VOLUME XII
ISSUE 1, SPRING 2019

Sage Winds

NATIONAL WEATHER SERVICE BOISE

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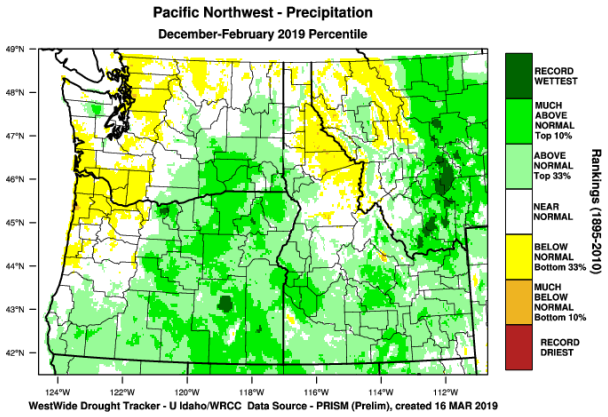
Winter Review

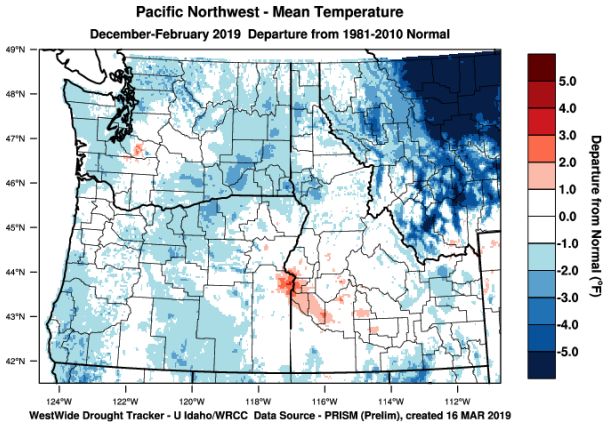
Joel Tannenholz

Winter 2018-19 was wetter or much wetter than normal across most of southeast Oregon and southwest Idaho. Temperatures averaged over the three-month period were near normal, except in the Treasure Valley, which was a few degrees warmer than normal.

Comparisons of average temperatures for December, January, and February showed a somewhat unusual pattern. January was warmer than December, which is normal. But February was slightly colder than January at most locations, which, on average, happens in only one year in ten.

Several locations also observed their seasonal lows in February, which also happens in about one year in ten. Seasonal lows normally occur in December or January, but have been observed as early as October and as late as March.





December

The average temperature for the month was slightly warmer than normal in the central Idaho mountains, and slightly cooler than normal in the Treasure Valley and near the Nevada border. Elsewhere temperatures were close to normal. Precipitation was near or slightly above normal, except for the mountains, where winter began with slightly below normal snowfall.

About half of the total precipitation fell on the first two days of the month, when a deep upper level trough from the north Pacific crossed the area. It came in the form of snow, even in the lower valleys.

The trough brought cold air, which was made even colder during nighttime hours, due to mainly clear skies and snow cover which also inhibited daytime warming.

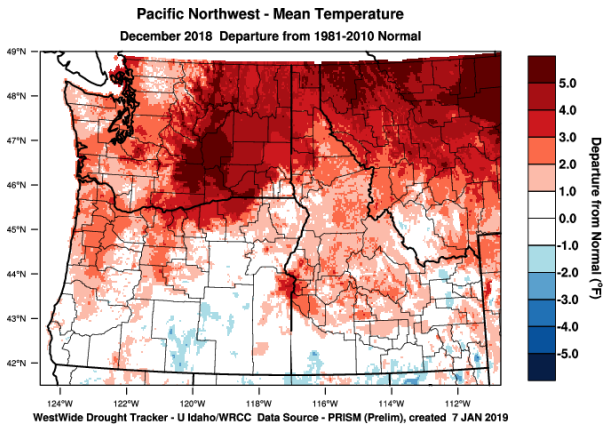
Milder weather arrived on the 9th as the upper level flow shifted into the west. Along with warmer air, westerly winds carried a series of Pacific weather systems inland. Most provided only light precipitation and breezy southeast to southwest winds.

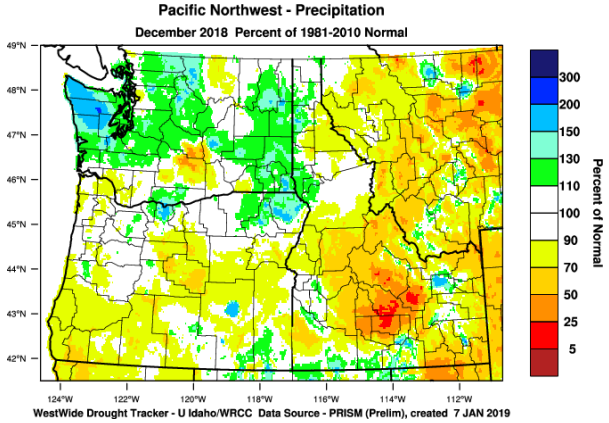
A record high temperature of 48 degrees was set at Baker City on the 18th , breaking the old record of 46 set in 1979.

A record snowfall of 3.4 inches was set at Boise on the 2nd , breaking the old record of 2.8 inches set in 1948.

Snowfall Reports (5 inches or more)

Date	Amount	Location
Dec 2	6″	Boise
	8-9″	Cascade
	12″	Idaho City
	8″	Table Rock
	8″	Mountain Home
Dec 12	7″	Deadwood Summit
	5″	Banner Summit
Dec 21	5″	Brundage





SPRING Spotter Checklist

When should you call us?

HAIL: pea size or larger.

SNOW: 1″ per hour or greater OR storm total 4″+ OR snow causing road closures.

REDUCED VISIBILITY: for any reason.

WIND: Greater than 40 mph or damage.

HEAVY RAIN: ½″+ in 1 hour

FREEZING RAIN: Any amount.

FLOODING: Any water where it shouldn't be, or overflowing river.

TORNADO or **FUNNEL CLOUD**

ANY WEATHER RELATED DAMAGE, DEATH, OR INJURY

How to contact us:

1-800-882-1428

@NWSBoise

facebook.com/NWSBoise

boise.weather@noaa.gov

Spotter Field Guide

Report current precipitation type in your area.

If you own a smartphone or tablet download the free **mPING** app in the App Store or Google Play.

January

January as a whole was warmer or much warmer than normal across the entire area. Precipitation was close to normal.

The month started out cold, but temperatures had risen to above normal by the 5th as the flow aloft backed into the southwest.

On the 10th a warm high pressure ridge began to build over the coast, keeping temperatures above normal through the 12th as it moved inland.

Although the ridge was in place over the northern Intermountain Region, temperatures at lower elevations were slightly cooler from the 13th through the 15th. The combination of clear skies and long winter nights allowed the air in the valleys to cool, creating a temperature inversion capped by the warm air at higher elevations.

By the 16th the ridge had departed, and our region was under southwest flow aloft again. A low pressure trough embedded in the flow brought light snow to the lower valleys, and moderate to heavy accumulation over the mountains on the 17th. The air in the trough was unstable enough to mix out the cold air in the valleys, allowing above normal temperatures to return.

The southwest flow eventually entrained a band of very moist subtropical air over the Pacific. This resulted in an unusually wet day for some areas on the 19th. Heaviest rain fell in a swath from the southwest Idaho highlands across the Treasure Valley to the west central Idaho mountains. Elsewhere only light amounts fell.

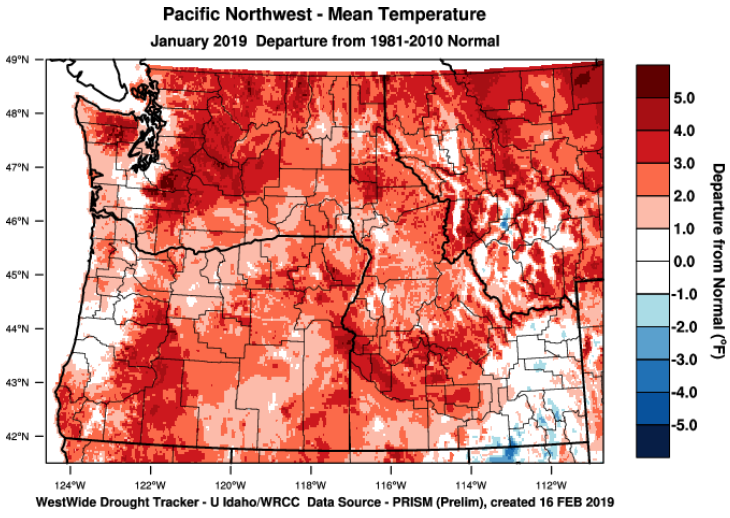
An upper level trough paid a brief visit on the 21st and 22nd, lowering temperatures by about 10 degrees.

On the 23rd a high pressure ridge was building near the coast. A weak disturbance rounding the north portion of the ridge crossed the area, bringing light snowfall to the valleys, with moderate amounts at higher elevations.

The rest of the month stayed mild and dry as the ridge gradually shifted inland.

Snowfall Reports (5 inches or more)

Date	Amount	Location
Jan 6	9″	Banner Summit
Jan 7	10″	Featherville
Jan 17	10″	Atlanta
	6″	Banner Summit
	9″	Brundage
	5″	Bogus Basin
	5″	McCall
Jan 20	5″	Tamarack
Jan 23	6″	Brundage
	6″	McCall



February

Southeast Oregon and southwest Idaho averaged only slightly colder than normal for the month.

Precipitation was much above normal across most of the region. But a few areas experienced the wettest February on record. February is normally the driest winter month.

There were two long spells of below-normal temperatures, from the 5th through the 12th, and from the 16th through the 24th. The cause was a combination of a high pressure ridge over the northeast Pacific and Alaska, and a semi-permanent low pressure trough over the western U.S. Northerly upper level flow between ridge and trough transported cold air from western Canada to the Intermountain Region, reinforcing the trough.

True Arctic air stayed away from our area, so we were spared the record-setting severe cold of Montana, and the somewhat "milder" modified Arctic air which resided in Washington and northern Oregon.

Brief periods of southwest flow aloft enabled temperatures to reach or exceed normal for a few days at the beginning, middle, and end of the month.

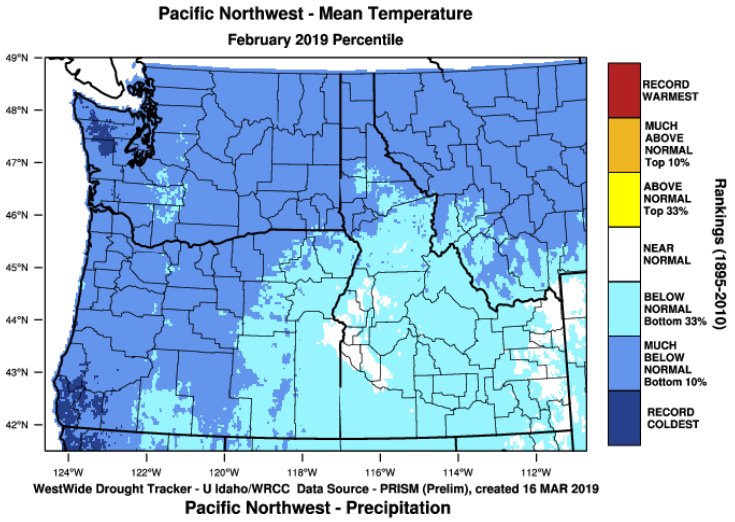
These milder spells were accompanied by the wettest weather of the month, due to disturbances embedded in the flow picking up moisture from off the California coast.

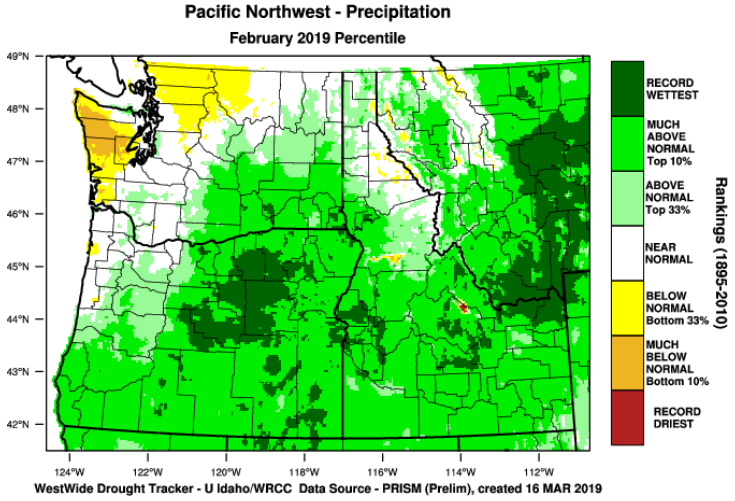
With a monthly snowfall 11.6 inches, Boise had the snowiest February in 70 years, going back to 1949, when 25.2 inches fell. A record rainfall of 0.84 inch was set at Burns on February 14, breaking the old record of 0.49 inch set in 1998. A record rainfall of 0.72 inch was set at Ontario, breaking the old record of 0.68 inch set in 1982.

Featherville received 60″ of snow in a 5 day period from February 22-27 and had a snow depth ranging from 6.5 to 7.5 feet.

Snowfall Reports (5 inches or more)

Date	Amount	Location
Feb 11	13″	Deadwood Summit
Feb 12	26″	Tamarack
Feb 14	13″	McCall
	16″	Soldier Mountain
	16″	Bogus Basin
	27″	Featherville





FLOOD SCIENCE
Snowmelt Processes

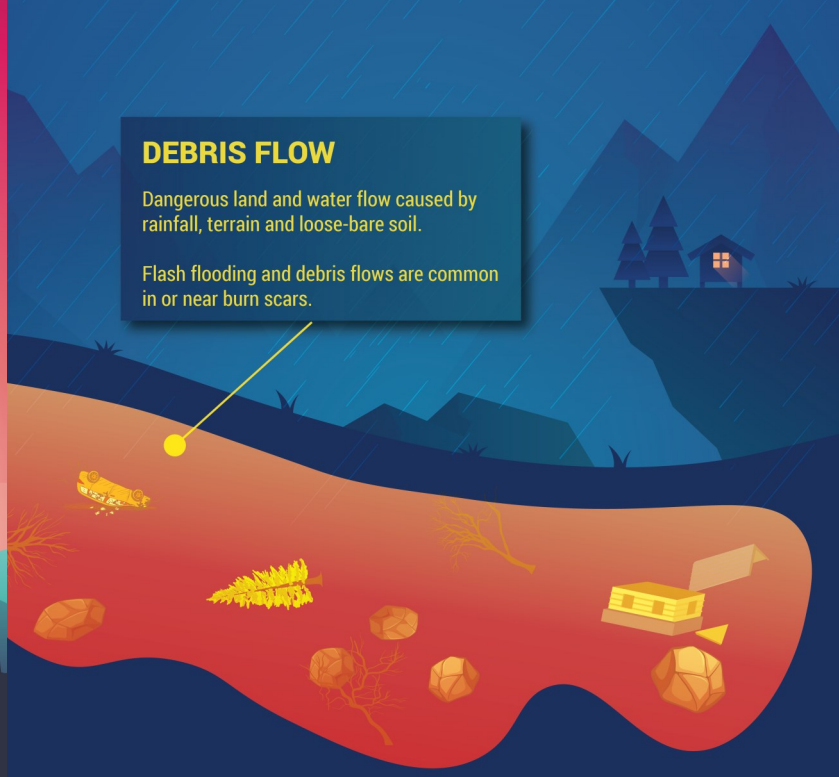
Snow Distribution
The path that weather systems take is the most important factor in determining snowpack, but terrain and vegetation also influence how snow accumulates on the ground.

Snowpack Characteristics
The temperature and the amount of water (snow water equivalent) in the snowpack are important to the melting process. Before rapid melting can occur, the snowpack as a whole needs to be warmed to 32ºF.

Snow Energy Exchanges
Incoming solar radiation, emitted longwave radiation, turbulent transfer of heat, ground conduction, and heat transferred during rainfall are all important factors in heating or cooling the snowpack.

Weather Factors
Strong winds and high dew point temperatures aid in melting by limiting the effects of evaporative cooling and allow the layer directly above the snowpack to remain warm due to turbulent mixing. Rain falling on a snowpack can accelerate the melt process, as

Where the Water Goes
Once rapid melting begins, the water will either infiltrate into the soil, run off into streams and other bodies of water, pool in place and potentially refreeze as ice, or a combination. Ice jam flooding can occur if the river channel has excessive ice cover.



FLOOD SCIENCE
Debris Flows

Debris flows carry everything
A debris flow is a moving mass of loose mud, sand, soil, rock, water and air that travels down a slope under the influence of gravity. To be considered a debris flow, the moving material must be loose and capable of "flow," and at least 50% of the material must be sand-size particles or larger. In areas of very steep slopes they can reach speeds of over 100 mph.*

Burn scars are notorious for debris flows
Burned soil can be as water repellant as pavement. When vegetation is burned at high intensity, water repellent compounds are vaporized, and condense on the soil layers below, which prevents soil from absorbing water. As a result, much less rainfall is required to produce a debris flow.

Rainfall and gravity take over
As water runs downhill through burned areas it can create major erosion and pick up large amounts of ash, sand, silt, trees and boulders. The force of the rushing water and debris can damage or destroy culverts, bridges, roadways and buildings even miles away from the burned area.

The risk of debris flow could last years
Most burn areas will be prone to this activity for at least two years. Each wildfire burn area poses its own unique risk of flash flooding due to many factors including proximity to population centers, burn severity, steepness of terrain and size of the burned area.

Do you have a personal weather station?

If you have a personal weather station that is connected to the internet, you can choose to have your data ingested into weather models to improve future weather forecasts. The program is called the Citizens Weather Observer Program (CWOP). To have your weather station data included sign up for a DW number at wxqa.com. There are many resources available to get your weather station data online.

Fall 2018 in Review

Joel Tannenholz

Overall, fall was warmer than normal in the mountains and cooler than normal in the valleys due to temperature inversions.

Precipitation was below normal area wide, despite a heavy rain event on October 9. Severe to extreme drought continued to plague much of southeast Oregon and Owyhee County Idaho.

September

September was warmer than normal in the central Idaho mountains, and the highlands of southwest Idaho and southern southeast Oregon.

The entire region was considerably drier than normal.

Several locations, including Boise, received no measurable rain.

Under a high pressure ridge, summer weather continued for the first week of September.

A cooling trend commenced on the 8th as a cool upper level low pressure trough from the Gulf of Alaska approached the British Columbia coast. As the trough edged closer, a dry cold front crossed the region on the 10th, followed by cooler North Pacific air.

The trough remained over the west coast through the 18th, keeping temperatures a few degrees below normal. It finally moved inland on the 19th, then continued east out of our area on the 20th.

Rather than stalling over the coast, the next trough continued on an eastward track, pushed along by a building upper level high pressure ridge offshore. By the 24th, the trough was east of our area. Like its predecessor, it produced no significant rain.

In its wake, northwest flow aloft over the Pacific Northwest states kept temperatures below normal.

A high pressure ridge which had been offshore edged inland, bringing a return to summerlike temperatures for the final five days of the month.

October

October temperatures averaged near or slightly below normal across most of the area. The exception was above normal temperatures in the central Idaho mountains.

Drier than normal conditions persisted near the Oregon-Nevada border, and in southwest Owyhee County. The Treasure Valley and parts of the Magic Valley were wetter than normal.

On the 4th a Pacific cold front ushered in two weeks of temperatures more typical of early November.

Following the front, a low pressure trough deepened over the Intermountain Region as a high pressure ridge amplified over the northeast Pacific. Between these two systems, northerly flow provided a steady supply of cool air.

On the 9th a deepening low pressure trough plunged south out of British Columbia. But this was no ordinary trough. It was actually the remains of Hurricane Walaka, which had been picked up northwest of Hawaii by southerly flow west of the Pacific high pressure ridge.

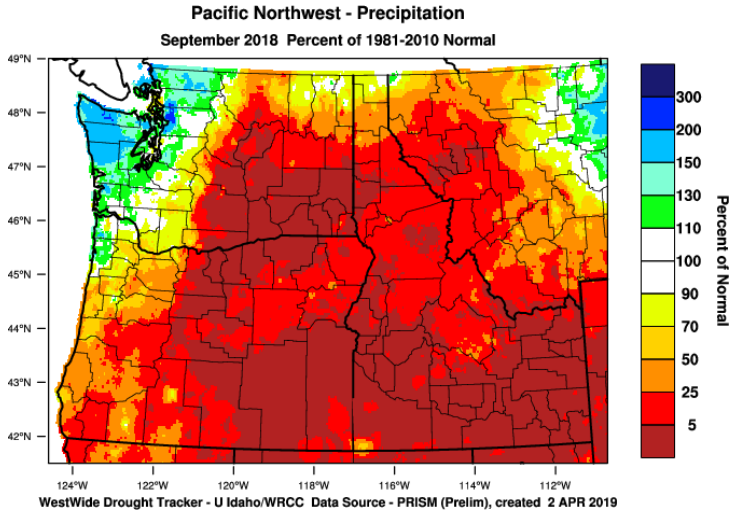
It reached the Gulf of Alaska on the 8th and was carried rapidly south through British Columbia to southeast Oregon and southwest Idaho.

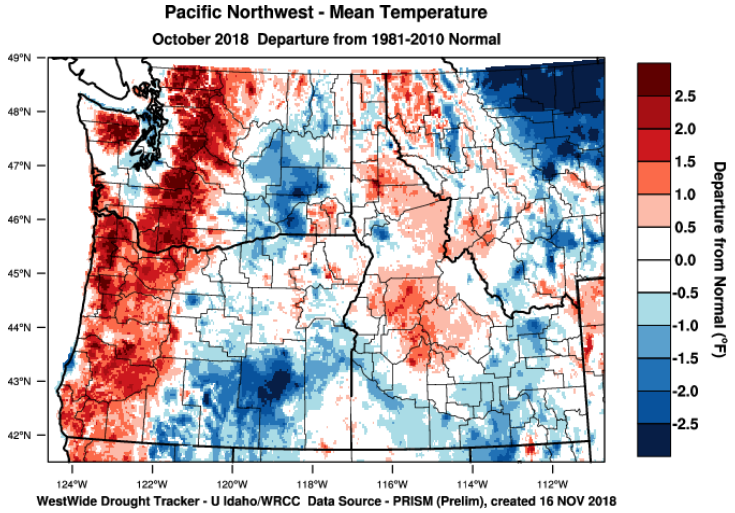
On the 10th, record daily maximum rainfall records were set at Boise (.95 inch), Ontario (.59 inch), Jerome (.76 inch), and Baker City (.42 inch).

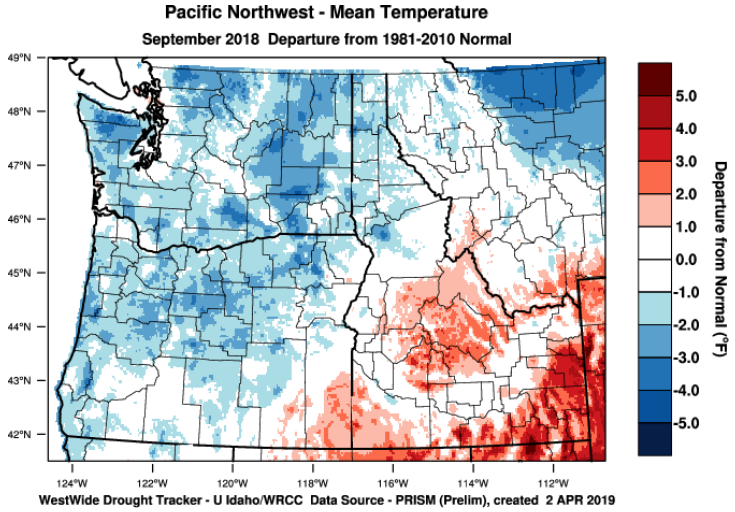
On the 13th a strong but dry Canadian cold front blew through the area, accompanied by gusty northwest winds. The wind diminished and the sky cleared by evening, and temperatures dropped below freezing at most locations by the following morning. At some lower valley locations, including Boise, it was the first freezing temperature of the fall season.

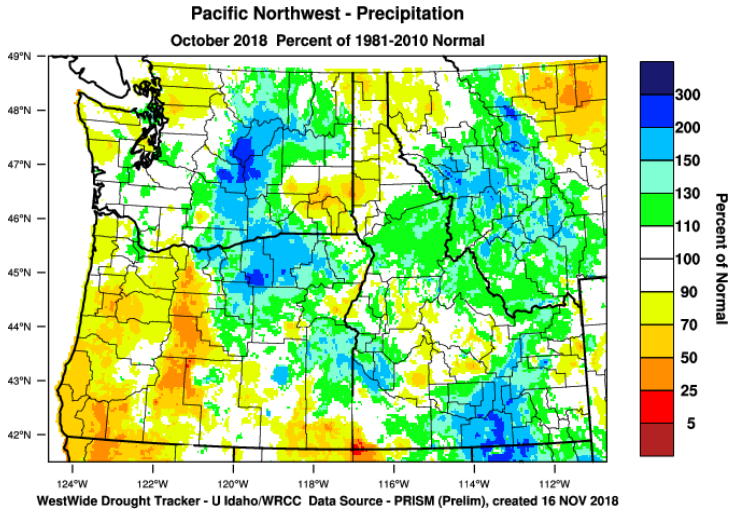
On the 15th and 16th the Pacific high pressure ridge shifted east toward the coast, and the north portion of the ridge built inland over the Northwest U.S. By the 16th temperatures had recovered to near normal across southeast Oregon and southwest Idaho.

Temperatures continued to warm under the ridge, and averaged above normal from the 20th through the 28th. Weak weather systems passing through the ridge brought brief periods of light showers. Increasing clouds were a sign of the next pattern change, which followed a strong Pacific cold front on the 28th.









November

November temperatures averaged near normal for most of the area, but slightly below normal in the valleys.

With the exception of the 1st through the 4th, the first three weeks of the month were cooler than normal. After the 21st, temperatures returned to near or above normal.

Precipitation was below or much below normal. Little or no rain or snow fell during the first three weeks of the month. Wet weather at the end of the month failed to make up the deficit.

The dry spell was due mainly to an upper level high pressure ridge which persisted near the coast.

During that period, dry, unseasonably cool air and clear skies allowed temperatures to fall below freezing most nights. At Burns, record lows in the single digits were recorded on the 7th, 8th, 9th, and 10th. The coldest was zero on the 9th.

The ridge limited precipitation, but its changing position also influenced temperatures.

When it was centered near the coast during the first four days of the month, temperatures were above normal.

When it relocated further offshore on the 5th, northwest flow aloft brought cooler air from the Gulf of Alaska.

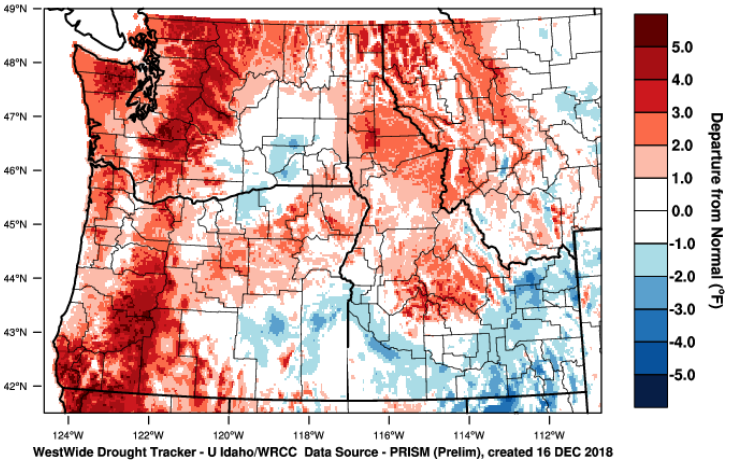
On the 8th the flow became northerly, allowing air from western Canada to lower temperatures even more. From the 8th through the 11th many locations experienced the coldest temperatures since February.

From the 18th through the 21st, the ridge was parked directly over the Intermountain Region. But the warm air aloft established a deep temperature inversion, effectively putting a lid on the cold air in the valleys.

The ridge weakened on the 21st and exited our area on the 22nd, allowing a series of pacific weather systems to move inland across the Intermountain Region. The change to a progressive pattern ended the dry spell and provided enough wind and instability to break the inversion, allowing temperatures to warm to near or above normal for the rest of the month.

Pacific Northwest - Mean Temperature

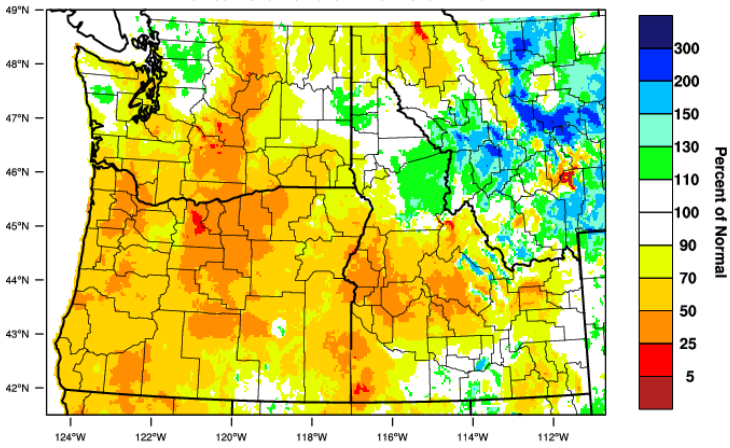
November 2018 Departure from 1981-2010 Normal



WestWide Drought Tracker - U Idaho/WRCC Data Source - PRISM (Prelim), created 16 DEC 2018

Pacific Northwest - Precipitation

November 2018 Percent of 1981-2010 Normal



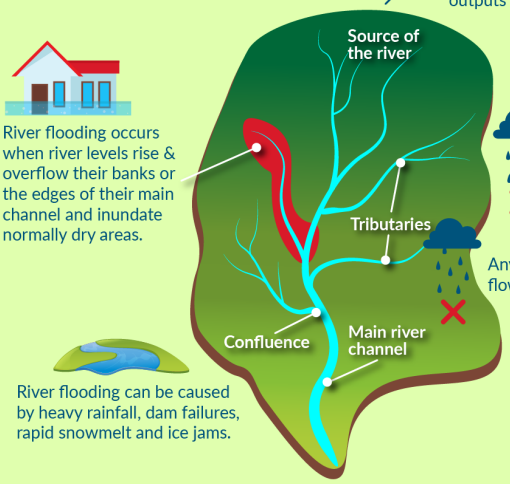
WestWide Drought Tracker - U Idaho/WRCC Data Source - PRISM (Prelim), created 16 DEC 2018

SCIENCE OF RIVER FLOODING

Water is essential for life on Earth. But in large enough quantities, the very substance we drink and use to grow crops can destroy homes, businesses and cause fatalities.

RIVER BASIN

The total area drained by a river and its tributaries. A river basin is an open system with inputs and outputs of water.



6 Steps to Create a Flood Model

HYDROLOGIC CYCLE

Hydrologists try to understand and simulate the natural hydrologic cycle, which is the intricate combination of many processes such as evaporation, transpiration, precipitation, infiltration, interflow, groundwater storage, and runoff.

PRECIPITATION

Precipitation is the primary input to basin hydrologic processes and serves as the primary driver of hydrologic models. Accurate representation of precipitation input is an important intial step. Small river channel systems are very sensitive to rainfall.

RUNOFF

The next step is to compute the amount of precipitation that appears in surface water within a relatively short time from the onset of a storm event. This is runoff. Runoff consists of 3 components: overland flow, rain falling directly on surface water bodies, and interflow.

UNIT HYDROGRAPH

After computing basin runoff, the next step is to calculate a forecast hydrograph in units of discharge. A hydrograph is a plot of the change of stage or discharge with respect to time. Discharge is the volume of water flowing past a location per unit time and is usually expressed in cubic feet per second (cfs).

STREAMFLOW DATA

Scientists use streamflow measurements to capture the vital relationship between discharge (volume flow rate) and stage (height) for a given location. This can only be done by taking streamflow measurements at different river levels and noting the corresponding stages. This relation is called a rating curve.

ROUTING

Hydrologists analyze and interpret how the water moves once it's in the river and how a flood wave is modified due to the effects of storage and friction as it moves downstream. So, what happens upstream affects the entire down-stream community.

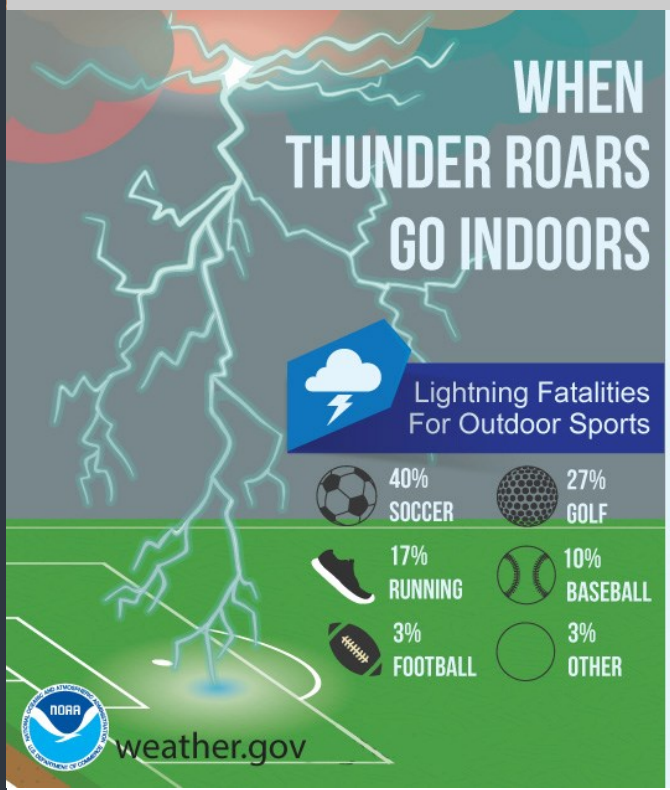
Meet our newest Forecasters!

Anna Lindeman is our newest Meteorologist Intern at the National Weather Service in Boise. Anna grew up outside of Washington D.C. and has always been interested in the weather (especially mountain meteorology!). She graduated from Virginia Tech with a bachelor's in meteorology and master's degree in geography and is excited to apply her mountain weather knowledge in southeastern Oregon and southwestern Idaho. In Virginia, Anna volunteered and worked on research projects with both the NWS Blacksburg and NWS Sterling, led the weather portion of the student-run radio station at Virginia Tech, and even taught a lecture on cold air damming!

Anna is very excited to start her NWS career in Boise! She hopes to gain valuable forecasting experience, work on more research projects, and learn about fire weather. During her free time, she enjoys hiking and exploring the city of Boise with friends. She is happy to now call Boise home and learn more about weather out west!

Stefanie Henry is our newest General Forecaster at the National Weather Service in Boise. Stefanie was born and raised in Illinois, and fell in love with weather phenomena at a young age. She attended Valparaiso University and the University of Oklahoma where she achieved her bachelor's and master's degrees in meteorology, respectively. In Oklahoma, Stefanie participated in the 12-week field research storm chase team VORTEX2, which was the largest and most ambitious effort in understanding supercells and tornadoes to improve upon tornado warnings. She also spent her time volunteering at the NWS in Norman, Oklahoma where she began living her dream of working for the weather service.

Stefanie has taken great pleasure in experiencing 7 years of mountain meteorology at her time with the weather service offices in Sacramento, CA and Missoula, MT, before arriving to Boise. There, she experienced record-breaking wildfire seasons in the Sierra Nevada and Northern Rockies, damaging severe wind events through populous cities, extensive river flooding after the extreme winter seasons in Montana, and abundant hail storms and tornadoes in the Central Valley of California. During her free time, her favorite activities are hiking, photography, snow shoeing, and exploring the city life with friends which has made Boise a great fit. She looks forward to the fun forecast challenges that southeastern Oregon and southwestern Idaho weather has to offer!



Interested in measuring precipitation? Join the CoCoRaHS observing network.

Join CoCoRaHS Today!

CoCoRaHS is a practical, enjoyable and useful activity. If you have an interest in weather and would like to help your local community, as well as scientists and others interested in precipitation, then CoCoRaHS is for you. It only takes a few minutes a day and gives you the chance to participate in real hands-on science. You'll be amazed at what you learn as you become more aware of the variable weather that impacts you, your neighbors, your state and our entire country.

Data on the web

Volunteers submit their observations using the CoCoRaHS website or apps. Observations are immediately available to the public via maps and data analysis tools, and to data users via the CoCoRaHS Web API. Data users such as scientists, resource manages, decision makers and others have come to rely on the high density, high quality measurements provided by CoCoRaHS observers.

CoCoRaHS is Educational

CoCoRaHS offers learning opportunities too. In addition to training materials, newsletters and the 'Message of the Day', members also enjoy opportunities to attend Webinars featuring experts in weather, climatology and other pertinent disciplines. CoCoRaHS offers classroom resources for K-12 teachers. Students get to collect and submit real scientific data – all while meeting State and National Standards in science, math, geography and more!

What is CoCoRaHS?

The Community Collaborative Rain, Hail and Snow Network, is a non-profit, community based, network of volunteers who measure and report rain, hail and snow in their backyards.

A brief History

CoCoRaHS came about as a result of a devastating flash flood that hit Fort Collins, Colorado in July 1997. A very localized storm dumped over a foot of rain in several hours while other portions of the city had only modest rainfall. The ensuing flood caught many by surprise, caused $200 million in damages, and resulted in five deaths. CoCoRaHS was born in 1998 with the intent of doing a better job of mapping and reporting intense storms. CoCoRaHS became a nationwide volunteer network in 2010 and is now international with observers helping provide critical precipitation observations, benefiting their country's needs.

Volunteers of all ages welcome!

Individuals and family volunteers of all ages and all walks of life are the foundation of the CoCoRaHS network, Anyone can help. It only takes a few minutes to check the rain gauge and report your observations.

Training: "the Key to our success"

It is important that all CoCoRaHS precipitation reports be accurate and consistant. Training is provided on how to install gauges, properly measure precipitation and transmit reports. CoCoRaHS precipitation reports are accurate and very useful.

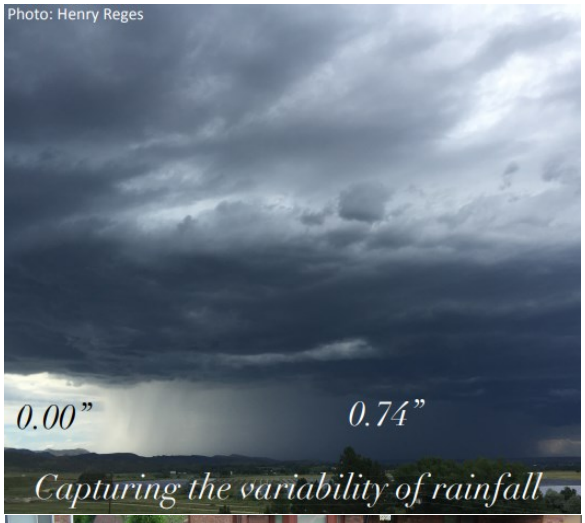
Why is there so much interest in rain, hail and snow?

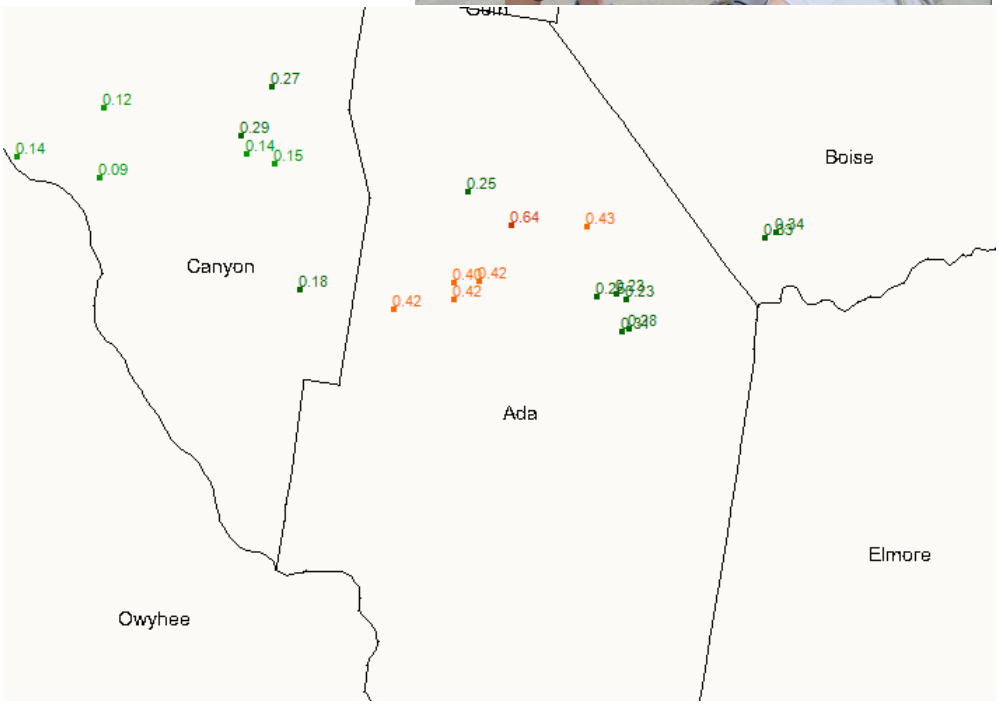
Precipitation is essential for life. It varies greatly with topography, storm type and season. It really is true that it may pour on one side of the street and be dry on the other. A portion of a field may be pounded by hail while others nearby receive no damage. Snowfall may pile up in one neighborhood and only dust another. Rain, hail and snow are fairly easy to measure, and the data collected are very important. Meteorologists, hydrologists, engineers, builders, farmers . . . you name it, everyone seems to care about rain, hail and snow. That's why we ask, "How much fell in your backyard?"

There are limited observations across southwest Idaho and southeast Oregon, compared to the rest of the country, so we would love to have your observations. To learn more about the CoCoRaHS program and to see where your fellow observers have recorded rain amounts, visit http://www.cocorahs.org/.

Invite your neighbors, relatives and friends by sending them this "Join" link:

http://www.cocorahs.org/application.aspx





National Weather Service Boise Staff

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Stefanie Henry
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Joel Tannenholz

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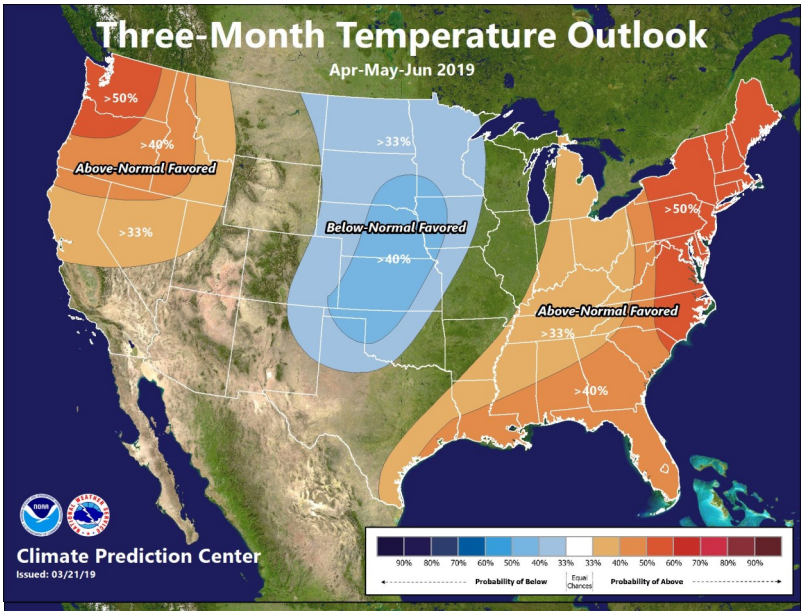
Wasyl Hewko

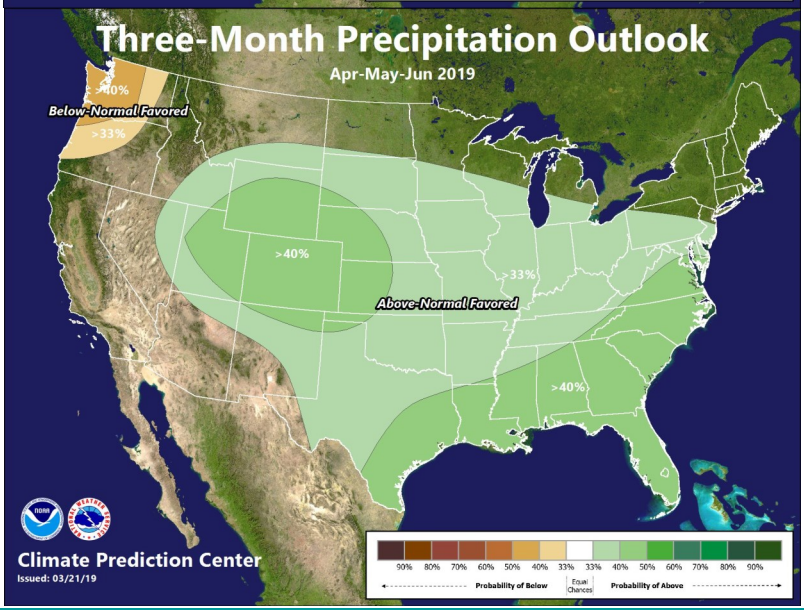
Spring Outlook

The following graphics show the official three-month outlook for the spring of 2019 (Apr-May-Jun) from the Climate Prediction Center, part of the NWS. A higher chance of above-normal temperatures is forecast across the Pacific Northwest and the eastern United States In the Midwest, odds favor a cooler than normal Spring.

As for the country's precipitation outlook, higher than normal chances exist across much of the Plains and east, while odds favor a drier than normal Spring in the coastal Pacific Northwest.

For southeast Oregon and southwest Idaho, these charts indicate higher odds for above normal temperatures, with odds favoring below-normal precipitation.





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SPRING is HERE!

Friendly reminders on keeping you and your family safe

Springtime weather to start preparing for:

- **Flooding**: Snow melt combined with rainfall can create sheet flooding, but some thunderstorms can produce heavy rainfall in a short period of time and create flash flooding. Both of these scenarios can threaten life and property.
- **Thunderstorms**: Hail, lightning, gusty winds, and flooding are all possible with thunderstorms, and can be dangerous. If you hear thunder, it is time to go indoors.

SPOTTERS! When do we want to hear from you?

- Hail is occurring – note the size in diameter. Use familiar items such as the size of a pea, quarter, etc.
- Heavy rainfall that is causing flooding of any kind.
- ANY property damage caused by wind, hail or rain.
- Funnel Cloud or Tornado

Questions? Comments? Suggestions?

Email:
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Spring Snowpack and Flood Outlook

The storm track over February 2019 brought record or near record precipitation values to much of the region along with cool conditions, allowing the snow pack to accumulate significantly. The potential for spring flooding due to snowmelt in 2019 is well above average across most of central and southern Idaho and eastern Oregon. The following graphic illustrates the amount of snow pack compared to normal for April 1st.