



Weather Summary

Mount Rainier National Park – Water Year 2023

The North Coast and Cascades Network (NCCN) Inventory and Monitoring Program monitors climate to compare current and historical data to understand long-term trends, provide data to model future impacts to park facilities and resources, and provide park staff with information needed to make management decisions. This brief summarizes climate data collected and notable weather events that occurred during Water Year¹ 2023 in Mount Rainier National Park.

Significant Weather Events

Between November 3rd and 5th 2022, a series of atmospheric rivers affected western Washington, resulting in the highest recorded streamflow in Water Year 2023 for both the Nisqually and the Carbon Rivers. At the Carbon River weather station, rainfall on November 4th made up almost half (48%) of the month's total rainfall. Downstream of the station, a USGS stream gage recorded water levels cresting at moderate flood level (Figure 1, red line). Since 1930, only nine other years had higher flows at this gage. Heavy precipitation and high river levels associated with this event washed out many sections of trail in the area (Figure 2).



Figure 2. Damage on the Wonderland Trail from the storm (NPS photo).

Spring and summer of 2023 were warm and dry, with an early heat wave in May that contributed to a precipitous and early melt of a close-to-normal snowpack (Table 1, Figure 3).

Table 1. Snowmelt at the Paradise SNOTEL station during the May 2023 anomalous heat event.

Date	Snow Height Inches	Melt in Inches	Maximum Temperature °F
5/12/2023	118	2	63.3°
5/13/2023	115	3	64.9°
5/14/2023	110	5	62.8°
5/15/2023	103	7	69.1°
5/16/2023	98	5	64.8°
5/17/2023	97	1	67.1°
5/18/2023	94	3	69.1°
5/19/2023	91	3	71.8°
5/20/2023	87	4	69.6°
Total Melt	–	33	–

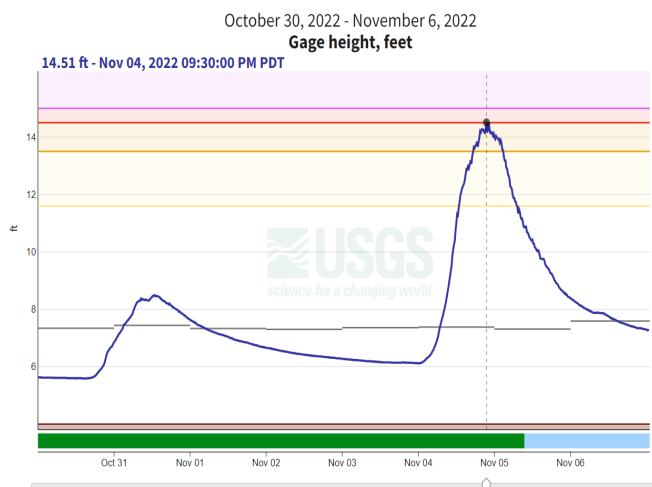


Figure 1. US Geological Survey stream gage, located six miles downriver from the Carbon River Entrance to the park, near Fairfax, WA. The deep red line denotes moderate flood level.

¹ Water year is defined as the period from October 1 to September 30 of the following year, to encompass a full cycle of precipitation accumulation.



Figure 3. Only patches of snow remain at Paradise on June 28, after the May heatwave melted snow two weeks earlier than average (NPS photo).

May to August temperatures were consistently above normal, and precipitation was significantly below normal. By June 20th, Mount Rainier and much of the surrounding area were in “moderate drought”². Statewide, a drought advisory was issued on July 5th³. By August 29th, the park and environs entered “severe drought” (Figure 4).

A parkwide campfire ban was issued on August 16th, supporting national incident management efforts to prevent wildfires⁴. Canadian wildfires and fires in the Cascades region of Washington affected air quality in mid-August. Periods of unhealthy to very unhealthy air quality conditions halted volunteer activities at Paradise and Sunrise for several days.

U.S. Drought Monitor August 29, 2023

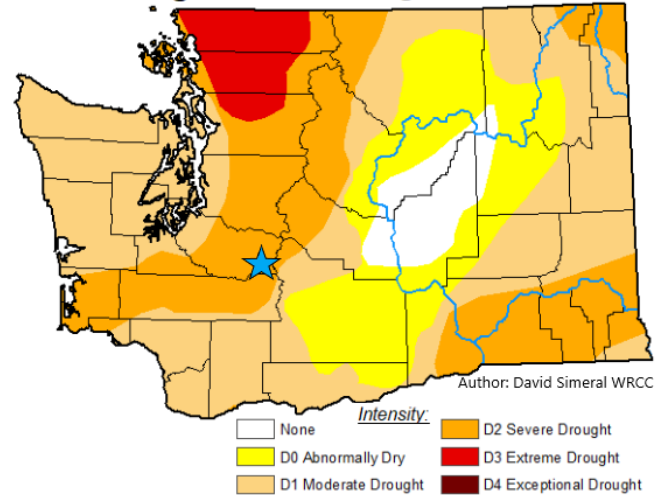


Figure 4. Mount Rainier (blue star) was in severe drought by August 29th, 2023 (Map courtesy of National Drought Mitigation Center).

On August 25th, a lightning storm sparked 45 fires in the neighboring Gifford Pinchot National Forest. The same storm sparked four wildfires in the park, including a 0.5-acre fire on the west side of the park near the Nisqually Entrance that warranted fire suppression (Figure 5). This fire was sparked in the more fire-resistant west side old-growth forest, confirming the overall dry conditions unusual for the west side of the Cascade Range⁵.



Figure 5. A trail of smoke emerges from the Twin Firs fire (NPS photo).

² National Drought Mitigation Center, the United States Department of Agriculture and the National Oceanic and Atmospheric Administration. “Map Archive.” US Drought Monitor. December 28, 2023. https://droughtmonitor.unl.edu/data/png/20230926/20230926_wa_trd.png

³ “Department of Ecology Drought Advisory.” Washington State Department of Ecology. July 5th, 2023. <https://apps.ecology.wa.gov/docs/WaterRights/wrwebpdf/2023DroughtAdvisory.pdf>

⁴ “Mount Rainier National Park parkwide fire ban goes into effect Friday, August 18, 2023.” National Park Service, August 16, 2023. Mount Rainier National Park.

<https://www.nps.gov/mora/learn/news/mount-rainier-national-park-parkwide-fire-ban-goes-into-effect-friday-august-18-2023.htm>

⁵ “Twin Firs Fire Burning in Mount Rainier National Park.” National Park Service, August 27, 2023. Mount Rainier National Park. <https://www.nps.gov/mora/learn/news/twin-firs-fire-burning-in-mount-rainier-national-park.htm>

Temperature

The start to Water Year 2023 was marked by record-breaking warm October temperatures, extending the summer glacier melt season even at higher elevations (Figure 6). Paradise and Longmire COOP stations reported monthly average temperatures of 10.7°F and 9.2°F, respectively, above normal (Figure 7). The Camp Muir weather station, located at an elevation of 10,188 feet, recorded an October average of 35.1°F, 6.3°F warmer than the period of record (POR) average and the warmest in that station's 18-year record. Winter into spring temperatures were colder than normal until May, when monthly average temperatures swung unusually warm at 6.5 and 6.2°F above normal for the Paradise and Longmire stations (Figure 7). Temperatures remained above normal through the month of August before finally returning to near-normal in September. Average monthly temperatures for selected stations in the park are presented in Table 2.



Figure 6. Crewmember surveying the Emmons glacier in early October 2022. Anomalous warm October temperatures extended the normal summer glacier melt season at all elevations.

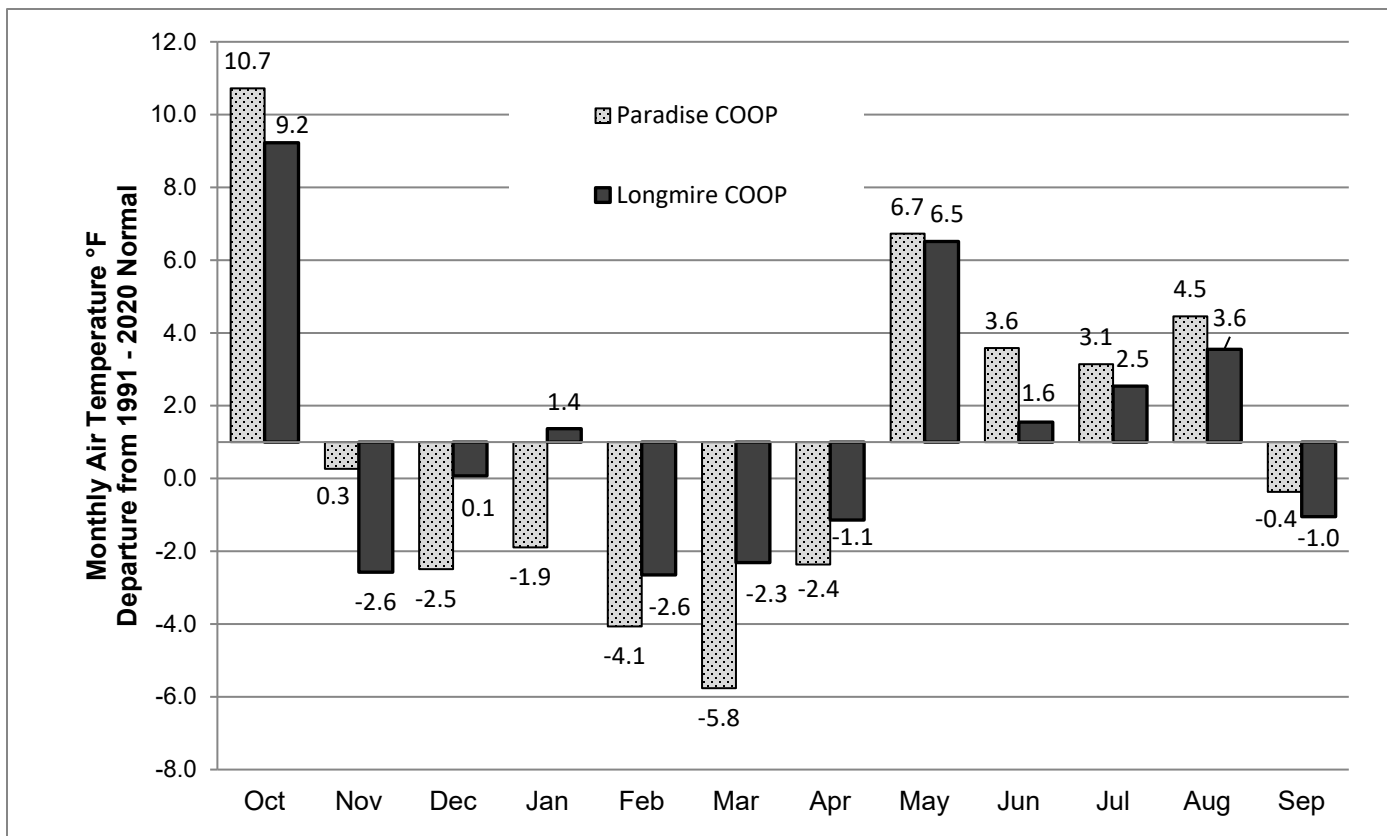


Figure 7. Comparison of Water Year 2023 average monthly temperature (°F) to the climatological normal 1991–2020 at the Paradise and Longmire COOP Stations.

Table 2. Average monthly air temperature (°F) from weather stations in Mount Rainier National Park in Water Year 2023.

Season	Month & Year	Camp Muir	Camp Schurman NPS	Carbon River NPS	Cayuse Pass SNOTEL	Longmire COOP	Ohanapecosh RAWs	Paradise COOP	Sunrise NPS
Fall	October 2022	35.1	36.7	50.4	49.7	54.0	52.0	50.3	45.3
	November 2022	17.8	19.4	34.4	30.9	33.3	32.9	31.8	26.0
Winter	December 2022	14.3	16.3	33.4	26.3	30.9	30.7	24.8	22.2
	January 2023	15.9	17.3	36.1	28.3	33.0	32.7	27.3	24.2
	February 2023	– ¹	14.4	33.2	26.5	30.4	31.7	24.2	21.2
Spring	March 2023	–	10.8	34.6	27.4	33.9	34.0	23.9	20.3
	April 2023	–	19.9	40.2	33.2	39.5	40.5	30.8	27.6
	May 2023	32.6	35.6	54.0	46.8	54.9	55.7	47.3	43.3
Summer	June 2023	36.1	38.0	53.6	48.4	55.3	58.7	48.8	45.7
	July 2023	42.7	44.8	60.0	55.7	63.3	66.0	56.2	53.1
	August 2023	45.1	45.6	63.3	56.6	64.5	66.6	58.9	54.9
Fall	September 2023	34.5	– ²	53.9	50.8	54.1	56.1	48.9	44.4
Annual		–	–	45.6	40.1	45.6	46.5	39.4	35.7

¹ Sensor failure on February 7; sensor replaced on April 27, 2023.

² Only partial data available for September.

Precipitation

Water Year 2023 was significantly drier than Water Year 2022⁶ and drier than normal, with the Paradise COOP station recording 84% and Longmire COOP station recording 74% of normal annual precipitation (Figure 8). Cumulative October–March precipitation recorded at the Paradise COOP was 86.9 inches, 18.22 inches less than normal. April precipitation was near normal, but dry conditions returned in May with Paradise recording only 38% and Longmire recording 31% of normal precipitation that month (Figure 9). Accumulated precipitation deficits resulted in a severe drought in the park by the end of August. A storm event starting September 24th brought 3.5 inches of precipitation to the Carbon River weather station at 1,700 feet in elevation and 5.8 inches to Paradise at 5,400 feet, and regionally ended the wildfire season. That single storm made up the bulk of September’s monthly precipitation of 4.1 inches and 7.9 inches at the Carbon and Paradise stations respectively (Table 3). Despite this much-needed precipitation, drought conditions remained severe through the end of the water year throughout the park. A map of Water Year 2023 precipitation is presented in Figure 9.

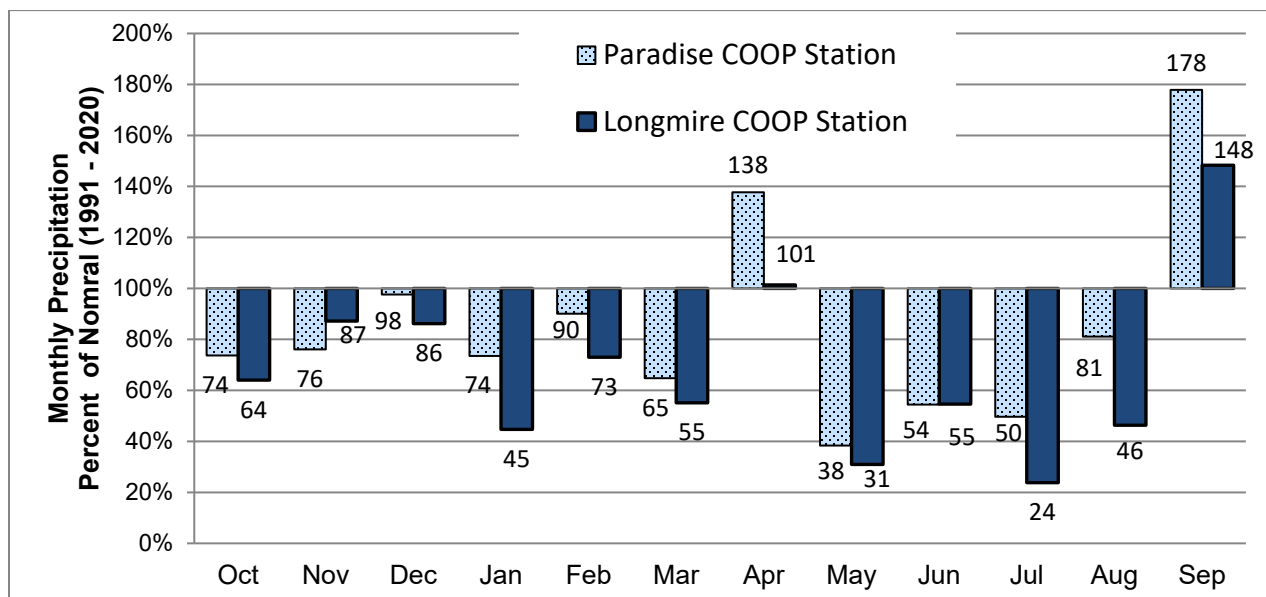


Figure 8. Water Year 2023 monthly total precipitation (inches) as a percent of climatological normal 1991–2020 at Longmire and Paradise COOP Stations.

Table 3. Total monthly precipitation (inches) from weather stations within Mount Rainier National Park in Water Year 2023.

Season	Month & Year	Carbon River NPS	Longmire COOP	Ohanapecosh RAWS	Paradise COOP
Fall	October 2022	4.7	5.8	4.5	8.3
	November 2022	10.3	11.3	14.5	13.8
Winter	December 2022	7.5	10.7	11.8	18.5
	January 2023	3.1	5.1	5.6	12.7
	February 2023	5.1	6.3	6.1	11.7
Spring	March 2023	3.8	4.2	4.8	8.6
	April 2023	7.6	6.0	7.3	11.5
	May 2023	2.0	1.5	1.1	2.0
Summer	June 2023	2.5 ¹	2.0	1.3	2.1
	July 2023	0.4 ²	0.3	0.4	0.7
	August 2023	0.7	0.7	1.3	1.3
Fall	September 2023	4.1	5.2	4.9	7.9
Annual		51.8	59.1	63.6	99.1

¹ Equipment theft interrupted data stream in June; replacements installed in July and data restored. Data from nearby Mowich SNOTEL station substituted for June.

² Data from nearby Mowich SNOTEL station substituted for July.

⁶ Hagen, S. Weather Summary: Mount Rainier National Park – Water Year 2022. 2023. North Coast and Cascades Network. Available at: <https://irma.nps.gov/DataStore/DownloadFile/684498>

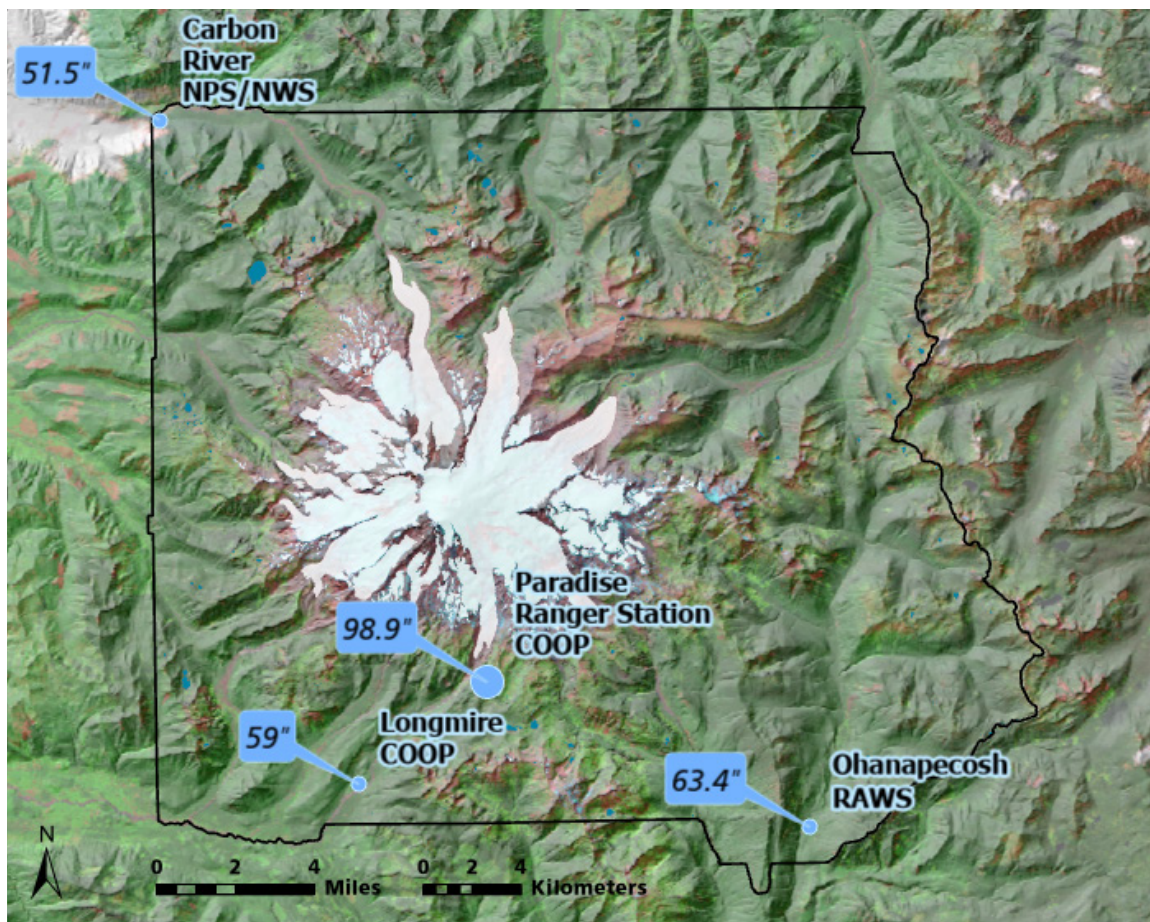


Figure 9. Water Year 2023 precipitation totals for selected stations at Mount Rainier National Park.

Snowpack

Despite a third consecutive La Niña winter, mountain snowpack remained only at normal levels. Typical of La Niña winters, temperatures were below normal. However, the unusually dry conditions for most of the snow-bearing months were atypical. This year's snowpack, illustrated by the snow water equivalent (SWE) at the Paradise SNOTEL Station (Figure 10), was above normal only in fall. As December arrived, the Water Year 2023 SWE (red line) tracked normal (gray shading) but at the beginning of January dipped below normal. A mid-April series of storms raised hopes that Water Year 2023 could follow the pattern of Water Year 2022 (solid black line) and build through late spring. Maximum SWE of 75 inches occurred on April 29th, arriving on the same day as peak normal SWE and over 3 inches higher. Two weeks later, unseasonably warm weather in May melted 33 inches of snowpack in nine days (Table 1). Precipitous melt followed, and by July 1st, the station was snow free, two weeks earlier than normal (Figure 10). At the Paradise COOP station (320 feet higher in elevation than the Paradise SNOTEL site), maximum accumulation occurred on April 4th and measured 187 inches of snow as height above ground. This station was snow free on June 29th. The Cayuse Pass SNOTEL site (5,240 feet) had a maximum SWE of 62.5 inches and a maximum height above ground at 145 inches on April 20th and 21st, respectively. This site was snow free on June 8th, 2023.

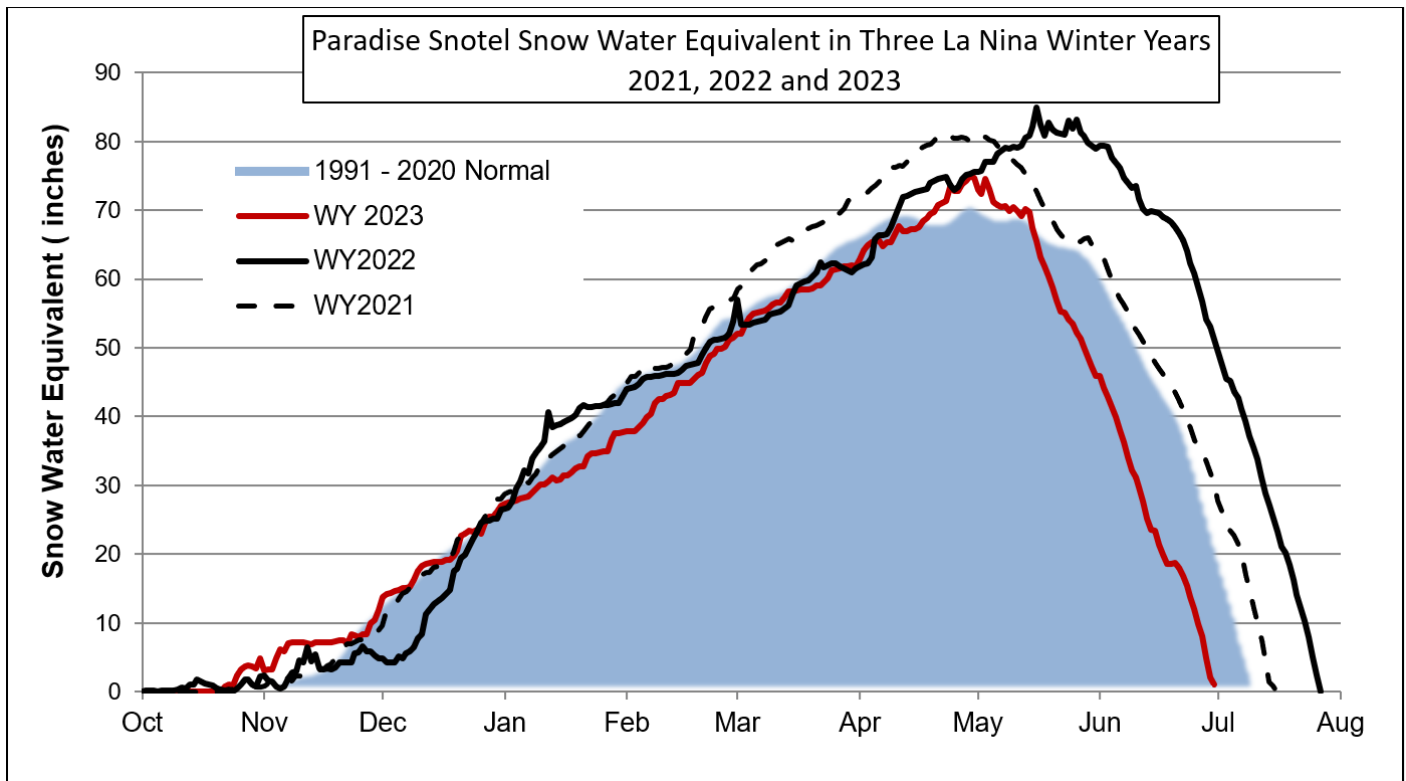


Figure 10. Daily snow water equivalent at the Paradise SNOTEL in Water Year 2023 compared to Water Years 2021, 2022, and the climatological normal 1991–2020.

More Information

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