



Weather Summary

Mount Rainier National Park – Water Year 2022

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 2022 in Mount Rainier National Park.

Significant Weather Events

A series of atmospheric rivers affected Oregon, Washington, and British Columbia over November 10th to 15th 2021, bringing heavy rains and high winds. At Mount Rainier National Park, rainfall contributions on November 12th made up a significant portion of the month's total rainfall (Table 1).

Table 1. November 12 precipitation in inches and as a percentage of November's total.

Weather Stations	Precipitation Nov. 12 th	Percent of Total Monthly Precipitation
Carbon River NPS	4.77"	34%
Ohanapecosh RAWS	4.14"	20%
Longmire COOP	4.04"	22%
Paradise COOP	6.35"	21%

This series of storms produced the highest streamflow recorded in Water Year 2022 for both the Nisqually and the Carbon Rivers.

On the northwest side of the park, heavy precipitation and high river levels caused additional erosion and completely washed out the Carbon River Road at the park boundary (Figure 1). All access was closed to the Carbon River Entrance on November 15th.



Figure 1. Asphalt roadbed that was eroded by high water from the storm event, November 2021 (NPS photo).

Downstream of the washout, a USGS stream gage on the Carbon River recorded high water levels that were sustained over multiple days as the result of two distinct pulses of precipitation (Figure 2).

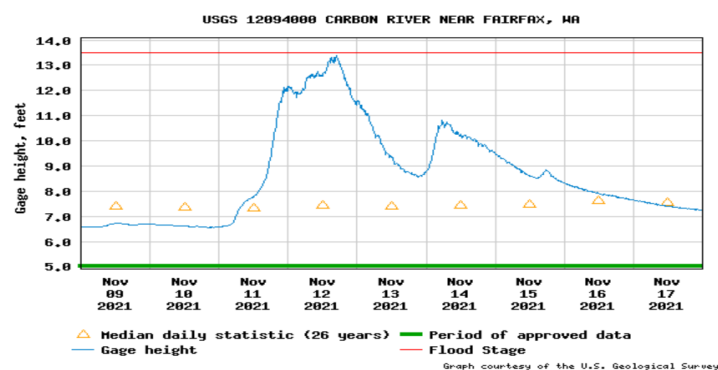


Figure 2. US Geological Survey stream gage, located six miles downriver from the Carbon River Entrance to the park.

On the southeast side of the park, the Ohanapecosh River eroded the footings of a suspension bridge to the Grove of the Patriarchs, resulting in the closure one of the most popular hiking destinations at the park. This area remains closed until repairs to the bridge are completed.

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.

On the northeast side of the park, wind speeds at the Sunrise High Elevation weather station peaked at 99.5 mph on November 15th. Evidence of powerful winds were seen in the nearby White River area, where treefall damaged buildings, requiring extensive repairs (Figure 3).



Figure 3. Treefall during high winds damaged buildings near the White River Entrance during the November 2021 storm (NPS photo).

Late summer and fall of 2022 were exceedingly warm and dry, and effects were felt parkwide. Wildfires in Washington started later than in the previous year (Water Year 2021)² with large fires occurring in the usually fire-resistant western slopes of the Cascade mountains. On August 8th, a lightning-sparked fire in the nearby Goat Rocks Wilderness (within five miles of the park boundary) caused a short evacuation of the neighboring community of Packwood and affected air quality in the park for many days. Effects on park operations included occasional closures of the Stevens Canyon Entrance, a campfire ban, and suspension of interpretive activities in smoke-affected areas. Wildfire smoke resulted in periods of unhealthy to very unhealthy air quality conditions around the park into mid-October (Figure 4).

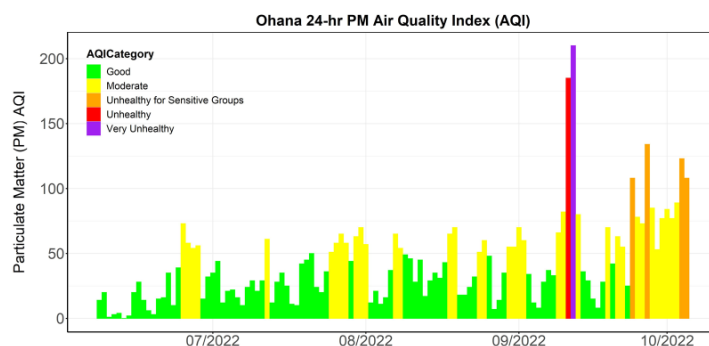


Figure 4. Concentrations of particulate matter (PM2.5) measured at Ohanapecosh Campground (Air Resources Division).

Surface water is the primary potable water supply for the park. The hotter and drier than normal summer and early fall impacted water supply sources on the east side of the park at Frozen Lake and Klickitat Creek (Figure 5).



Figure 5. Frozen Lake, the primary water supply for the Sunrise area of the park, was affected by the summer heat and lack of rain (NPS photo).

Temperature

Water Year 2022 began with temperatures intermittently swinging colder and then warmer than normal for the Paradise and Longmire COOP stations. Variations from normal became marked in April, when cool late spring months (downward bars) were followed by an exceptionally warm late summer and early fall (upward bars) (Figure 6). Average monthly temperatures for selected stations in the park are presented in Table 2.

² Hagen, S. Weather Summary: Mount Rainier National Park – Water Year 2021. 2022. North Coast and Cascades Network.

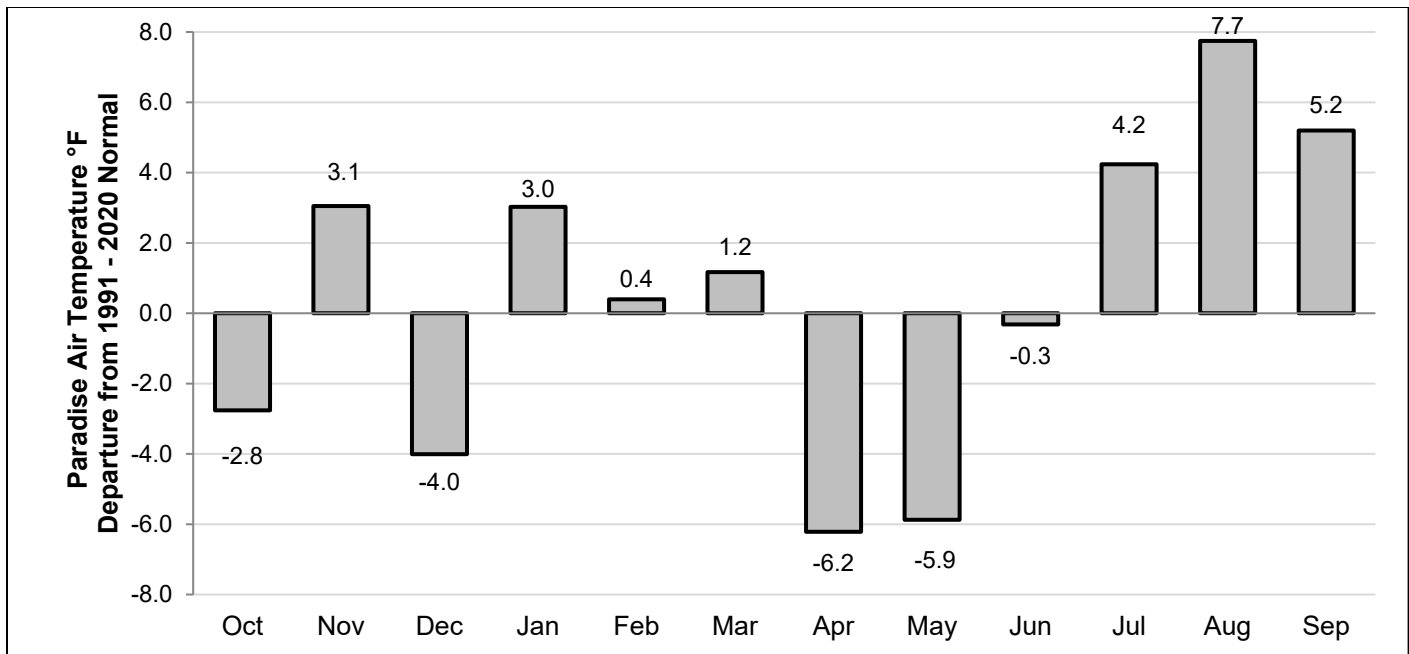


Figure 6. Comparison of Water Year 2022 average monthly temperature (°F) to the climatological normal 1991–2020 at the Paradise COOP Station.

Table 2. Average monthly air temperature (°F) from weather stations in Mount Rainier National Park in Water Year 2022.

Season	Month & Year	Camp Muir	Camp Schurman NPS	Carbon River NPS	Cayuse Pass SNOTEL	Longmire COOP	Ohanapecosh RAWS	Paradise COOP	Sunrise NPS
Fall	October 2021	24.0	26.9	44.5	37.5	43.9 ¹	43.8	36.8	39.6
	November 2021	20.4	23.9	42.2	34.6	38.7 ²	40.1	34.6	27.8
Winter	December 2021	10.7	12.1	33.2	25.0	29.9 ³	31.9	23.3	28.0
	January 2022	21.8	23.0	34.7	34.3	31.7	30.5	32.2	24.7
	February 2022	20.0	20.7	35.1	30.3	31.7	32.3	28.7	19.4
Spring	March 2022	18.4	19.7	40.2	32.4	37.7	38.1	30.9	25.1
	April 2022	11.0	14.6	38.1	29.6	37.1 ⁴	39.2	27.0	32.5
	May 2022	21.2	23.8	45.5	36.4	44.0 ⁵	45.9	34.7	36.7
Summer	June 2022	31.2	34.8	54.3	46.0	53.7	56.0	44.9	49.7
	July 2022	44.0	46.4	62.9	57.3	63.4	66.5	57.3	55.7
	August 2022	46.5	48.0 ⁶	64.0	58.5	66.4 ⁷	68.0	62.1	52.4
Fall	September 2022	41.7	NA ⁸	57.2	53.8	60.8	60.2	54.5	45.8
Annual		25.9	NA ⁹	46.0	39.6	44.9	46.0	38.9	36.4

¹ Longmire October values include 3 days missing values, substituted values from co-located telemetered station.

² Longmire November values include 2 days missing values, substituted values from co-located telemetered station.

³ Longmire December values include 2 days missing values, substituted values from co-located telemetered station.

⁴ Longmire April values include 3 days missing values, substituted values from co-located telemetered station.

⁵ Longmire May values include 6 days missing values, substituted values from co-located telemetered station.

⁶ August data at Camp Schurman is 8/1 – 8/27, average is without last 4 days of data.

⁷ Longmire August values include 3 days missing values, substituted values from co-located telemetered station.

⁸ September data was not available.

⁹ Annual average is not available, missing data from August and September.

Precipitation

The beginning of Water Year 2022 was wetter than normal, particularly in November with the Paradise COOP station recording 170% and Longmire COOP station recording 140% of normal precipitation (Figure 7). Winter precipitation was unremarkable except for a drier than normal February. In May 2023, variations from normal precipitation became pronounced, swinging from very wet to very dry. For example, the Paradise COOP station recorded 231% more

precipitation than normal in June and 1% of normal in August. Deviations from normal precipitation July through September resulted in drought conditions. Areas of the park and environs were in moderate drought by October of 2022.³ Monthly precipitation totals from three representative weather stations in the park are presented in Table 3. Precipitation at upper elevation weather stations neared 140 inches, while lower elevation weather stations ranged between 78 and 91 inches (Figure 8).

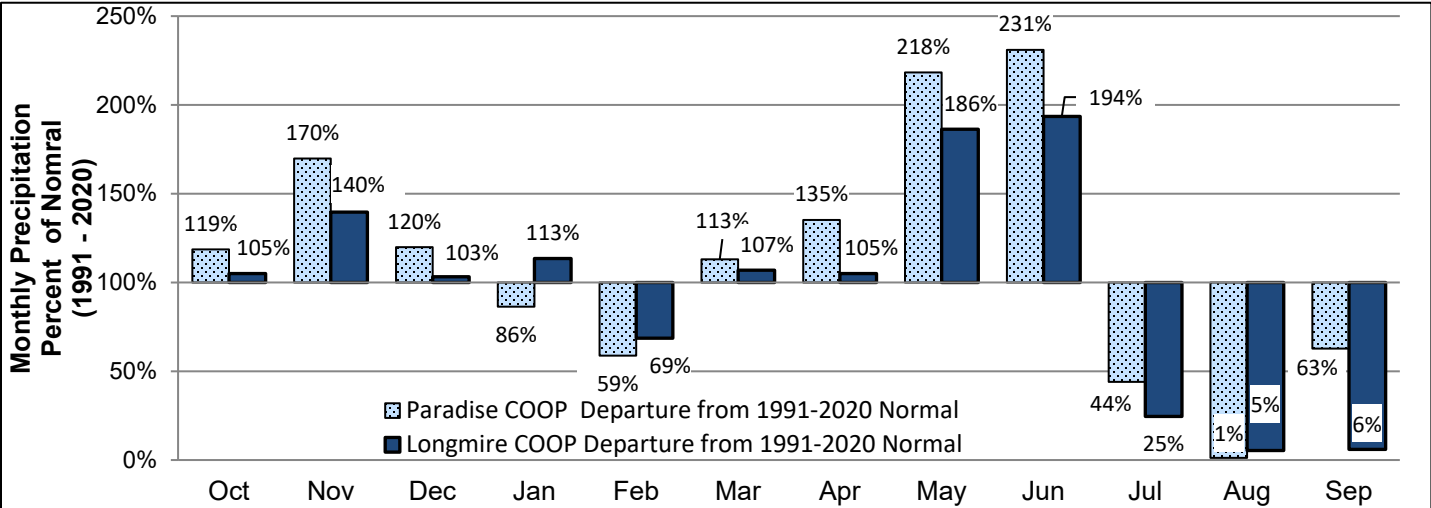


Figure 7. Water Year 2022 monthly total precipitation (inches) as a percent of climatological normal 1991–2020 at Longmire and Paradise COOP Stations.

Table 3. Total monthly precipitation (inches) from weather stations within Mount Rainier National Park in Water Year 2022.

Season	Month & Year	Carbon River NPS	Longmire COOP	Ohanapecosh RAWS	Paradise COOP
Fall	October 2021	6.7	9.5	7.9	13.4
	November 2021	14.1	18.1	20.4	30.8
Winter	December 2021	6.4 *	12.8	13.3	22.7
	January 2022	12.6	13.0	8.3	14.9
	February 2022	7.3	5.9	9.2	7.6
Spring	March 2022	6.1	8.1	5.8	14.9
	April 2022	6.6	6.2	7.0	11.3
	May 2022	10.2	8.9	7.7	11.1
Summer	June 2022	6.9	7.2	5.4	8.9
	July 2022	0.9	0.3	0.5	0.6
	August 2022	0.1	0.1	0.0	0.0
Fall	September 2022	0.1	0.2	0.0	2.8
Annual		78.0	90.2	85.5	138.9

* Freezing temperatures between December 25, 2021 and January 3, 2022 might have inhibited the melt and measurement of accumulated snow. It's possible that precipitation volumes were lost or that precipitation that fell in December was accredited to January.

³ Hegewisch, K. C., J. T. Abatzoglou, D. McEvoy, O. Chedwiggen, B. Nijssen, and J. L. Huntington. Historical Water Watcher web

tool. Climate Toolbox (<https://climatology.org/>) accessed on February 5, 2023.

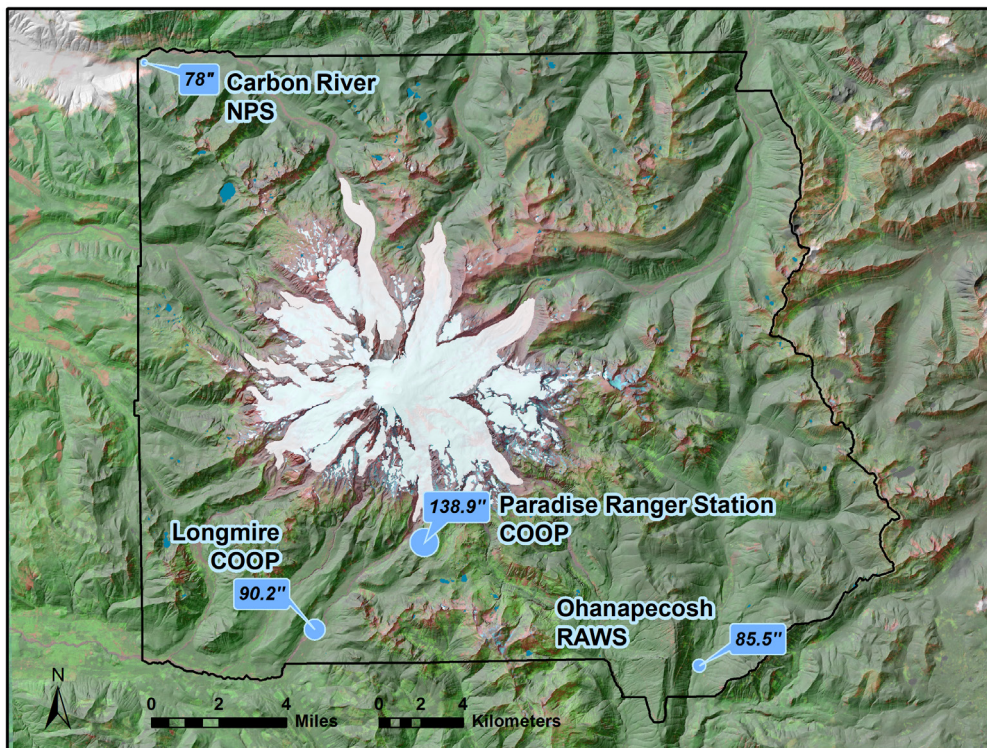


Figure 8. Water Year 2022 precipitation totals for selected stations at Mount Rainier National Park.

Snowpack

La Niña, a climate pattern in the Pacific Ocean that brings abnormally wetter and cooler conditions to the Pacific Northwest region⁴ was back for a second consecutive winter. This year's snowpack, represented as snow water equivalent (SWE) at the Paradise SNOTEL Station (Figure 9), was above normal at its maximum and accumulated later and lasted longer due to the cool and wet spring. Although not as robust as the Water Year 2021 SWE (dotted line), the above-normal accumulation set an expectation for adequate water availability from snowmelt going into summer. Maximum SWE of 83.1 inches occurred on May 26th,

2022, 6.6 inches greater and three weeks later than normal. At the Paradise Coop station (320' higher in elevation than the SNOTEL site) maximum accumulation occurred on April 12th and measured 190 inches of snow as height above ground, much lower and later than in 2021 (236 inches on March 26th, 2021). July's warmer than normal temperatures caused an average of 3 inches of melt per day. This station was snow free on July 28th. On the east side of the park, snowmelt generally occurs earlier in the year. The Cayuse Pass SNOTEL site (5,240') was snow free on July 7th, 2022 and the Sunrise NPS station (6,420'), on July 9th, 2022.

⁴ NOAA. What are El Niño and La Niña? National Ocean Service website. Available at:

<https://oceanservice.noaa.gov/facts/ninonina.html> (accessed February 2, 2023).

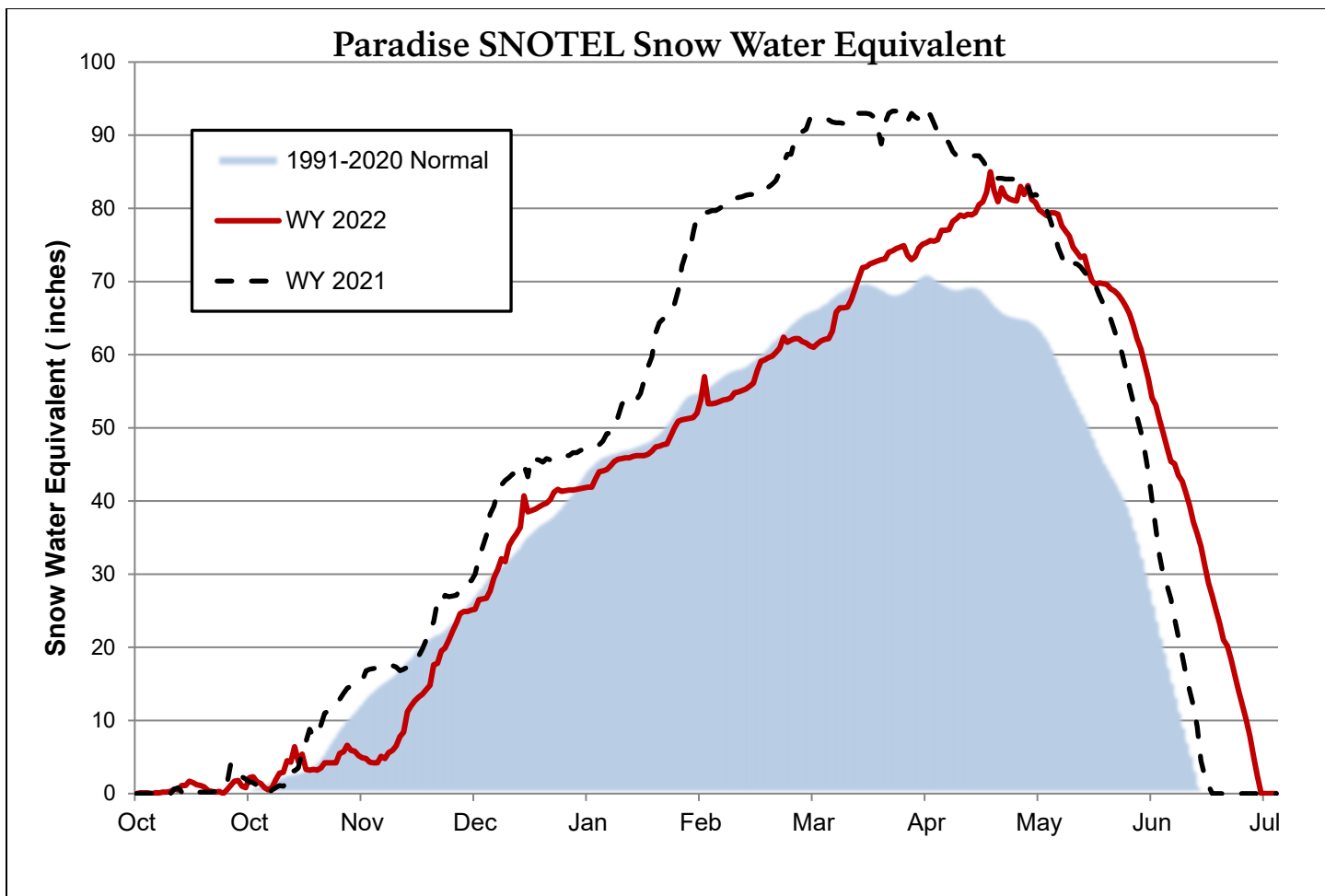


Figure 9. Daily snow water equivalent at the Paradise SNOTEL in Water Year 2022 compared to Water Year 2021 and the climatological normal 1991–2020.

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The North Coast &
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