013). In Utah, there is widespread consensus that global warming is happening, and the strength of this consensus has been steadily rising since 2010 (Figures 1 and 2). Over the last 14 years, some public opinion metrics have risen dramatically (e.g., perception of scientific consensus on global warming; Figure 2i) while others have been largely stable (e.g., if fossil fuel companies should be required to pay a carbon tax; Figure 2f).

Utah's support for policies, such as funding research into renewable energy or requiring fossil fuel companies to pay a carbon tax, is generally high (≥ 60%) and reflects nationwide trends (Figure 2; Marlon et al., 2022). However, variation across Utah's counties does not follow clear rural–urban nor socioeconomic divides (Figure 3). Rather, county-level opinions may be linked to prevailing economic industries and political views.

Differences among groups can also provide useful insight into support for or against climate change policy (Figure 4). USU Extension professionals work to "provide research-based programs and resources to improve the lives of individuals, families, and communities throughout Utah" and are more concerned about global warming than the state as a whole (USU Extension, n.d.). Motivated college students are the most concerned.

Taken together, there is widespread and growing consensus among Utahns that global warming and climate change are important environmental issues in the state. There is also substantial—and generally higher—statewide support for policies that could mitigate global warming, such as funding research into renewable energy sources and requiring fossil fuel companies to pay a carbon tax (Figure 2; Brunner & Ryder, 2023; Schad & Givens, 2023). Support for these policies could be motivated by dual benefits. For instance, implementing a carbon tax could provide the dual benefit of also improving air quality (Cameron et al., 2024; Michaels et al., 2024), another major environmental concern in the state (Flowerday et al., 2023; Schad & Givens, 2023).

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