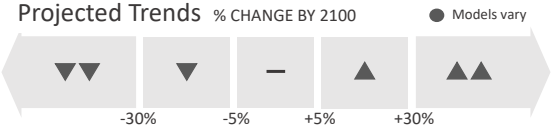
OBSERVED/PROJECTED CLIMATE CHANGES AND ASSOCIATED IMPACTS FOR BUTTE-SILVER BOW, MONTANA



CLIMATE CHANGES	METRIC	TREND	OBSERVED/PROJECTED CHANGES
Air temperature	Minimum temperature AVG DAILY MIN TEMP (°F)	▲	28.1°F (+4.3°F) by 2050 and 34.2°F (+10.4°F) by 2100[1] COMPARED TO HISTORICAL AVERAGE OF 23.8°F FROM 1961–1990
	Maximum temperature AVG DAILY MAX TEMP (°F)	▲	54.7°F (+4.8°F) by 2050 and 60.9°F (+11.0°F) by 2100[1] COMPARED TO HISTORICAL AVERAGE OF 49.9°F FROM 1961–1990
Extreme heat	Days over 90°F # OF DAYS WITH MAX TEMPS >90°F	▲▲	9.0 days (+1,025%) by 2050 and 39.2 days (+4,800%) by 2100[1] COMPARED TO HISTORICAL AVERAGE OF 0.8 DAYS PER YEAR FROM 1961–1990
Precipitation	Annual precipitation AVG INCHES PER YEAR	▲	19.2 in (+3.8%) by 2050 and 20.0 in (+8.2%) by 2100[1] COMPARED TO HISTORICAL AVERAGE OF 18.5 INCHES PER YEAR FROM 1961–1990
	Seasonality	▲▼	Significant increase in winter (+21%) and spring (+22%) precipitation, with slight decreases in summer (-7%) and fall (-5%) by 2100[2]
Snow	Snowpack APRIL 1 SNOW-WATER EQUIVALENT	▼▼	~20% decline in April snowpack from 1935 to 2015 (greater at low elevations)[3] 50% or greater decline in April snowpack by 2100[3]
	Snowmelt timing		Earlier spring snowmelt due to warmer temperatures, increasing spring peak flows and reducing late-summer streamflows[3]
Extreme precipitation	Frequency # OF DAYS WITH 1" RAIN IN 24 HOURS	▲	0.9 days (+12.5%) by 2050 and 1.4 days (+75%) by 2100[1] COMPARED TO HISTORICAL AVERAGE OF 0.8 DAYS PER YEAR FROM 1961–1990
	Amount 20-YEAR RETURN PERIOD TOTAL	▲	+16% increase in precipitation amount during 20-year events projected by 2100[4]
Drought	Frequency & severity	▲▲	Likely increases in the frequency and severity of both seasonal and persistent (i.e., multi-year) droughts, largely due to rising temperatures[3,5]
Wildfire	Fire activity	▲▲	Significant increases in the length of the fire season, the frequency of large wildfires,[6] and annual area burned[7] in the Northern Rockies

[1] U.S. Climate Resilience Toolkit Climate Explorer (https://crt-climate-explorer.nemac.org), county-scale projections generated using the high-emissions (RCP 8.5) scenario for the average of 2041–2049 and 2091–2099 time periods compared to historical conditions (average of 1961–1990).
[2] J.R. Alder, J. R. and S. W. Hostetler, 2013. USGS National Climate Change Viewer. US Geological Survey (https://doi.org/10.5066/F7W9575T), county-scale projections generated using the high-emissions (RCP 8.5) scenario for the mid-century (average of 2025–2049) and late-century (average of 2075–2099) time periods compared to recent conditions (average of 1981–2010).
[3] C. Whitlock, W. F. Cross, B. Maxwell, N. Silverman, A. A. Wade, "2017 Montana Climate Assessment" (Montana State University and University of Montana, Montana Institute on Ecosystems, Bozeman and Missoula, MT, 2017), , doi:10.15788/m2ww8w 88/m2ww8w.
[4] D. R. Easterling et al., in Climate Science Special Report: Fourth National Climate Assessment, Volume I, D. J. Wuebbles et al., Eds. (U.S. Global Change Research Program, Washington, DC, 2017; https://science2017.globalchange.gov/chapter/7/), pp. 207–230.
[5] B. I. Cook, J. E. Smerdon, R. Seager, S. Coats, Clim Dyn. 43, 2607–2627 (2014).
[6] A. L. Westerling, Phil. Trans. R. Soc. B. 371, 20150178 (2016).
[7] S. A. Parks, J. T. Abatzoglou, Geophysical Research Letters, 47, e2020GL089858 (2020).

LIKELY IMPACTS ASSOCIATED WITH PROJECTED CLIMATE CHANGES*

 **Public Health**	• Reduced air quality due to the impacts of heat and smoke from larger, more frequent wildfires, exacerbating respiratory and cardiopulmonary illnesses • Increased risk of injury or death due to severe flooding, as well as increases in gastrointestinal disease and other water-borne or mold-related illnesses as a result of flood damage • Likely increase in the incidence of West Nile virus as a result of increased summer drought, and potential for climate-driven changes in other vector-borne diseases • Increases in the intensity/frequency of extreme events (e.g., flooding) may overwhelm emergency systems, block emergency access or evacuation routes, or damage/disrupt emergency shelters • Increased vulnerability among those with existing chronic health conditions as well as children, the elderly, pregnant individuals, low-income residents, and anyone lacking access to health services and/or adequate health insurance
 **Water Resources**	• Reduced late-summer surface water availability due to warmer temperatures, decreased snowpack, and earlier snowmelt, with more severe reductions occurring during periods of drought • Likely increases in the demand for groundwater (i.e., for municipal or agricultural use) as traditional surface water sources dry up earlier in the season and during longer periods of drought • Reduced water quality due to warmer water temperatures that increase the risk of pathogen growth and harmful algal blooms • Increased runoff during heavy rainfall events that follow dry periods, resulting in greater risk of landslides and flash floods (particularly in burned or unvegetated areas)
 **Contaminated Sites**	• Altered contaminant transformation or degradation and volatility due to warmer temperatures and extreme heat, as well as increased sensitivity to contaminants in aquatic organisms experiencing heat stress • Decreased contaminated runoff from sites and slowing of contaminant migration into groundwater during periods of drought, though these can also lead to higher concentrations of contaminants in receiving waters or a lack of water needed for treatment systems • Potential for spread of contaminants by wildfires, which can also cut off site access and threaten critical on-site infrastructure such as pump and treat systems, active monitoring systems, and power/data lines • Increased dilution of contaminants due to wetter conditions, though this can also speed contaminant migration in groundwater and burden water containment and treatment systems • Increased erosion and scour during more extreme precipitation events and flooding, which can undermine containment by rapidly transporting contaminants and exceeding treatment capabilities, increasing contaminant concentrations in waterbodies, cutting off site access, and damaging infrastructure

* All icons from the Noun Project: (1) Public health icon created by Pete Fecteau; (2) Water icon created by Megan Mitchell; (3) Pollution icon created by Kamin Ginkae

Resources:

- Northern Great Plains Chapter of the Fourth National Climate Change Assessment (https://nca2018.globalchange.gov/chapter/22/)
- 2017 Montana Climate Assessment (http://montanaclimate.org/)
- Climate Change and Human Health in Montana: A special report of the Montana Climate Assessment, January 2021 (https://doi.org/10.15788/c2h22021)
- Montana Wildfire Risk Assessment (https://mwra-mtdnrc.hub.arcgis.com/)
- Risk Factor for Butte, MT (https://riskfactor.com/city/butte-mt/3011397_fsid/flood)
- U.S. Climate Resilience Toolkit Climate Explorer (https://crt-climate-explorer.nemac.org)

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