



Weather Summary

Olympic National Park – Water Year 2023

The North Coast and Cascades Network (NCCN) Inventory and Monitoring Program monitors climate, comparing 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 Olympic National Park.

Significant Weather Events

The water year began with the Olympic Peninsula amid an unprecedented period of dry weather. The proceeding two months of August and September had recorded only 5% of average rainfall. By October 1st, the Elwha Ranger Station had received only 0.10 inch of rain since mid-July. The Hoh Rainforest had received only .29 inches of rain². The first significant rain event occurred on October 21st, after a period of 96 days with little or no measurable precipitation. By this point, several Peninsula rivers had reached record low levels, including the North Fork Skokomish, Quinault, and Hoh Rivers (Table 1).

Table 1. Daily river flow (cubic feet per second) for six rivers on the Olympic Peninsula. Data are from USGS gauges.

River	Flow (cfs) ¹ Oct 17 th , 2022	Mean Flow (cfs) Oct 17 th , Period of Record	Record Low	Year	Period of Record (# of Years)
North Fork Skokomish	30	487	30 ²	2022	98
Elwha	246	1,100	31	1939	109
Calawah	46	1,080	42	1988	46
Queets	344	5,380	310	1988	68
Quinault	189	2,720	189 ²	2022	110
Hoh	238	3,080	238 ²	2022	62

¹ CFS = Cubic feet per second.

² Records set in October of 2022 (also shown in bold).

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.

² Weather Summary: Olympic National Park – Water Year 2022. North Coast and Cascades Network. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2298502>

These extreme low flows impeded and delayed upstream spawning migrations of adult salmonids, making fish vulnerable to harvest and prompting fishing closures on many rivers. In addition, juvenile fish mortalities were observed due to strandings from low flows on several rivers including the Calawah, a river draining the northwest corner of the Olympic Mountains (Figure 1).

These conditions rapidly came to an end at the end of the month. From October 30th to November 4th, a series of atmospheric rivers dropped some of the heaviest precipitation of the year. A second series of major storms impacted the Olympic Mountains from December 24th to 31st, causing minor flooding.



Figure 1. Thousands of dead juvenile fish, including coho, steelhead, and cutthroat trout, were reported in the Calawah River. Flows reached near historic lows in mid-October 2022 (Table 1) due to an unusually dry period between May and late September. Photo courtesy of John McMillan.

Colder than normal temperatures during the winter months of December and February included memorable lowland snow events. On December 20th, CoCoRaHS stations on the North Olympic Peninsula recorded as much as 16 inches of snow. A second event on February 22nd

brought 4–6 inches of snow to low elevation sites on the North Olympic Peninsula.

Probably the most significant weather-related events of the year were the numerous wildfires ignited by a dry lightning storm on August 28th. The prolonged warm and dry conditions of late spring and summer months, combined with the early melting of the snowpack, left areas of the park primed for fire. The lightning strikes were followed by 20 additional days of warm and dry weather, which precipitated major fire growth. The Eagle Point Fire was the first to expand, and on September 2nd, it burned upslope across the Obstruction Point Road, closing a popular trailhead for the remainder of the summer. On September 16th, the Delabarre Fire went from 0.1 acres to 3,554 acres in a 36-hour burn period (Figure 2). By the end of the month, seven active wildfires were burning nearly 5,000 acres within Olympic National Park, and several major backcountry areas were closed to visitors.



Figure 2. Wildfire spreads rapidly through old growth timber in the upper Elwha Valley, September 16th, 2023.

Temperature

Average annual air temperature during Water Year 2023 was above normal, with great variation between two parts of the year. Fall continued a trend from summer of warmer than normal temperatures. October was remarkably warm with temperatures 3.9°F and 7.1°F above normal at Quillayute Airport and Elwha stations, respectively. This temperature pattern quickly shifted toward the end of October, with five of the next six months (November to April) colder than normal. Only the month of January had above normal temperatures (Figure 3).

In another dramatic shift, the month of May broke records statewide, including the Quillayute Airport where it was the highest in the 58-year period of record. Quillayute and Elwha stations were 4.5°F and 5.2°F above normal, respectively (Figure 3). This high monthly average was partially driven by a heat wave from May 12th to 16th, which included the highest recorded May temperature on record at Quillayute Airport (93°F on May 14th). The contrast between the months of April and May was best illustrated at our Waterhole and Buckinghorse SNOTEL stations. May temperatures at these high elevation sites were 12.6°F and 15.1°F higher than the prior month (Table 2), leading to an unprecedented rate of snowmelt in the high country (see Snowpack section).

Summer months of June through August continued to be much warmer than normal, with average temperatures 3.9°F and 2.9°F above normal at Quillayute and Elwha stations, respectively (Figure 3). Average July and August temperatures at coastal sites were particularly noteworthy. For example, average July and August temperatures at Quillayute were 63.1°F and 66.1°F, respectively, both records as the hottest in the 58-year period of record (Table 3). This warm trend continued into the fall, with above normal temperatures in September.

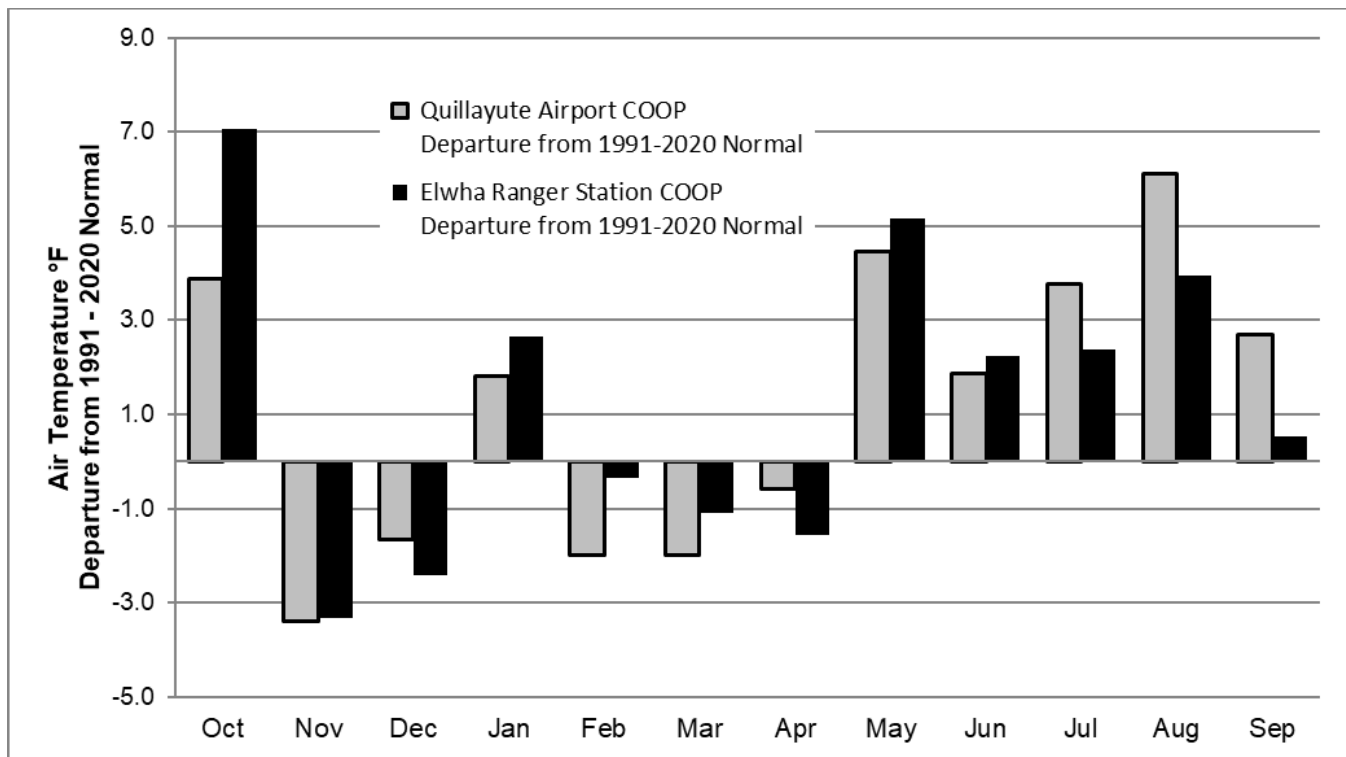


Figure 3. Comparison of Water Year 2023 average monthly temperature (°F) to the climatological normal 1991-2020 at Quillayute Airport and Elwha Ranger Station.

Table 2. Average monthly air temperatures (°F) from weather stations within northeast Olympic National Park in Water Year 2023.

Season	Month	Year	Buckinghorse SNOTEL	Deer Park Ranger Station	Deer Park Road	Elwha Ranger Station	Hayes River Guard Station	Waterhole SNOTEL
Fall	October	2022	51.1	47.2	55.2	55.6	47.1	46.6
	November	2022	33.5	28.4	36.5	37.5	31.9	30.2
Winter	December	2023	28.4	23.6	31.6	34.3	29.2	26.3
	January	2023	31.7	26.9	37.0	39.7	34.0	23.9
	February	2023	28.6	23.7	35.0	37.9	32.1	20.1
Spring	March	2023	28.9	23.9	36.5	41.2	33.1	26.6
	April	2023	33.6	30.0	41.5	45.5	39.0	31.6
	May	2023	48.7	45.5	56.9	58.5	53.9	44.2
Summer	June	2023	50.0	47.4	58.3	59.4	56.9	46.9
	July	2023	56.0	52.9	62.3	64.6	62.0	52.3
	August	2023	58.3	55.3	64.1	67.0	62.8	54.1
Fall	September	2023	48.6	45.4	55.5	58.6	52.5	45.9
Water Year			41.4	37.5	47.5	50.0	44.5	37.4

Table 3. Average monthly air temperature (°F) from west side weather stations within and adjacent to Olympic National Park in Water Year 2023.

Season	Month	Year	Hoh Rainforest	Kalaloch Ranger Station	Ozette Ranger Station	Quillayute Airport COOP	Quinault Rainforest
Fall	October	2022	52.1	52.3	53.4	54.5	53.2
	November	2022	36.3	41.0	41.7	41.3	– ¹
Winter	December	2023	35.2	40.7	39.3	39.4	– ¹
	January	2023	39.1	44.4	44.5	43.5	– ¹
	February	2023	36.4	41.0	41.1	40.1 ²	– ¹
Spring	March	2023	37.1	41.5	42.0	41.9	38.8 ³
	April	2023	42.6	45.1	45.8	46.3	43.7 ³
	May	2023	56.2	53.6	54.6	56.2	56.9 ³
Summer	June	2023	57.9	54.4	55.1	57.4	58.2 ³
	July	2023	63.0	58.2	59.6	63.1	63.0 ³
	August	2023	64.7	60.2	62.0	66.1 ⁴	65.5 ³
Fall	September	2023	56.0	56.3	56.1	59.8	57.4 ³
Water Year			48.0	49.1	49.6	50.8	– ³

¹ Data lost due to sensor failure.

² Missing two days of data

³ Sensor failed post deployment calibration.

⁴ Missing one day of data

Precipitation

Total annual precipitation for Water Year 2023 was well below average at all weather stations at Olympic National Park. Elwha Ranger Station received 41.9 inches (Table 4), 72% of normal. Quillayute Airport received 86.0 inches of annual precipitation (Table 5), 85% of normal. Spatial distribution was typical, with highest annual precipitation at the Quinault and Buckinghorse stations (with 111.8 and 111.6 inches, respectively), while the lowest quantity (25.8 inches) was recorded in the rain-shadowed Deer Park area (Figure 4).

Table 4. Total monthly precipitation (inches) from weather stations within northeast Olympic National Park in Water Year 2023.

Season	Month	Year	Buckinghorse SNOTEL	Deer Park Ranger Station	Deer Park Road	Elwha Ranger Station	Hayes River Guard Station	Waterhole SNOTEL
Fall	October	2022	11.4	4.42	3.48	5.25	7.14	5.1
	November	2022	12.6	– ¹	3.30	7.88	7.33	8.7
Winter	December	2023	22.5	– ¹	5.42	8.35	– ¹	11.1
	January	2023	18.7	– ¹	3.62	5.95	– ¹	9.8
	February	2023	10.1	– ¹	1.39	4.59	– ¹	6.4
Spring	March	2023	8.2	– ¹	1.64	3.19	– ¹	4.1
	April	2023	14.5	6.12	1.99	3.15	– ¹	6.2
	May	2023	0.4	0.78	1.31	0.73	4.65	0.9
Summer	June	2023	0.6	0.88	0.87	0.40	3.32	0.6
	July	2023	1.3	0.69	0.69	0.74	0.08	0.6
	August	2023	0.5	0.30	0.74	0.23	0.00	0.2
Fall	September	2023	10.8	4.01	1.35	1.47	0.06	3.6
Water Year			111.6	– ¹	25.8	41.9	– ¹	57.3

¹ Unheated rain gauge. No data collected during winter months.

Table 5. Total monthly precipitation (inches) from west side weather stations within and adjacent to Olympic National Park in Water Year 2023.

Season	Month	Year	Hoh Rainforest	Kalaloch Ranger Station	Ozette Ranger Station	Quillayute Airport COOP	Quinault Rainforest
Fall	October	2022	8.59	6.52	7.41	9.24	10.08
	November	2022	10.92	9.30	9.03	10.59	11.39
Winter	December	2023	15.17	11.14	13.46	14.74	22.84
	January	2023	12.13	9.39	9.60	10.47	20.96
	February	2023	10.13	9.40	8.57	10.86	10.20
Spring	March	2023	7.39	9.53	6.67	8.95	9.84
	April	2023	11.32	12.33	9.28	12.00	14.38
	May	2023	0.55	0.62	0.73	0.47	0.65
Summer	June	2023	1.03	0.46	1.26	0.66	0.93
	July	2023	1.24	1.02	1.56	1.34	1.11
	August	2023	0.76	0.78	1.11	1.15	0.77
Fall	September	2023	4.16	3.14	3.04	5.52	8.63
Water Year			83.4	73.6	71.7	86.0	111.8

The first 20 days of October had no precipitation, extending a remarkably dry summer in Water Year 2022. The fall months of October and November remained drier than normal; Quillayute Airport received 78% and 84% of normal precipitation, respectively, over those two months (Figure 5). Winter months of December to February remained slightly drier than normal, with westside stations at Quillayute Airport, Hoh, and Kalaloch ranger stations receiving 95%, 85%, and 80% of average, respectively, while the Elwha Ranger Station received 75% of normal (Figure 5). Spring months saw two extremes, with the months of March and May very dry at all stations, while April was consistently wetter than normal. Averaging the three months, spring was 78% and 60% of normal at Quillayute and the Elwha, respectively. It is noteworthy that the month of May was extremely dry, and the Quillayute Airport received only 0.47 inches of rain, 11 percent of normal and the lowest May rainfall on record (Table 5, Figure 5). June continued a record dry period, especially on the coast where the May–June period ranked as the driest in the period of record³

The summer months of June, July, and August received 49% and 50% of normal precipitation at the Quillayute and Elwha, respectively. September was only the second month of this water year with normal to above normal precipitation with Quillayute Airport 121% and Elwha Ranger Station 90% of normal (Figure 5). Despite this, the month was mostly dry, as no precipitation fell during the first 20 days of September.

³ Office of the Washington State Climatologist, July 2023 Report and Outlook. <https://climate.washington.edu>

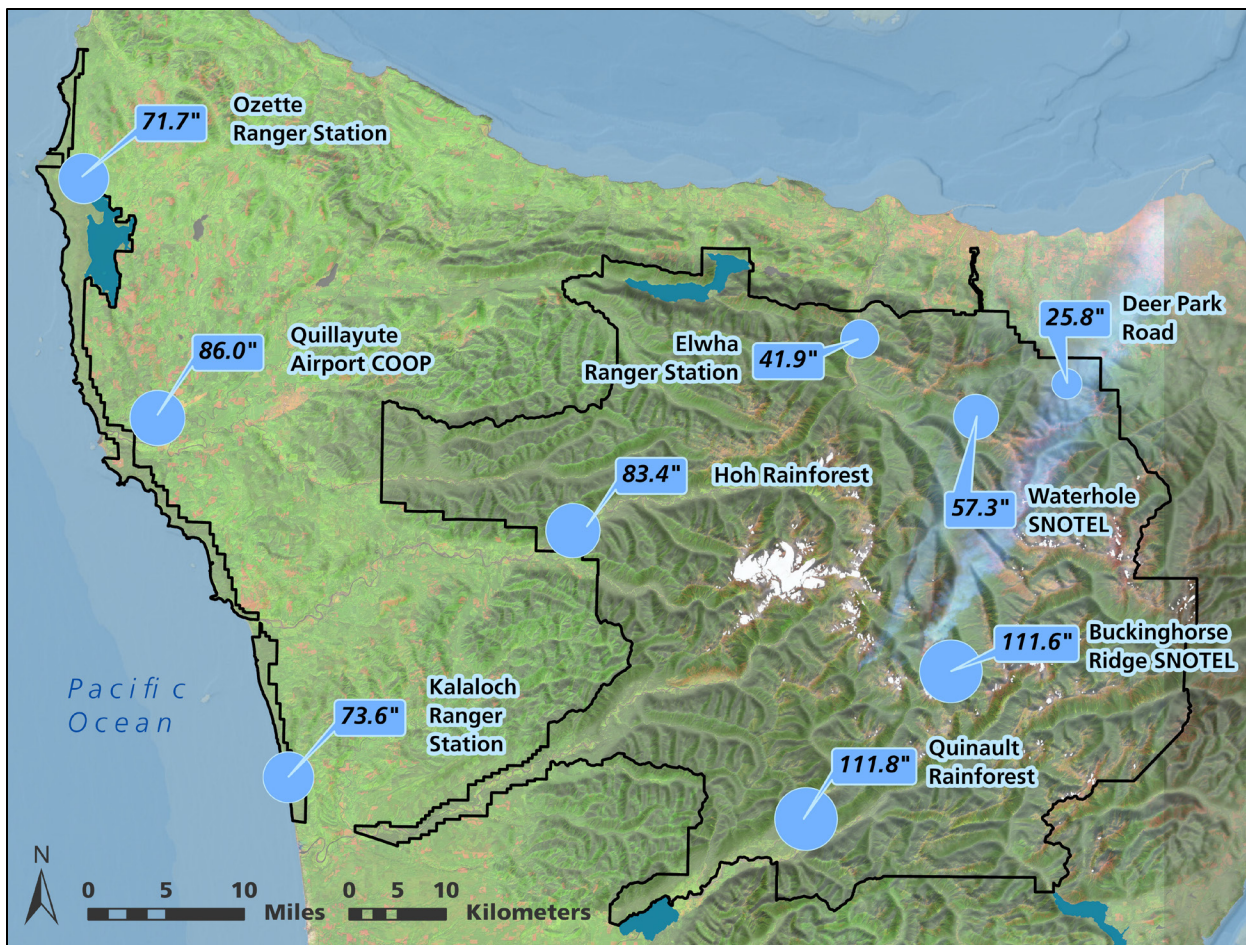


Figure 4. Total precipitation measured at weather stations located within Olympic National Park during Water Year 2023. Blue circles are proportional to the total amount of precipitation measured at each site. Note that the Landsat image used in the background of this map was from September 2023, and columns of smoke from the Low Divide and Delabarre fires can be seen originating just north of the Buckinghorse Ridge SNOTEL station.

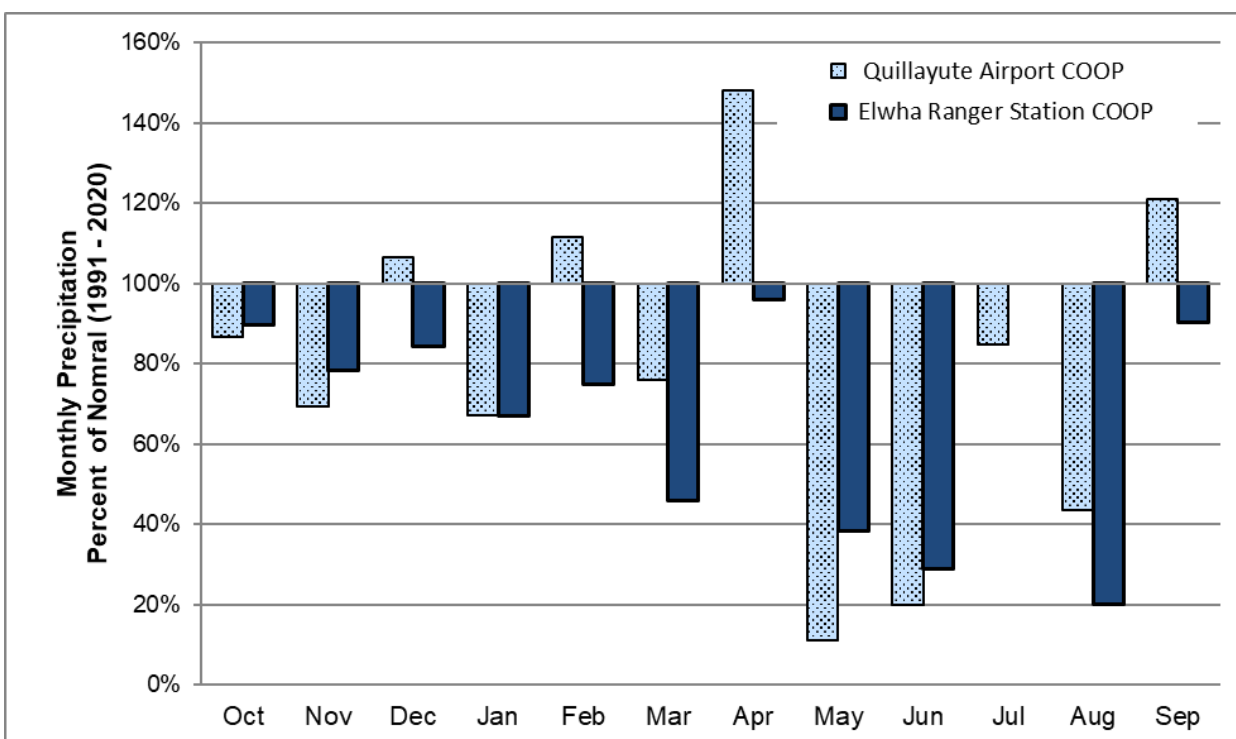


Figure 5. Water Year 2023 monthly total precipitation (inches) as a percent of the climatological normal 1991–2020 at Quillayute Airport and Elwha Ranger Station.

Snowpack

A cooler than normal November and early December provided a near normal snowpack and promised a robust snow year early in the season. Unfortunately, conditions warmed in late December and January allowing much of the precipitation to fall as rain rather than snow (Figure 6), translating to little growth of the snowpack during these two months (Figure 7). Continued cold temperatures in February and March allowed for a steady accumulation of snow; however below normal amounts of precipitation during those months meant that the snowpack remained below normal throughout this period (Figures 7 and 8).

A cool and wet April continued to add snow to the mountains. At the Waterhole SNOTEL near Hurricane Ridge, a peak snow water equivalent of 33.8 inches (81% of normal) occurred on April 22nd, 18 days later than normal (Figure 7). May however, was extremely warm and dry. The Waterhole SNOTEL experienced 29 days without precipitation, and the monthly temperature was 4.3°F above average. This led to an unprecedented rate of melt, with the site being snow free on May 29th, 22 days earlier than normal. A typical

snowpack at this site melts in a period of 76 days, whereas this year, the entire snowpack melted from peak to snow free in 36 days.

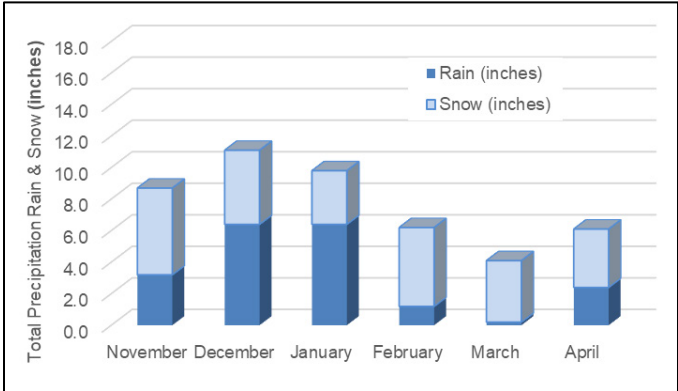


Figure 6. Total precipitation falling as rain versus snow at Waterhole SNOTEL near Hurricane Ridge, Water Year 2023. The greatest proportion of precipitation in December and January fell as rain, slowing the growth of the snowpack.

This early snow melt, combined with the dry and warm summer months, exacerbated summer drought conditions and set the stage for late summer and fall wildfires and a second year of record low flows on Olympic Peninsula rivers.

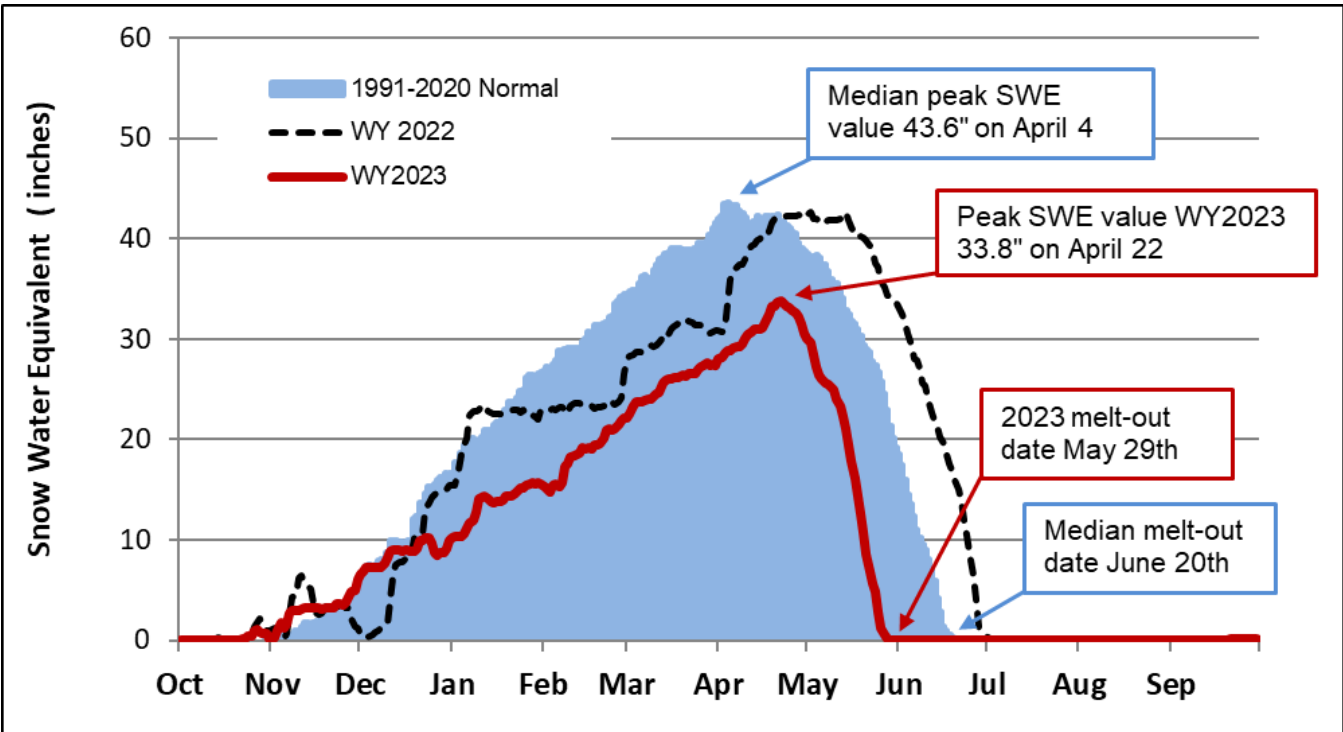


Figure 7. Daily snow water equivalent at the Waterhole SNOTEL, Hurricane Ridge, in Water Year 2023 compared to Water Year 2022 and the climatological normal 1991–2020. Close tracking of the median occurs in the early months of November and December, but despite continued cold conditions, the lack of precipitation during subsequent months leads to below normal snowpack. Despite the peak snowpack being 18 days later than normal, a dry and extremely warm May led to a melt out date 22 days earlier than normal.

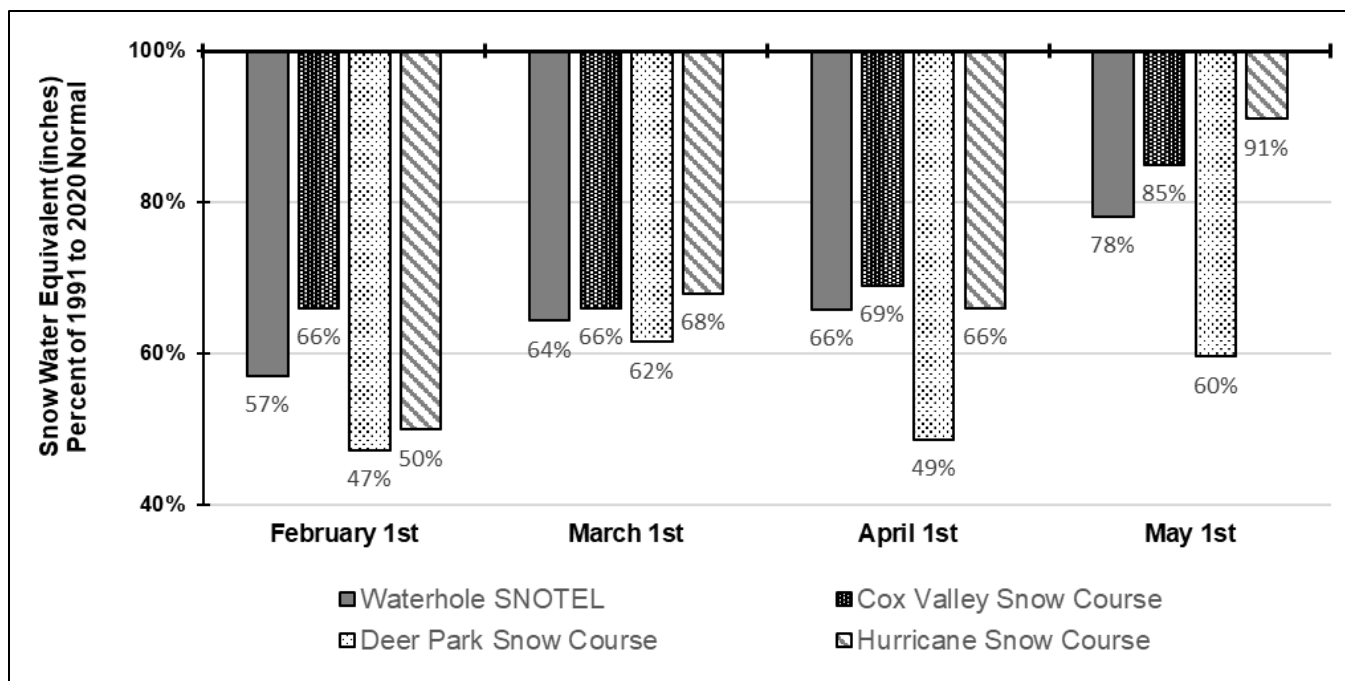


Figure 8. Monthly snow water equivalent at Waterhole SNOTEL and the Cox Valley, Deer Park, and Hurricane Snow Courses in Water Year 2023, compared to the climatological normal 1991–2020. Greatest snow deficits were documented at the Hurricane Snow Course, the lowest elevation site at 4360', and Deer Park, a south facing snow course greatly influenced by exposure to wind and solar radiation. The snowpack deficit became less through the winter and spring months but never achieved normal amounts.

More Information

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