

# ***WEATHER OUTLOOK 2021-22***

***PRESENTED BY***



**WorldWeather** Inc.

Predicting The Impact of Nature

**WEBSITE:**

<http://www.worldweather.cc>

**EMAIL:**

[worldweather@bizkc.rr.com](mailto:worldweather@bizkc.rr.com)

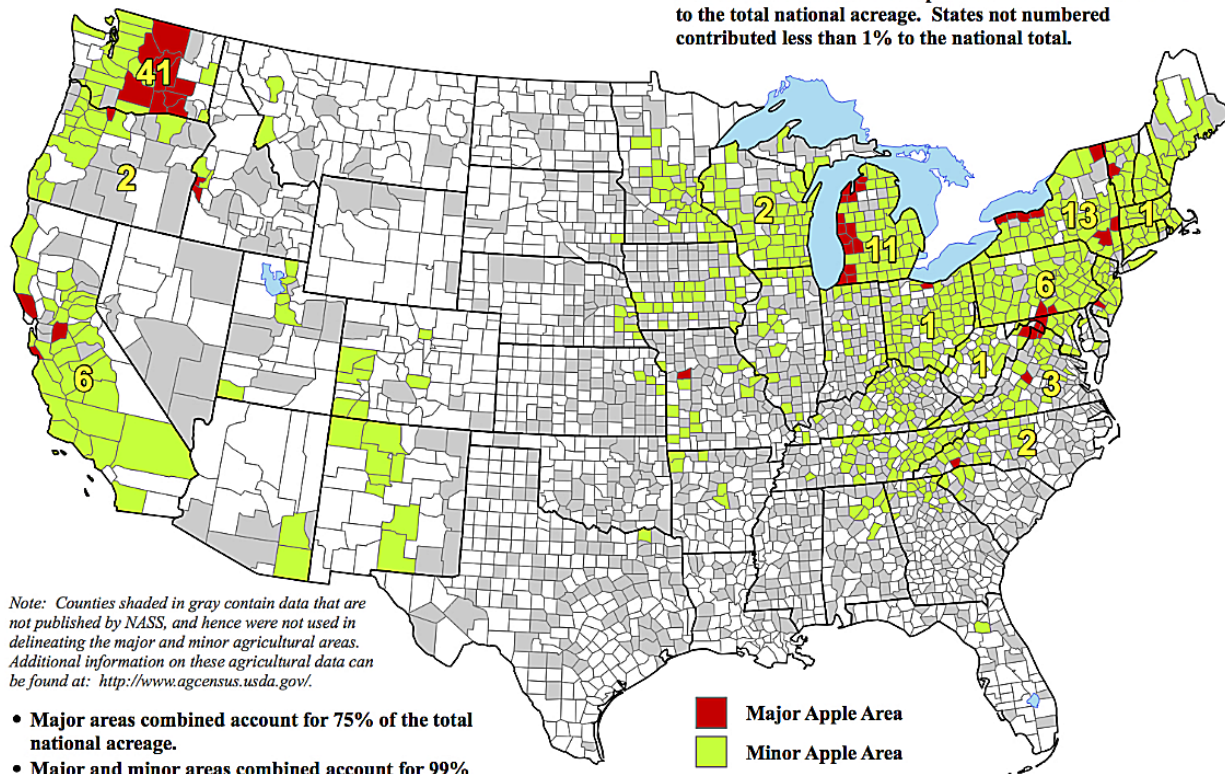
**Telephone: 913-383-1161**

**Fax Number: 913-383-1198**



# United States: Apples

Yellow numbers indicate the percent each state contributed to the total national acreage. States not numbered contributed less than 1% to the national total.



*Note: Counties shaded in gray contain data that are not published by NASS, and hence were not used in delineating the major and minor agricultural areas. Additional information on these agricultural data can be found at: <http://www.agcensus.usda.gov/>.*

- Major areas combined account for 75% of the total national acreage.
- Major and minor areas combined account for 99% of the total national acreage.
- Major and minor areas and state acreage percentages are derived from NASS 2007 Census of Agriculture data.

Major Apple Area  
Minor Apple Area

USDA World Agricultural Outlook Board  
Joint Agricultural Weather Facility



Contiguous U.S.

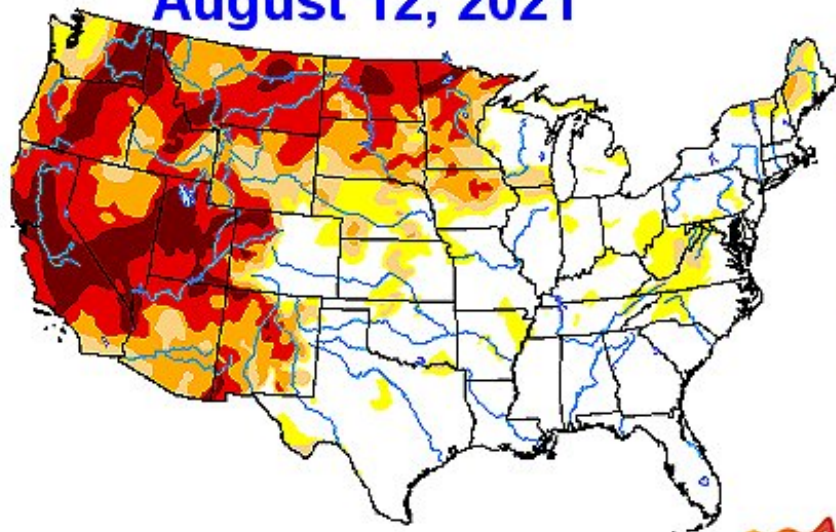
Drought Severity

D0 - Abnormally Dry  
D1 Drought - Moderate

D2 Drought - Severe  
D3 Drought - Extreme

D4 Drought - Exceptional

August 12, 2021

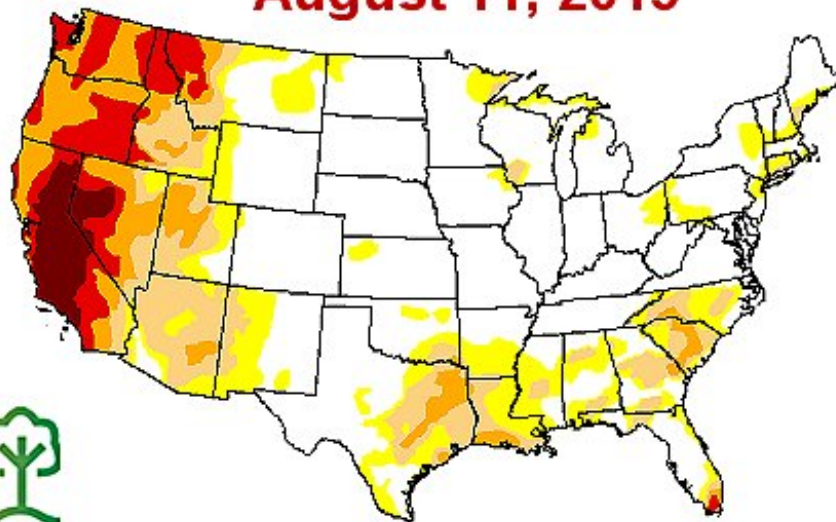


USDA

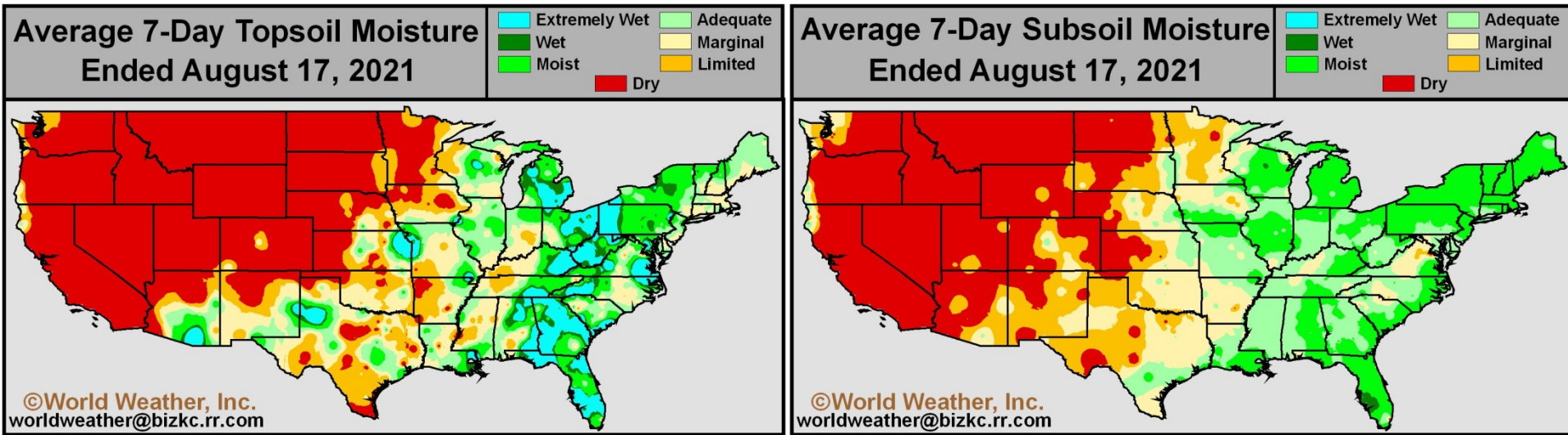


National Drought Mitigation Center

August 11, 2015



**U.S. Drought Monitor Comparison**

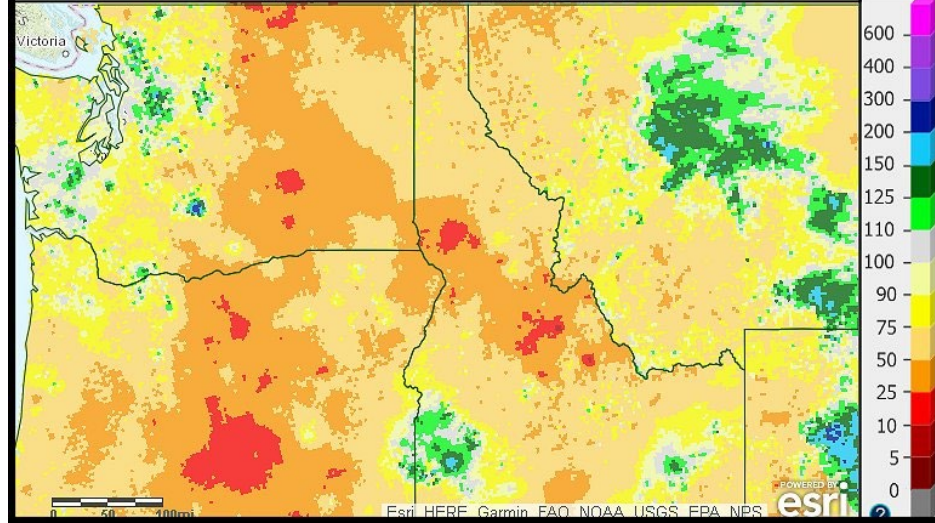


Unusually dry and hot weather has occurred this year in the western United States. However, most apple production areas had sufficient water supply to support the largely irrigated crop. Michigan was the wettest production area in the nation and had well-timed precipitation throughout the growing season which should have resulted in a good production year. Most of the northeastern U.S. and neighboring areas of Canada received a favorable distribution of rain and sunshine supporting good production as well.



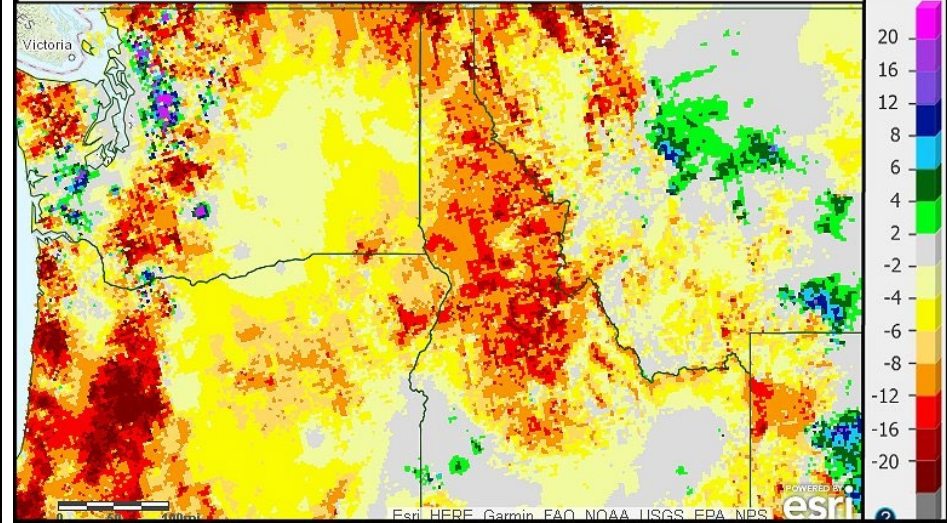
**Year To Date Percent Of Normal Precipitation  
Ending Saturday, August 14, 2021**

Percent



**Year To Date Departure From Normal  
Rainfall Ending August 14, 2021**

Inches

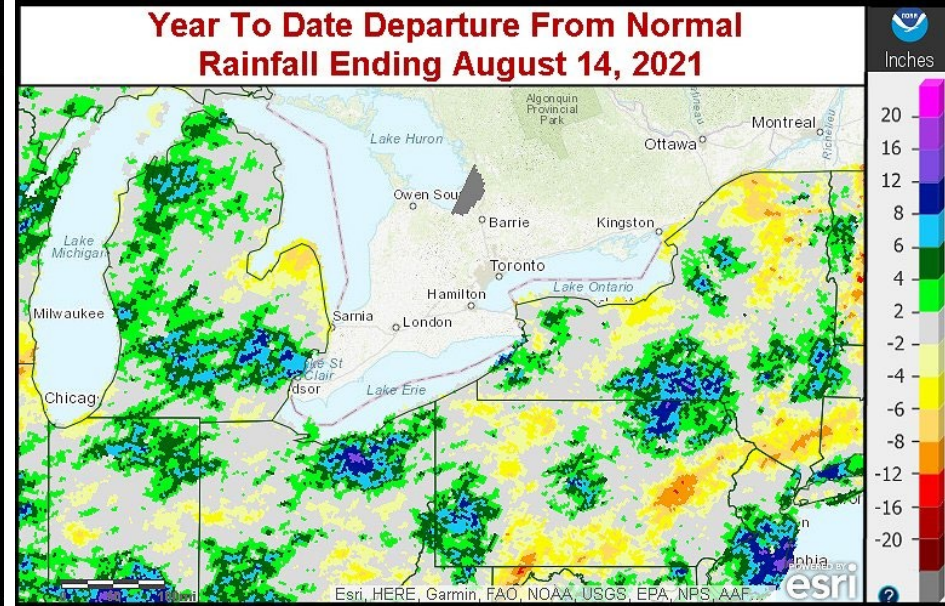


Had it not been for irrigation water in Washington and neighboring areas in the Pacific Northwest, this year's crop would have been a disaster. The Cascade Mountains were one of the few areas in the western United States that reported normal to above normal snowfall last winter and that paid off hugely this summer when temperatures soared to record levels warranting frequent and significant irrigation. [Another good winter snowfall season is now needed to replenish soil moisture and water supply.](#)

## Year To Date Percent Of Normal Precipitation Ending Saturday, August 14, 2021



## Year To Date Departure From Normal Rainfall Ending August 14, 2021

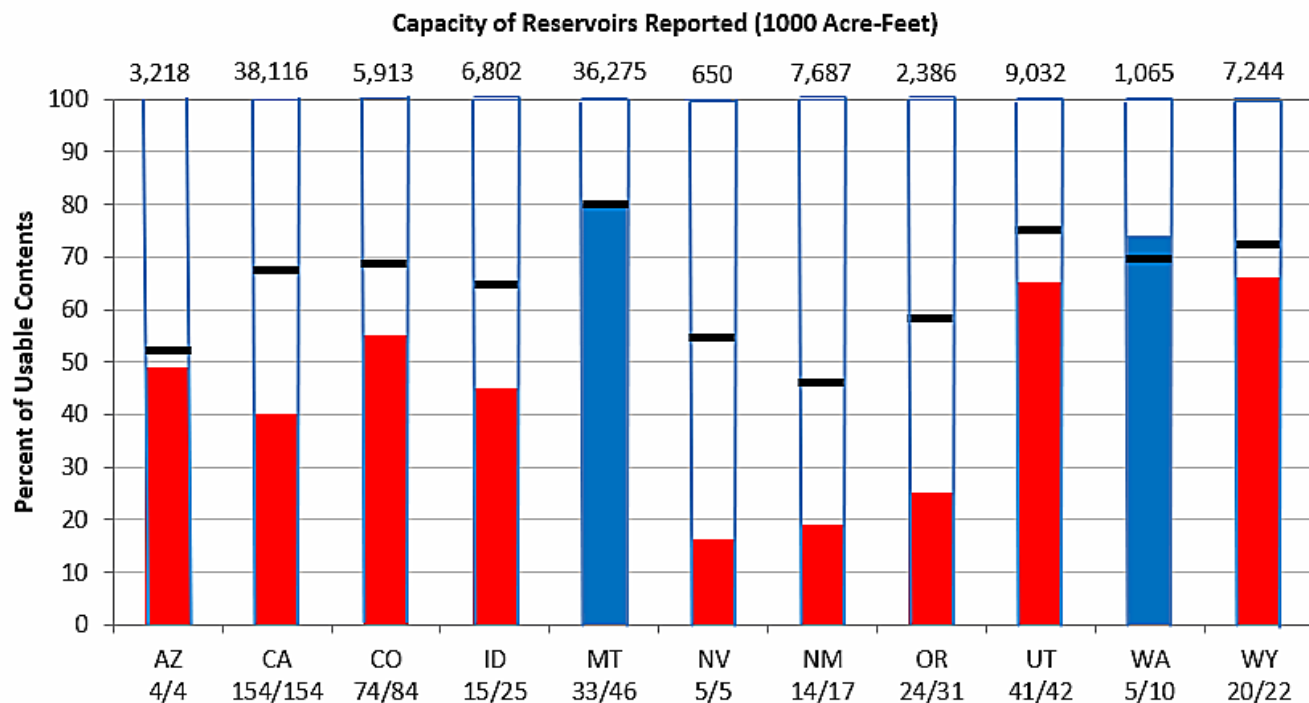


Rainfall this year in the Great Lakes region and northeastern United States, as well as neighboring Canada, was erratic enough to induce pockets of above average precipitation not far from areas that received a little lighter than usual moisture. Sufficient rain fell to maintain good soil moisture during much of the year and whenever soil conditions became dry there was usually some timely rain. Not all areas have done well. A part of Pennsylvania and Ohio have accrued some moisture deficits in groundwater storage.



# Reservoir Storage as of August 1, 2021

■ Below Average ■ At or Above Average ■ Average



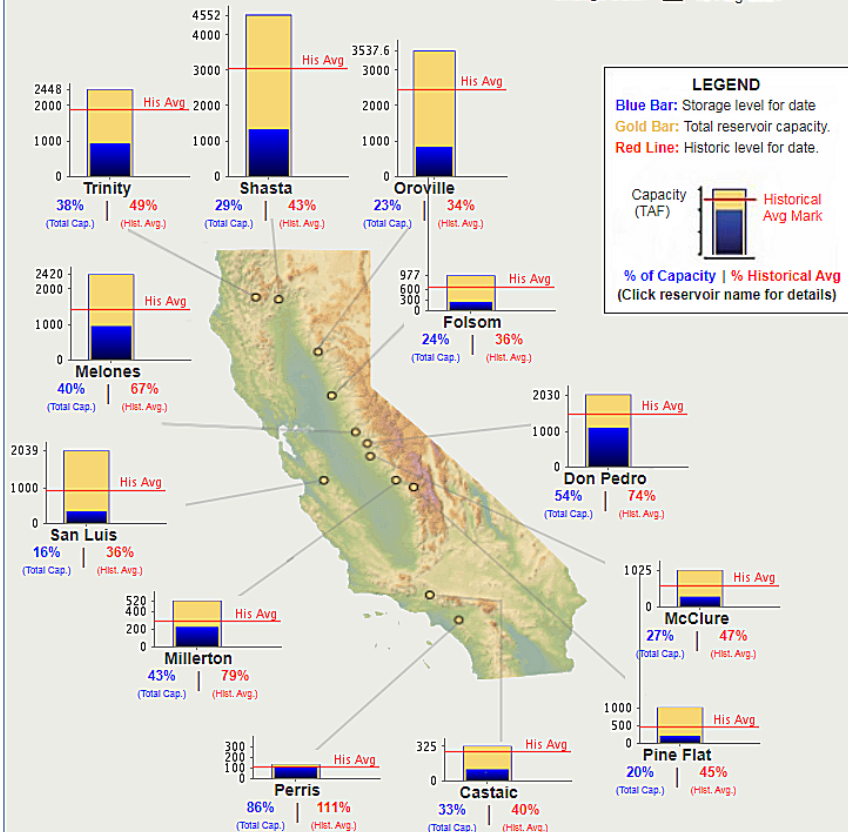
Prepared by: USDA Natural Resources Conservation Service  
National Water and Climate Center, Portland, OR  
[www.nrcs.usda.gov/wps/portal/wcc/home/](http://www.nrcs.usda.gov/wps/portal/wcc/home/)



# CURRENT CONDITIONS FOR MAJOR RESERVOIRS: 15-AUG-2021

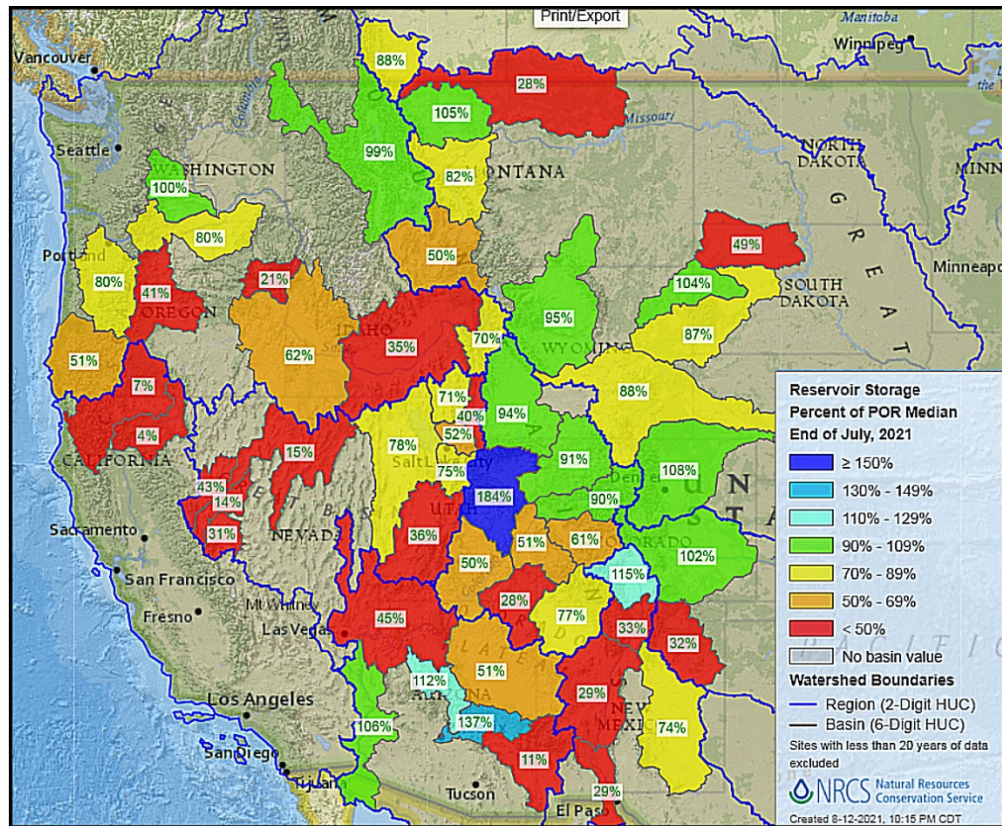
Data as of Midnight: 15-Aug-2021

Change Date: 15-Aug-2021



[Click for printable version of current data.](#)

Report Generated: 16-Aug-2021 4:30 PM

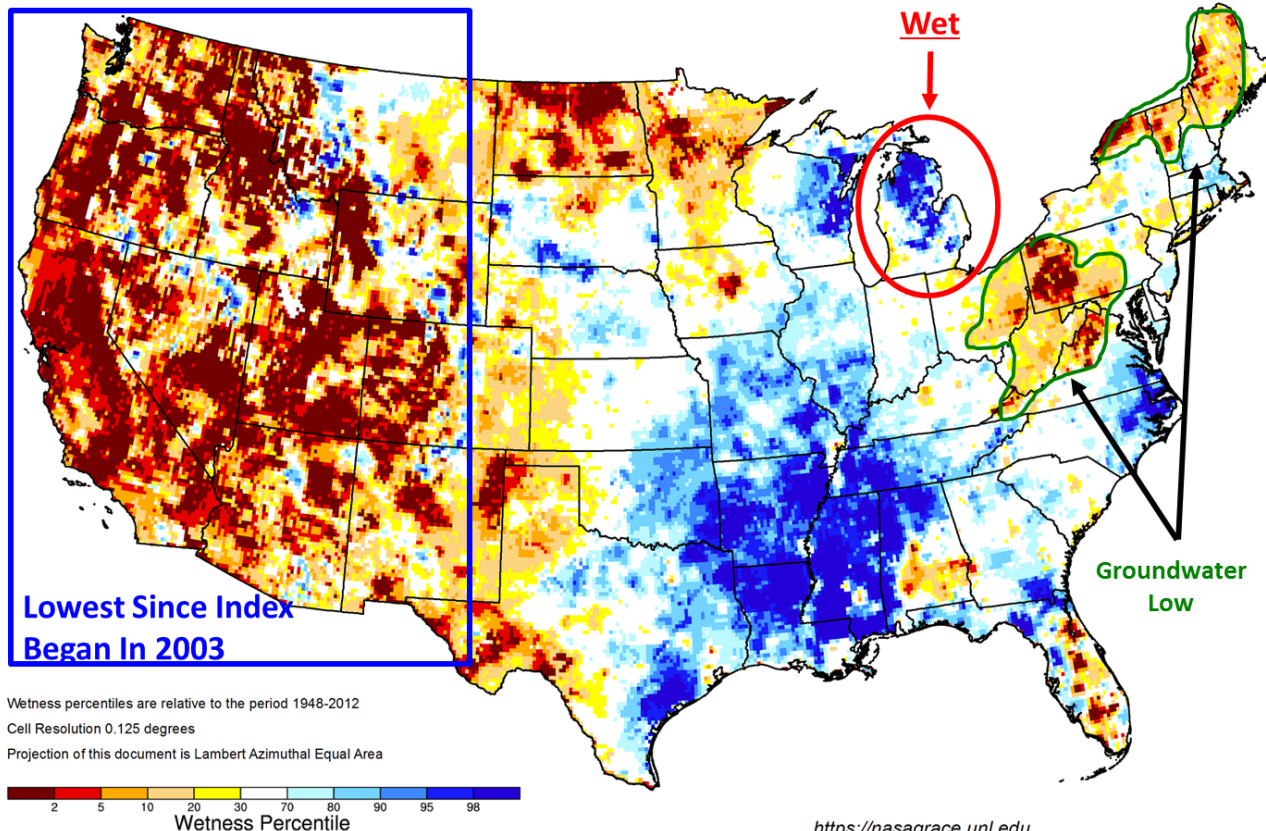


Water supply in much of the west is below normal with many areas well below normal.



# GRACE-Based Shallow Groundwater Drought Indicator

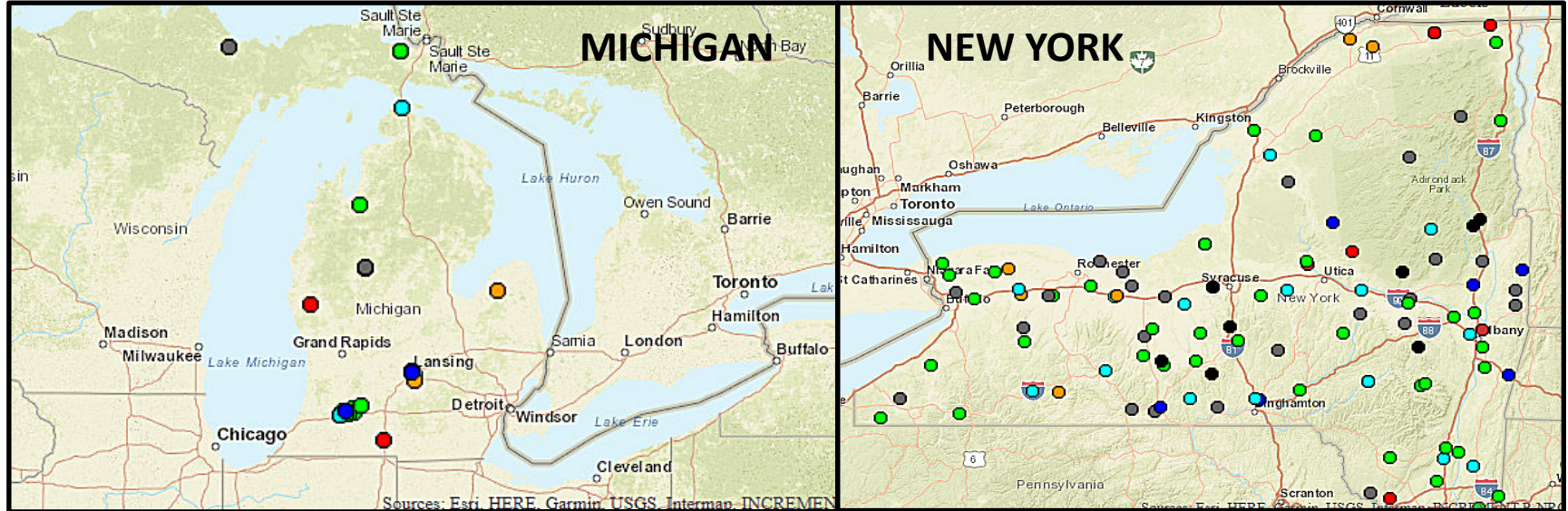
August 09, 2021



NASA's groundwater drought index for the western U.S. has never been so low since its inception in 2003 and that raises worry over 2022 water supply especially in California and states to the east. Michigan, much of New York and parts of Pennsylvania have good long term moisture, but there is need for greater moisture in a part of the NE U.S.



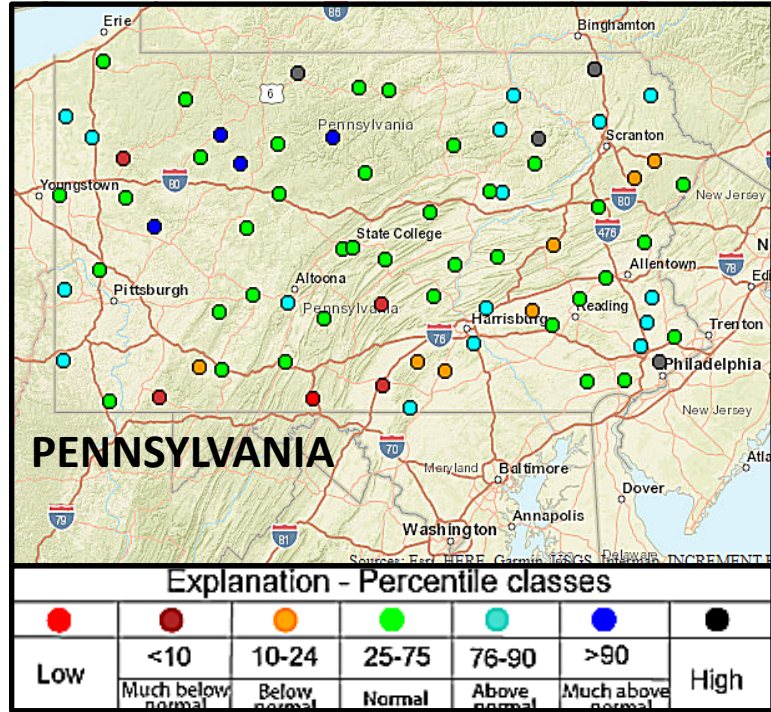
# GROUNDWATER RANKINGS



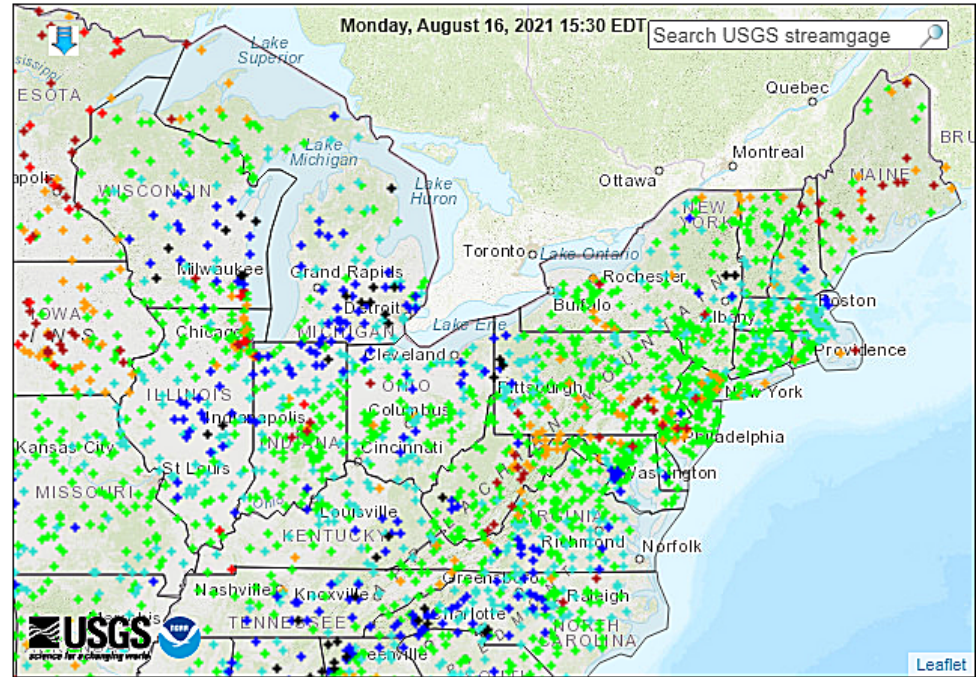
Not many areas in Michigan or New York have a problem with long term water supply, but there are a few areas that are a little dry down deep into the ground.



## GROUNDWATER RANKINGS

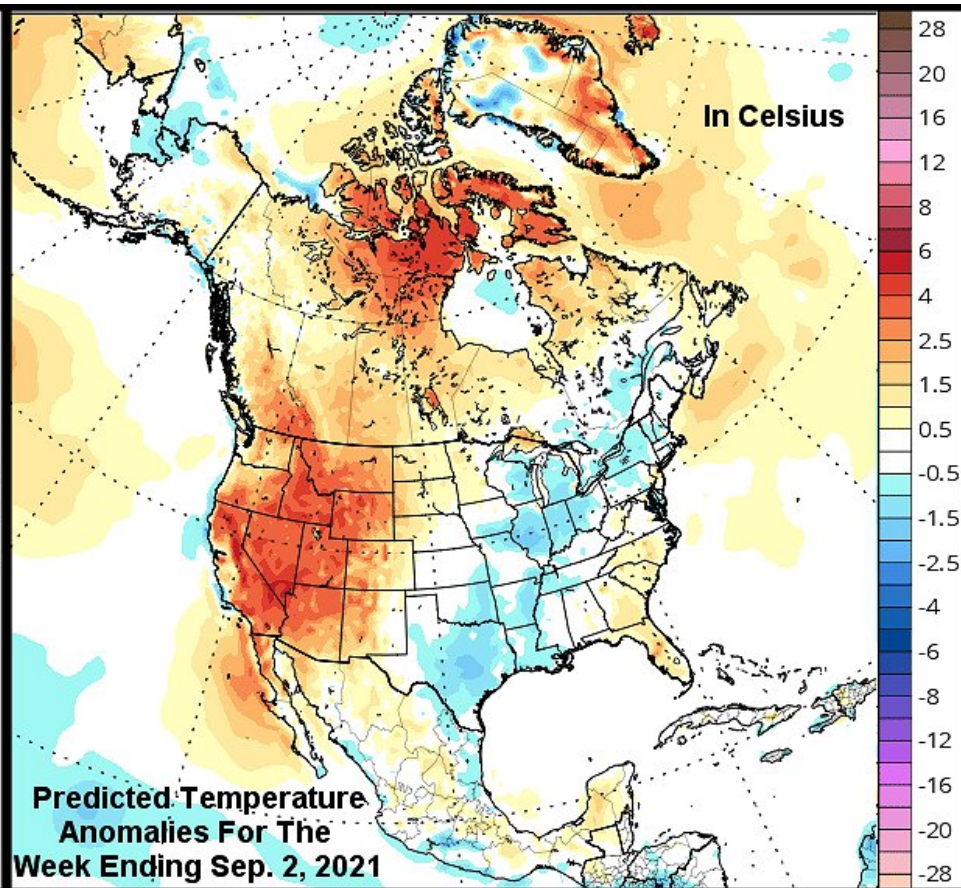
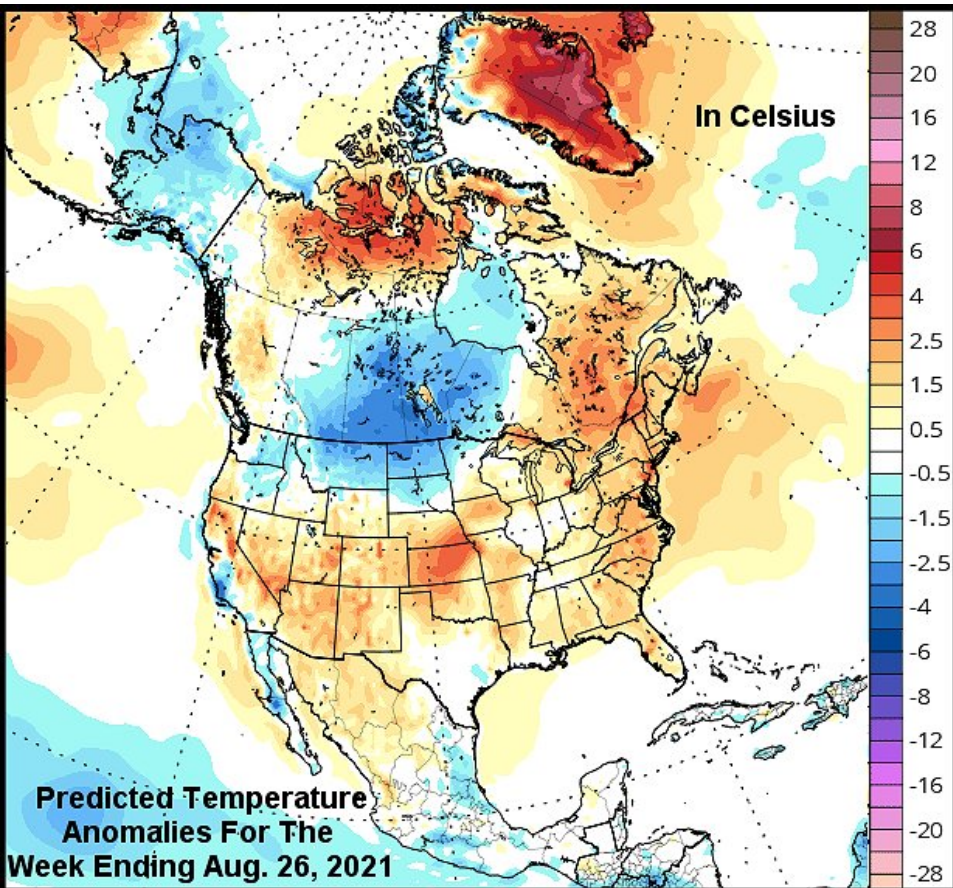


## Map of real-time streamflow compared to historical streamflow for the day of the year

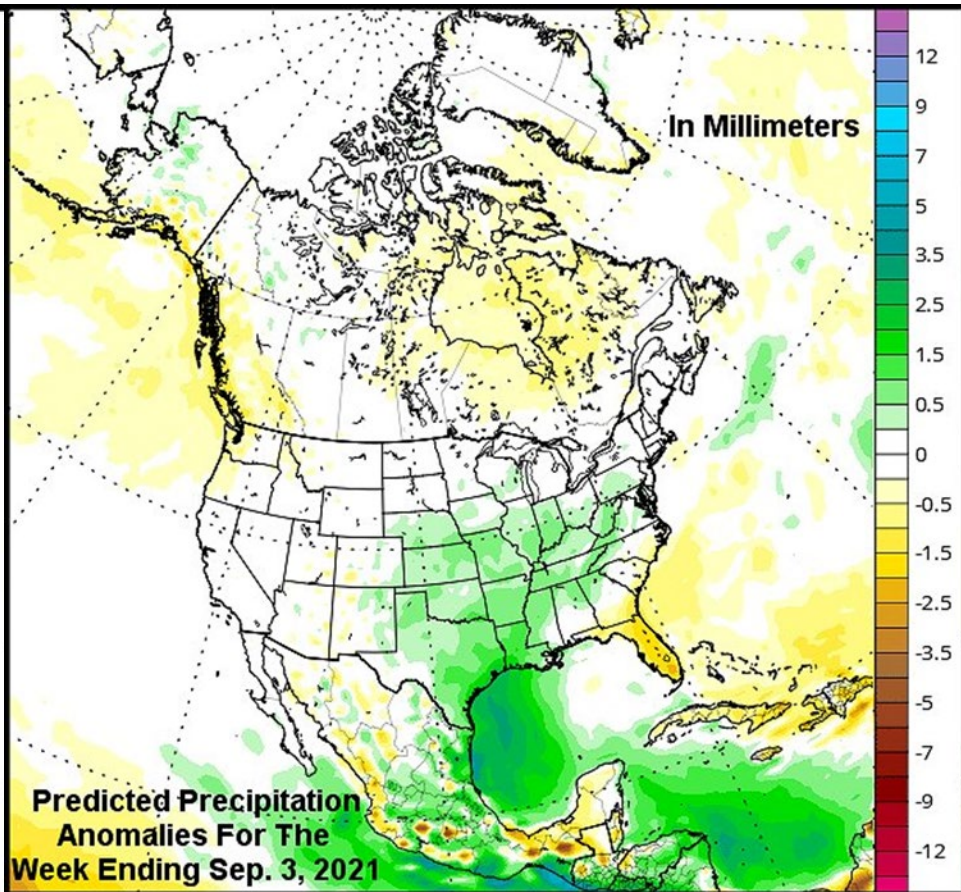
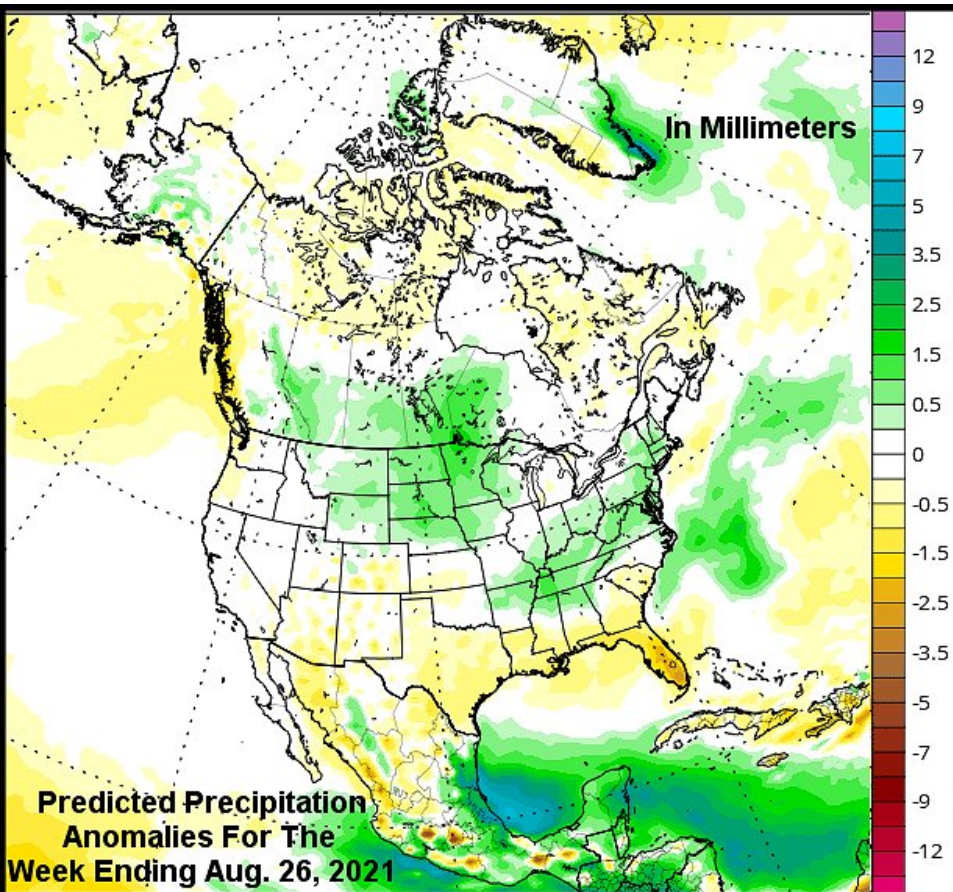


The situation in Pennsylvania is quite similar to that in New York and Michigan with only a few pockets running low on groundwater supply. River and streamflow is running high in Michigan and close to normal in most of the key apple production areas in the northeastern U.S. and neighboring areas of Canada.





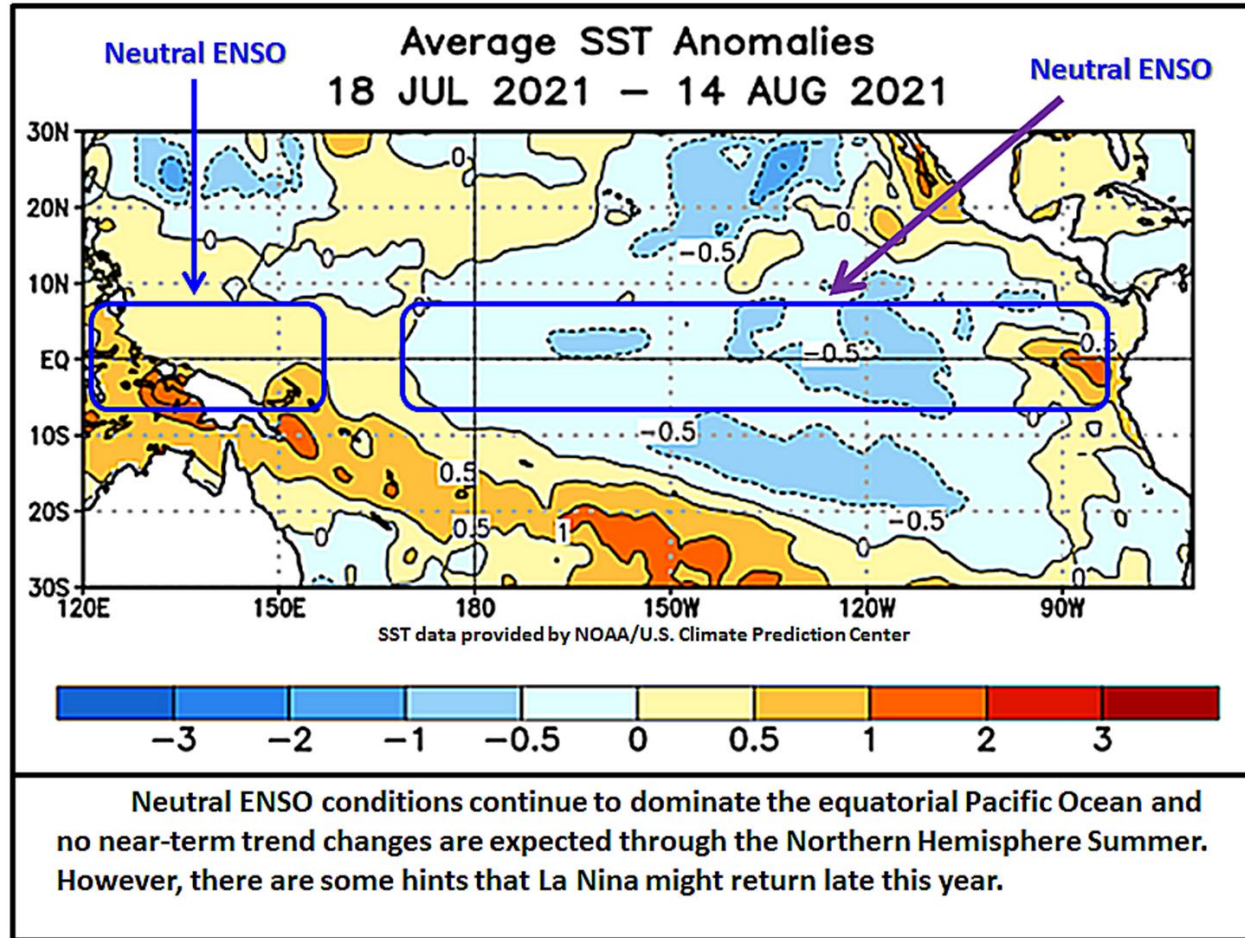






# **INFLUENCES FOR 2021 AND 2022**

- **Water Supply Is An Obvious Issue In The Western U.S.**
- **La Nina Will Have Much To Say About Winter Precipitation**
- **Pacific Decadal Oscillation (PDO) May Help Northern California Rain**
- **18-Year Cycle To Dictate Storm Movement In 2022**
- **Solar Cycle May Play An Important Role In Weather For 2022 -2023**



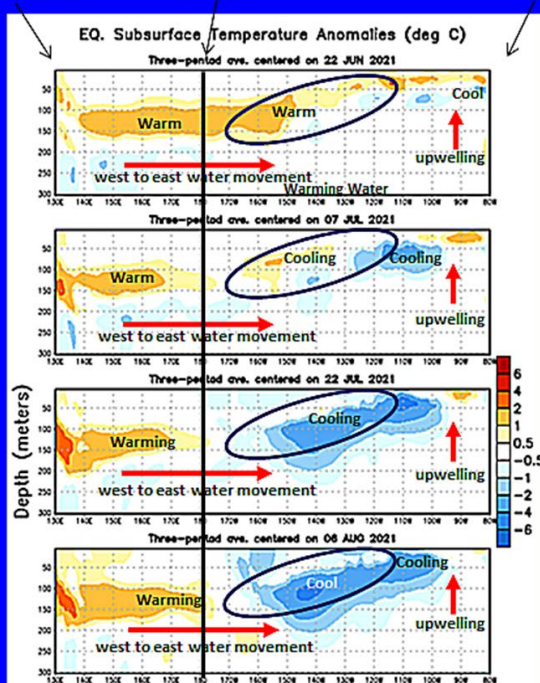
Neutral ENSO conditions are prevailing today across the equatorial Pacific Ocean, but over the next few weeks the ocean surface water temperature will drop below average inducing La Nina conditions for the second winter in a row. That could lead to less rain in California and much of the southern United States as well as northern Mexico and parts of the Great Plains.



# Sub-Surface Temperature Departures (°C) in the Equatorial Pacific

Australia Coast      International Dateline      South America Coast

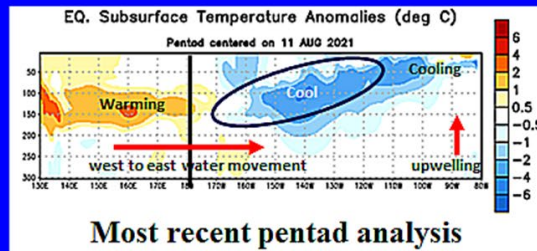
Time



Longitude

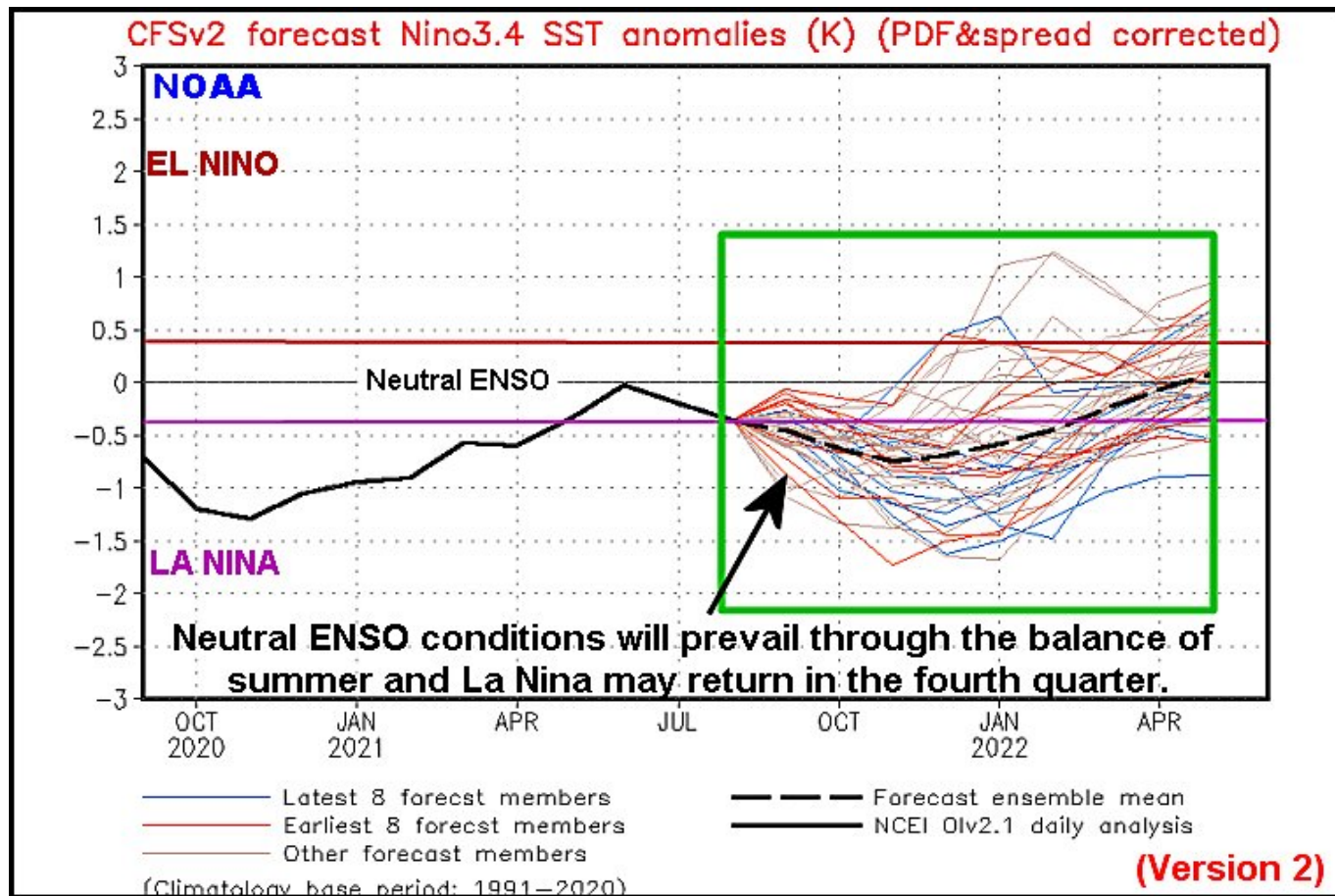
In the last two months, negative subsurface anomalies have emerged and strengthened across most of the eastern Pacific Ocean. Positive subsurface temperature anomalies have weakened and now only persist near the surface in the far eastern Pacific while remaining at depth in the western Pacific.

Each Rectangle Box Is A Snapshot Of Eastern Equatorial Pacific Ocean Temperature Anomalies. The Top Of Each Box Is The Ocean Surface And The Bottom is 300m Down

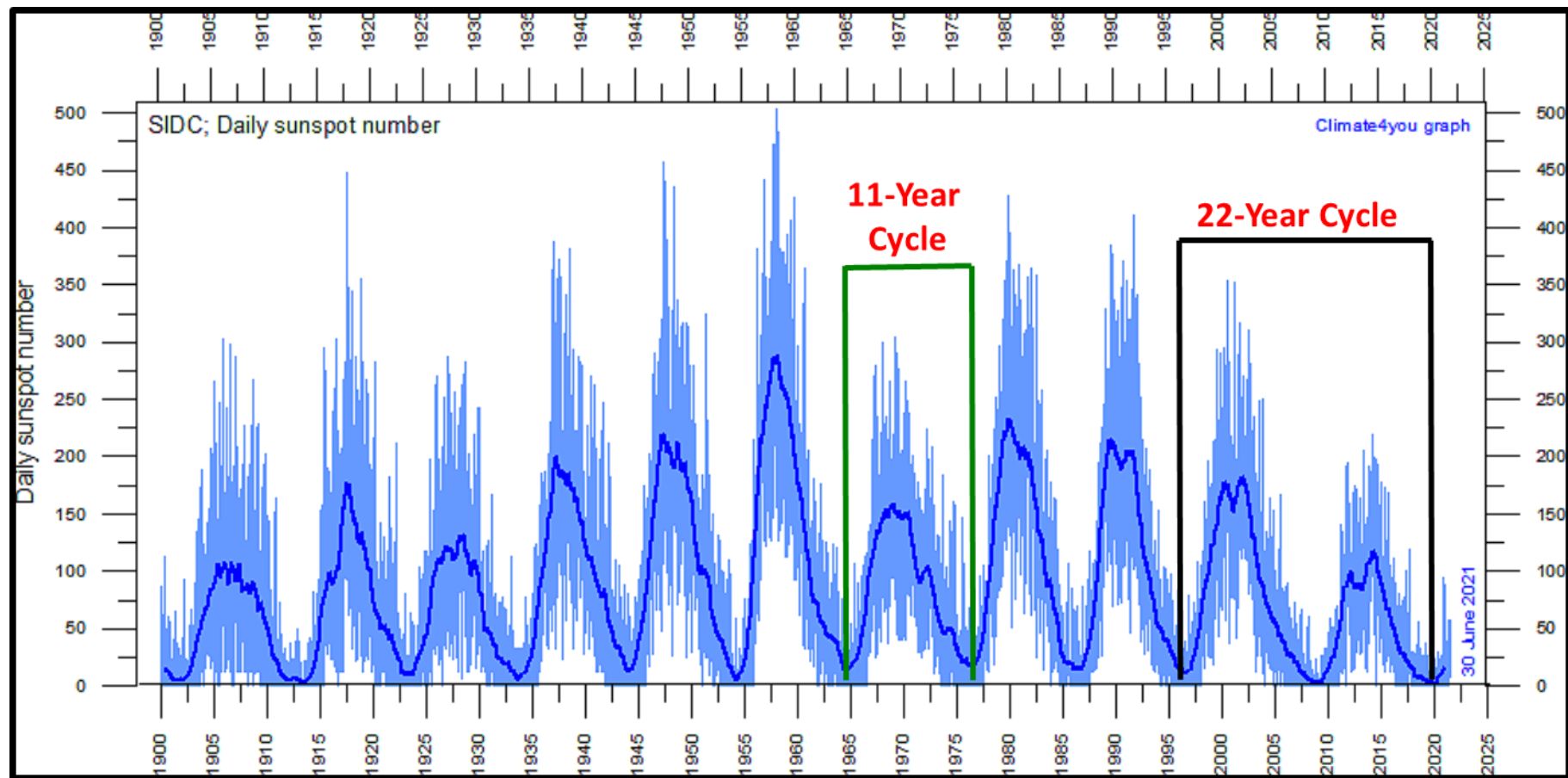


Ocean surface temperatures in the equatorial Pacific change from below the surface to the surface and noting subsurface temperature changes provides a good indicator of how ENSO will change. There is an obvious cooling trend beneath the ocean's surface that promises to influence autumn and winter weather around the world. That should bring good moisture back to the Cascade Mountains.

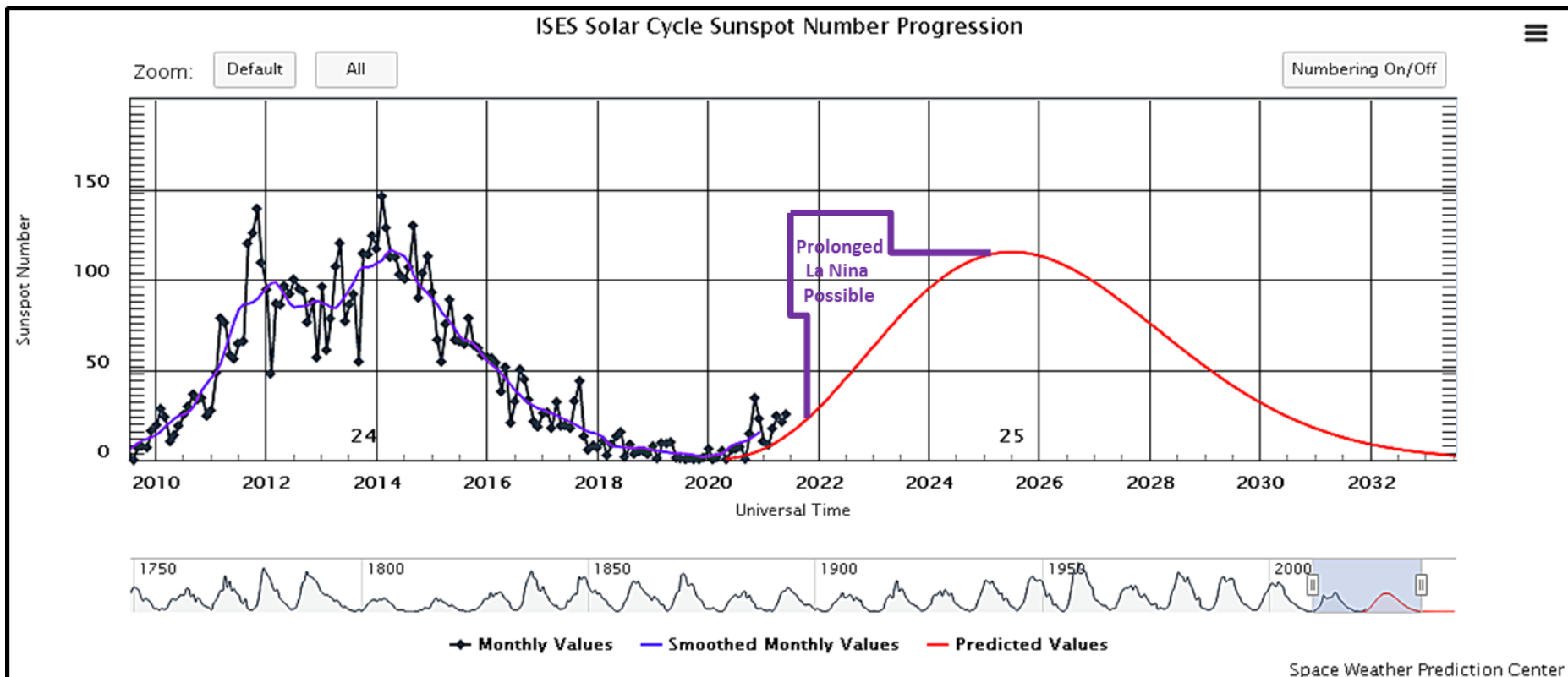




NOAA's ENSO model is predicting La Nina, although this event may be short-lived and weak. That opens the door for other weather patterns to have influence on weather a little more than usual when La Nina is present. California is hoping to get better rainfall this year, but La Nina does not bode well for that cause.

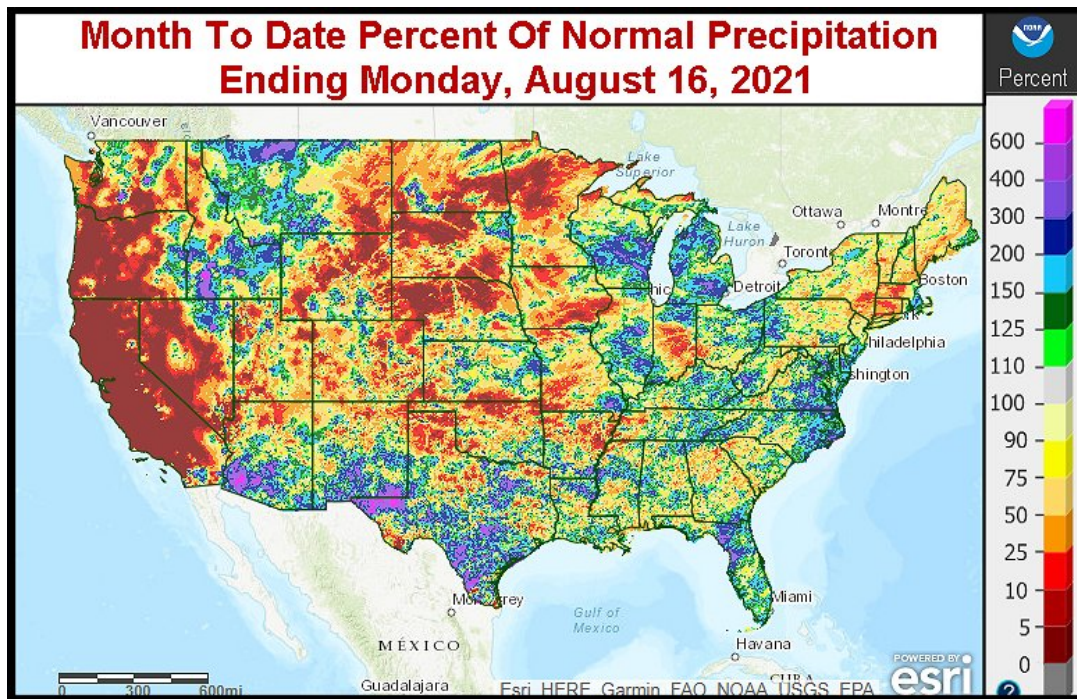




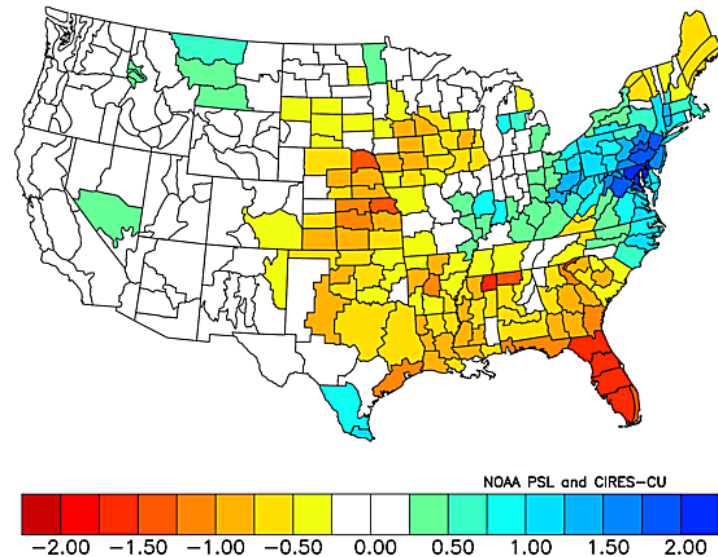


Multiple year La Nina events tend to occur most often between the solar minimum and solar maximum. Some of the more serious drought years in North America have been associated with this pattern at 22-year intervals.

# August Weather 2021 Compared To Other Post Solar Minimum Dual La Nina Years



NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Aug 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average



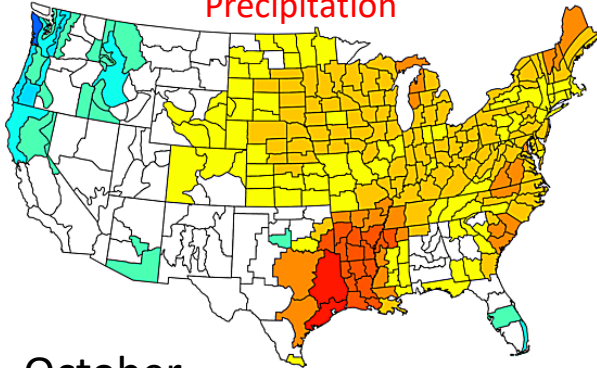
Early August weather in the U.S. has some similar traits to other post solar minimum dual La Nina years already and the second La Nina has not begun yet.



# Oct – Dec Weather In Post Solar Minimum Dual La Nina Years

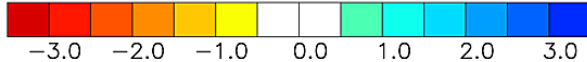
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Oct 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average

Precipitation



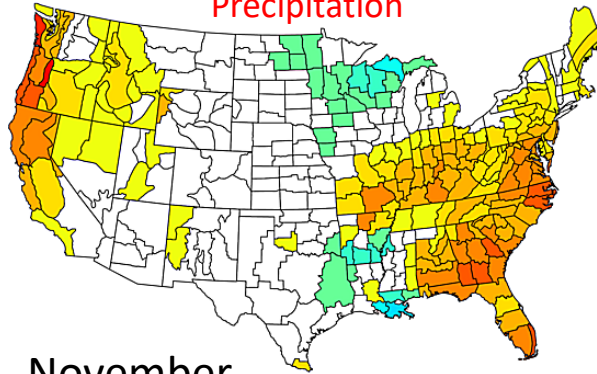
October

NOAA PSL and CIRES-CU



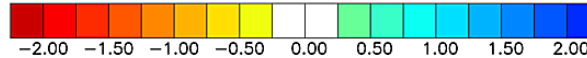
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Nov 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average

Precipitation



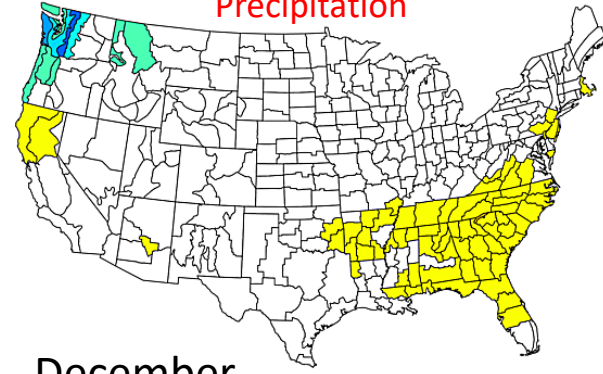
November

NOAA PSL and CIRES-CU



NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Dec 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average

Precipitation



December

NOAA PSL and CIRES-CU

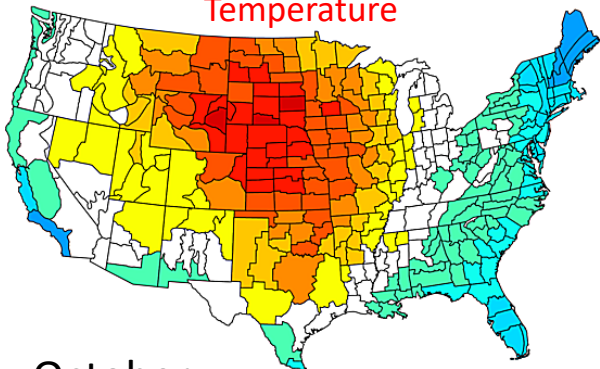


Precipitation during the second year of a La Nina multi-year event that occurs between the solar minimum and maximum usually produces these precipitation anomalies. Notice the tendency for good autumn and early winter precipitation in the Cascade Mountains, but also notice the limited rainfall at times in California. Autumn precipitation in the northeastern U.S. and Michigan is often light and infrequent favoring good harvest progress.

# Oct – Dec Weather 2021 In Other Post Solar Cycle Dual La Nina Years

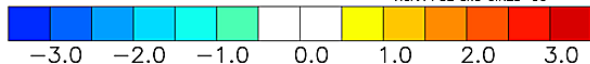
NOAA/NCEI Climate Division Composite Temperature Anomalies (F)  
Oct 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average

Temperature



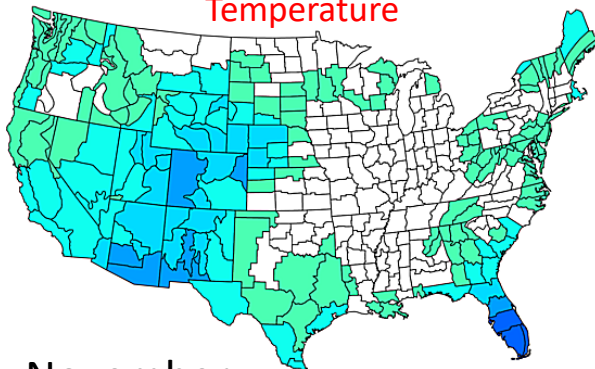
October

NOAA PSL and CIRES-CU



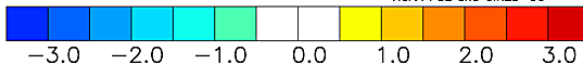
NOAA/NCEI Climate Division Composite Temperature Anomalies (F)  
Nov 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average

Temperature



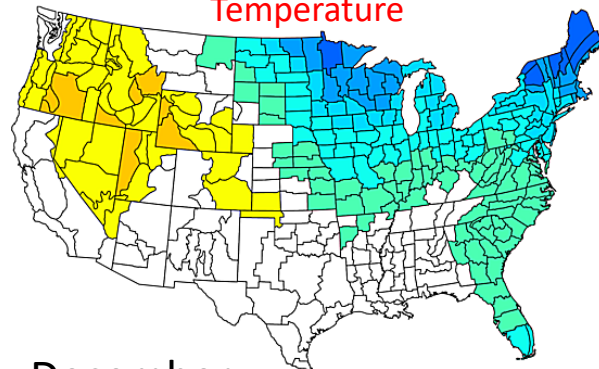
November

NOAA PSL and CIRES-CU



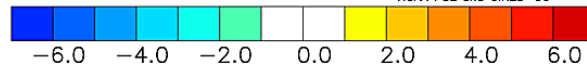
NOAA/NCEI Climate Division Composite Temperature Anomalies (F)  
Dec 1955,1956,1974,1975,1999,2000,1933,1934  
Versus 1991–2020 Longterm Average

Temperature



December

NOAA PSL and CIRES-CU



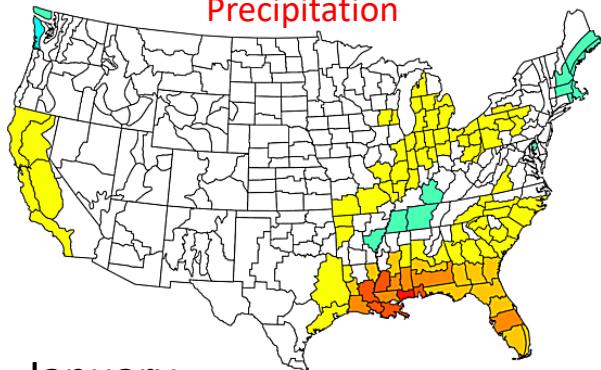
Temperatures during the second year of a La Nina multi-year event that occurs between the solar minimum and maximum usually produces these anomalies which include a mix of temperatures favoring a cool autumn in California and the northeastern states and a warm October in the central United States.



# Oct – Dec Weather 2021 In Other Post Solar Cycle Dual La Nina Years

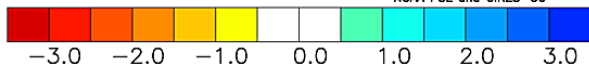
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Jan 1957,1956,1976,1975,2001,2000,1935,1934  
Versus 1991–2020 Longterm Average

**Precipitation**



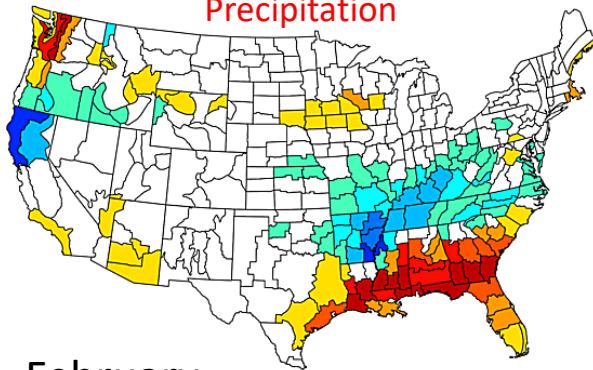
**January**

NOAA PSL and CIRES-CU



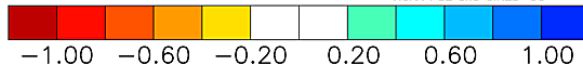
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Feb 1957,1956,1976,1975,2001,2000,1935,1934  
Versus 1991–2020 Longterm Average

**Precipitation**



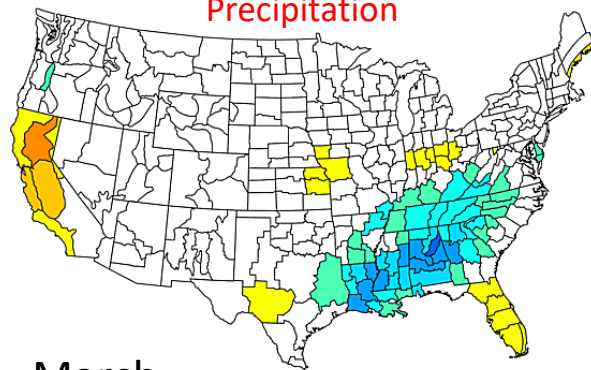
**February**

NOAA PSL and CIRES-CU



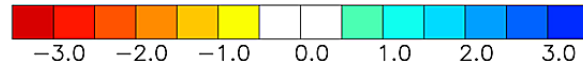
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Mar 1957,1956,1976,1975,2001,2000,1935,1934  
Versus 1991–2020 Longterm Average

**Precipitation**



**March**

NOAA PSL and CIRES-CU



Precipitation during the second year of a La Nina multi-year event that occurs between the solar minimum and maximum usually produces these precipitation anomalies. California tends to receive less than usual rain and mountain snowfall during the January through March period, although it is not ever completely dry. Most other apple production areas usually get an average amount of winter moisture suggesting a good start to the growing season in spring with sufficient moisture in place.

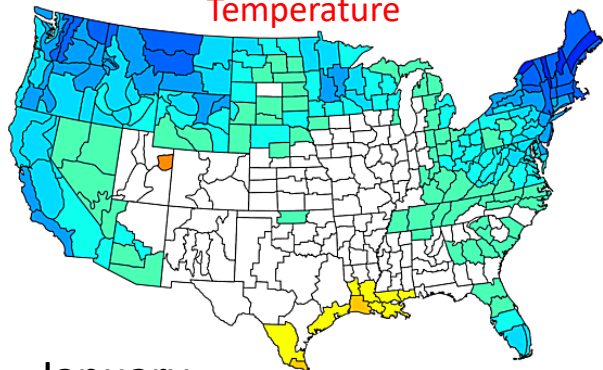
# Oct – Dec Weather 2021 In Other Post Solar Cycle Dual La Nina Years

NOAA/NCEI Climate Division Composite Temperature Anomalies (F)

Jan 1957,1956,1976,1975,2001,2000,1935,1934

Versus 1991–2020 Longterm Average

Temperature



January

NOAA PSL and CIRES-CU

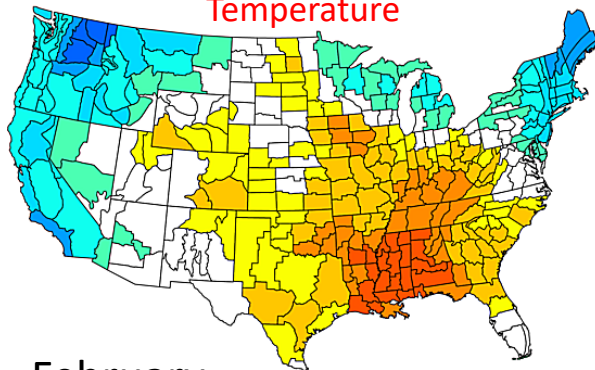
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0

NOAA/NCEI Climate Division Composite Temperature Anomalies (F)

Feb 1957,1956,1976,1975,2001,2000,1935,1934

Versus 1991–2020 Longterm Average

Temperature



February

NOAA PSL and CIRES-CU

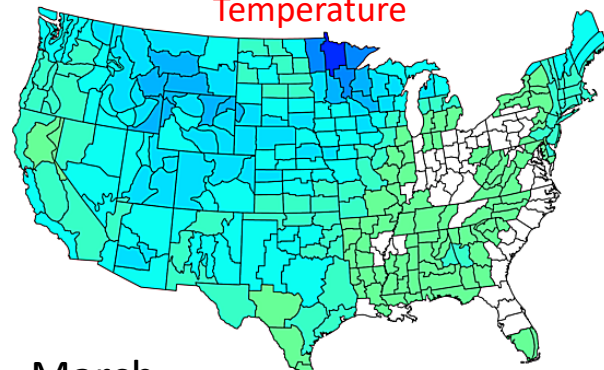
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0

NOAA/NCEI Climate Division Composite Temperature Anomalies (F)

Mar 1957,1956,1976,1975,2001,2000,1935,1934

Versus 1991–2020 Longterm Average

Temperature



March

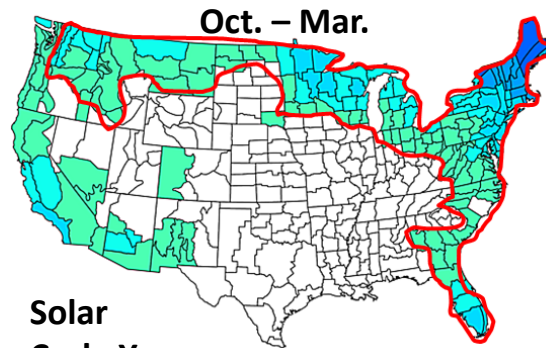
NOAA PSL and CIRES-CU

-4.0 -3.0 -2.0 -1.0 0.0 1.0 2.0 3.0 4.0

Temperatures during the second year of a La Nina multi-year event that occurs between the solar minimum and maximum usually produces these temperature anomalies. Notice the tendency for cool weather in the Pacific northwest and California with some tendency for the same in northeastern apple production areas. The cool weather should bode well for sufficient chill hours to support a good spring flush of flowers as long as water supply and soil moisture are favorable.



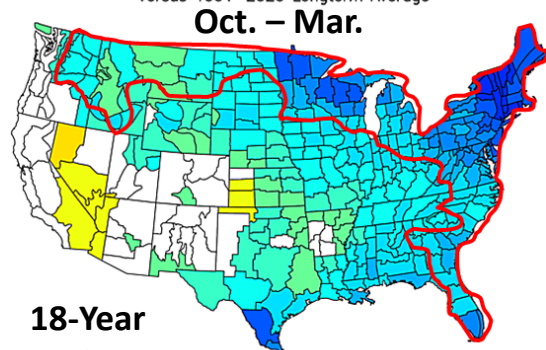
NOAA/NCEI Climate Division Composite Temperature Anomalies (F)  
Oct to Mar 1955–56, 1956–57, 1974–75, 1975–76, 1999–00, 2000–01, 1933–34, 1934–35  
Versus 1991–2020 Longterm Average



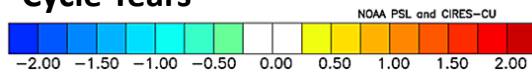
**Solar  
Cycle Years**



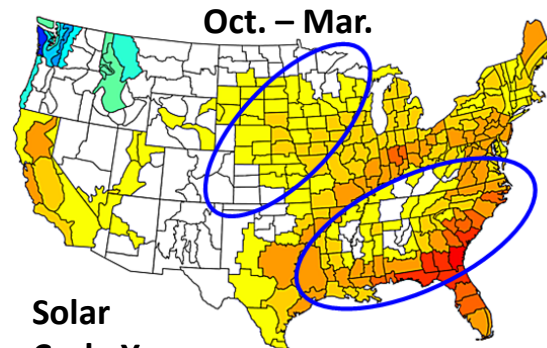
NOAA/NCEI Climate Division Composite Temperature Anomalies (F)  
Oct to Mar 1967–68, 1985–86, 2003–04  
Versus 1991–2020 Longterm Average



**18-Year  
Cycle Years**



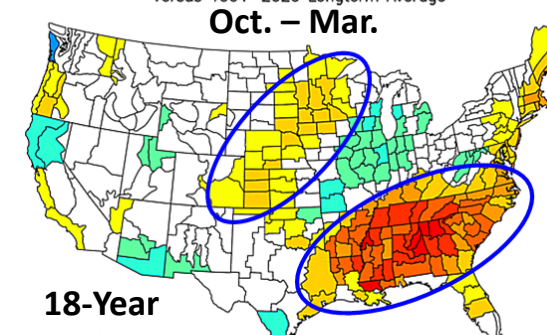
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Oct to Mar 1955–56, 1956–57, 1974–75, 1975–76, 1999–00, 2000–01, 1933–34, 1934–35  
Versus 1991–2020 Longterm Average



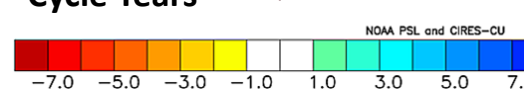
**Solar  
Cycle Years**



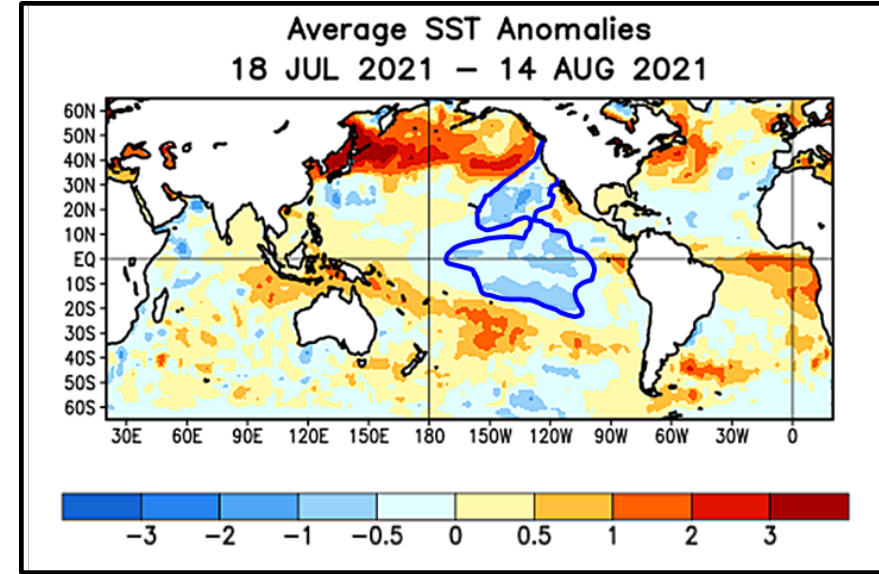
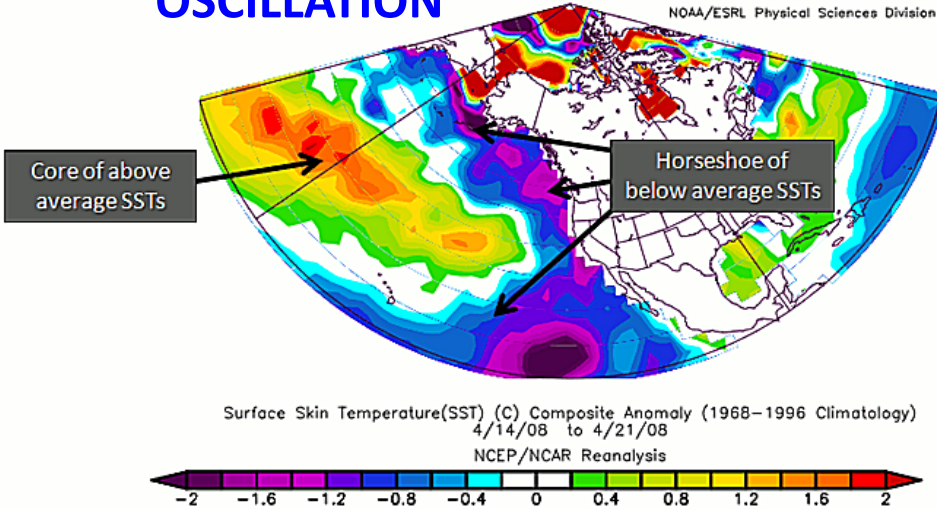
NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)  
Oct to Mar 1967–68, 1985–86, 2003–04  
Versus 1991–2020 Longterm Average



**18-Year  
Cycle Years**



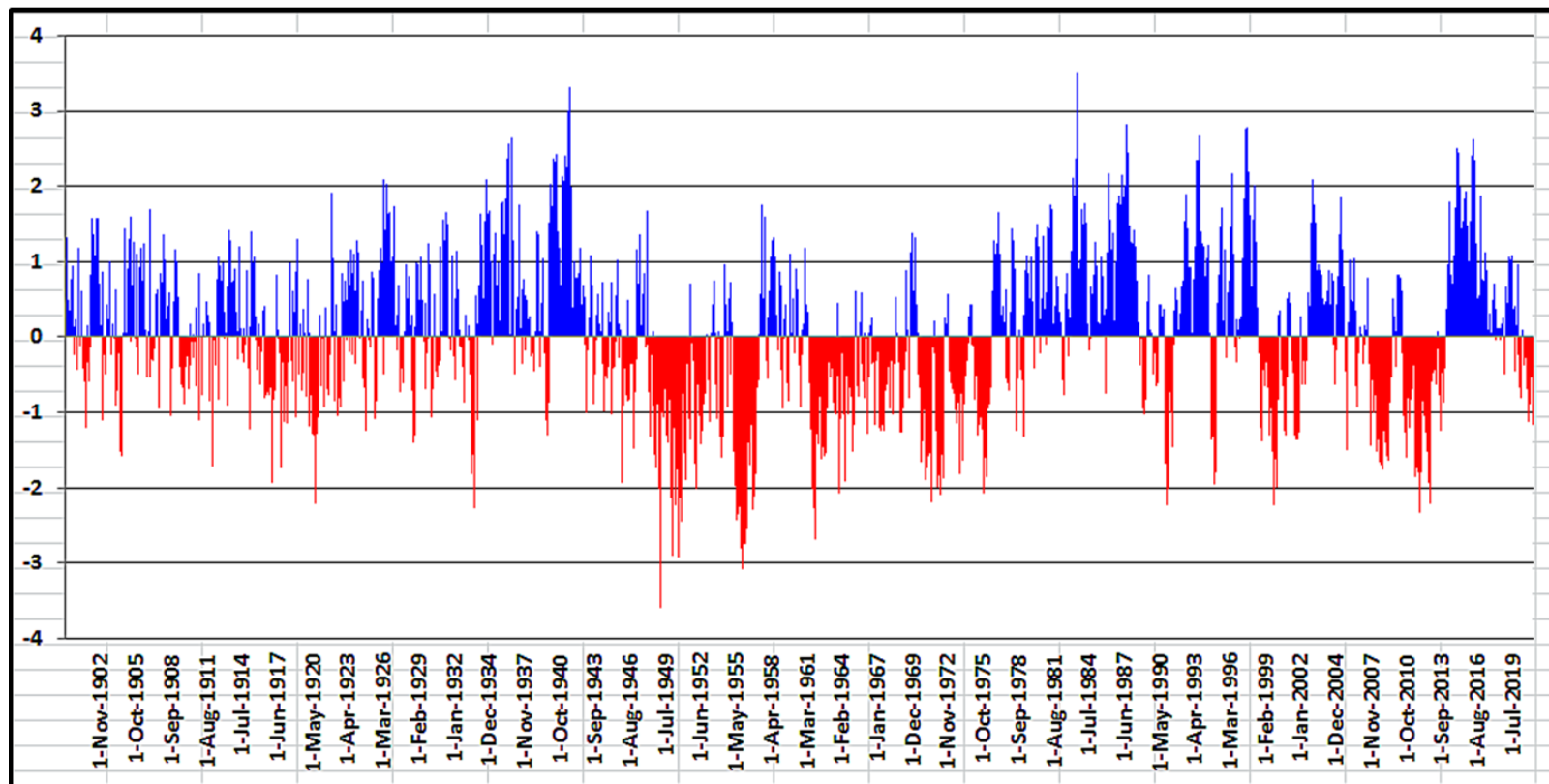
# NEGATIVE PHASE OF PACIFIC DECADAL OSCILLATION



Recent changes in ocean surface temperature anomalies have induced a weak negative Pacific Decadal Oscillation (PDO) event. A strong event would be similar to the graphic on the left and that may evolve this winter or in 2022. If a more significantly negative PDO event develops it could add to the drier bias in the central U.S. and raise the potential for drought there while it may help apple areas get good rainfall and seasonable temperatures.

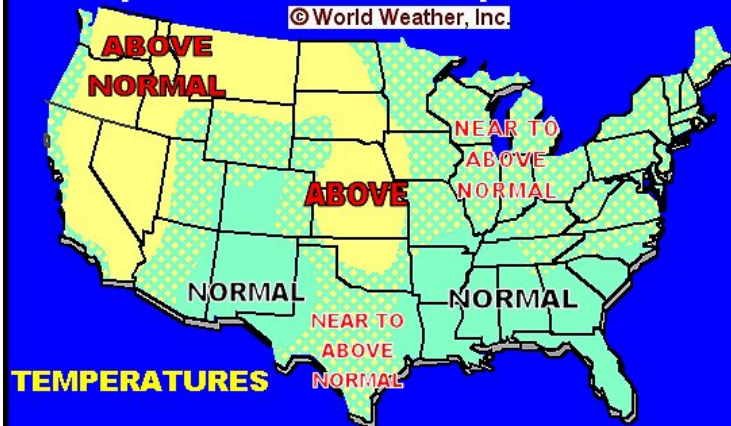


# Pacific Decadal Oscillation Index Since 1900



### Temperature Outlook For September 2021

© World Weather, Inc.



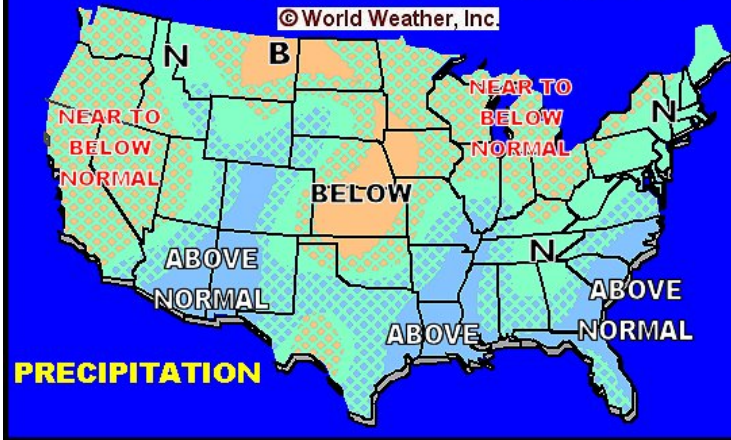
### Temperature Outlook For October 2021

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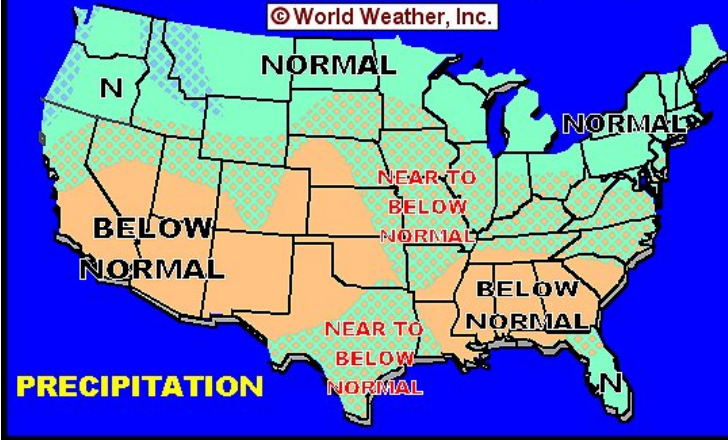
### Precipitation Outlook For September 2021

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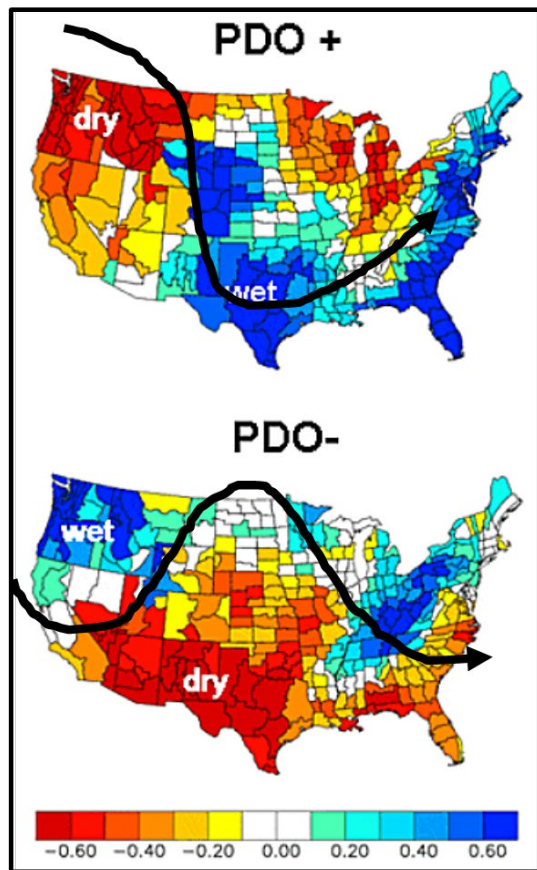


### Precipitation Outlook For October 2021

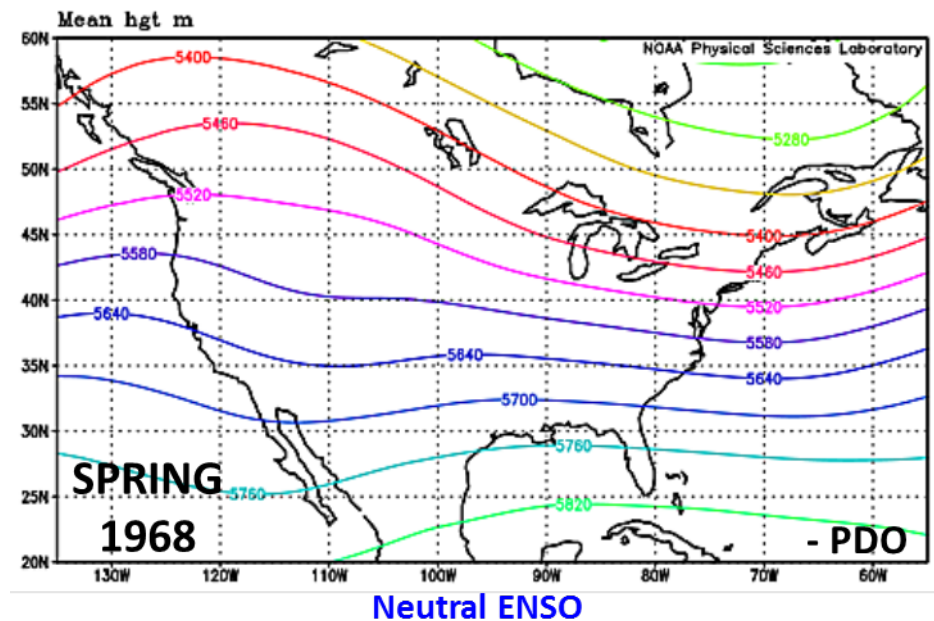
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# PRECIPITATION ANOMALIES ASSOCIATED WITH PDO PHASES

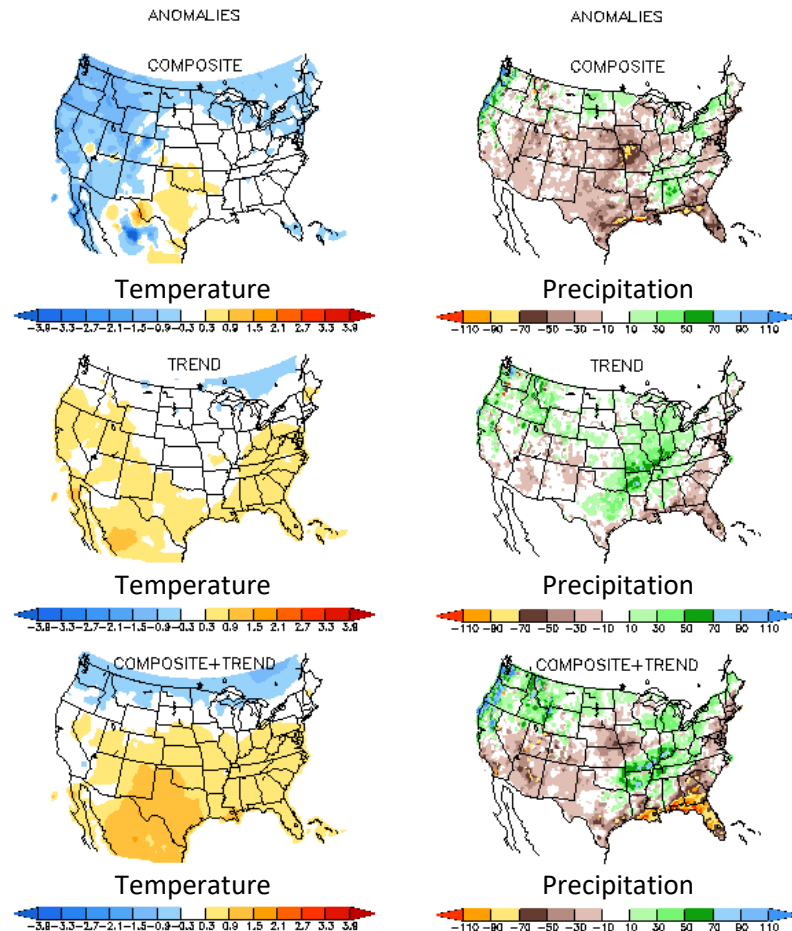


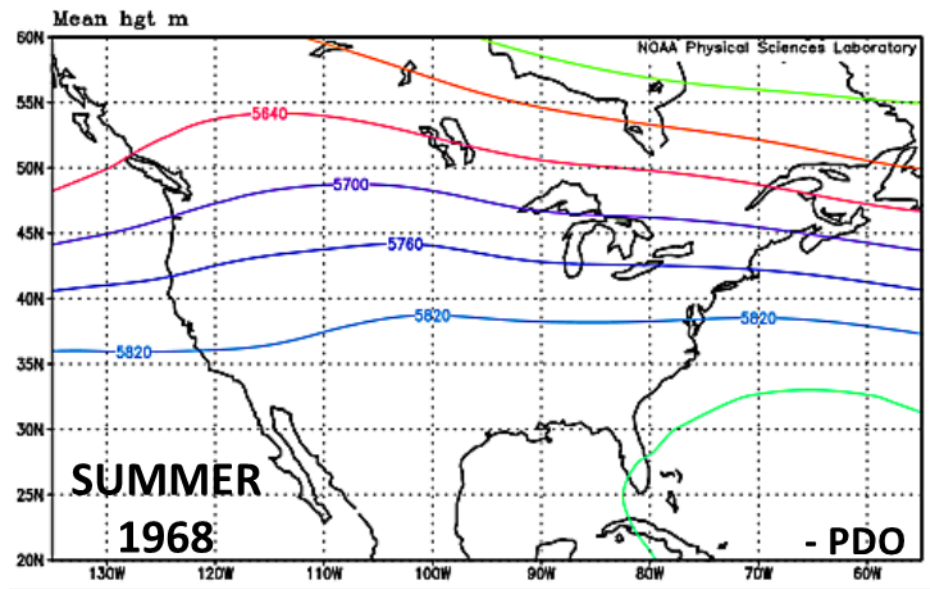




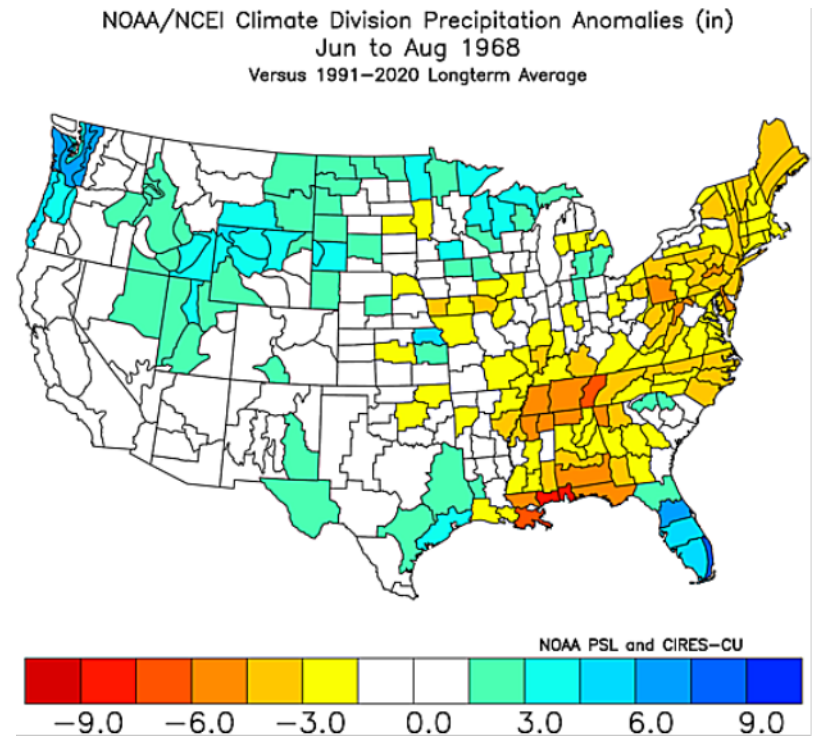
Spring 2022 will be similar to 1968 with a northwesterly flow pattern aloft which may send some waves of cool weather into the northeastern states later than usual. That could induce some late season frost. La Nina will keep the Pacific NW and NE states favorably moist while southern California is drier than usual.

## La Nina Spring Weather Anomalies



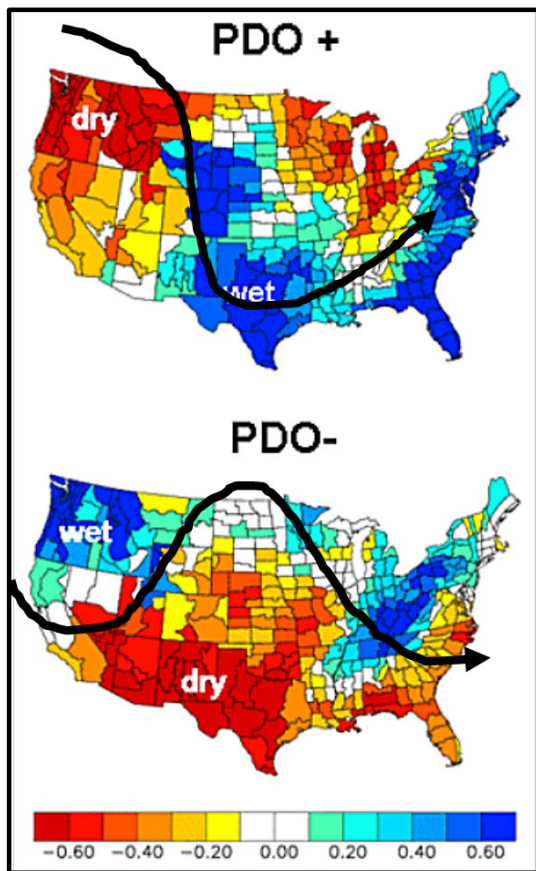


Neutral ENSO With Slight El Nino Bias

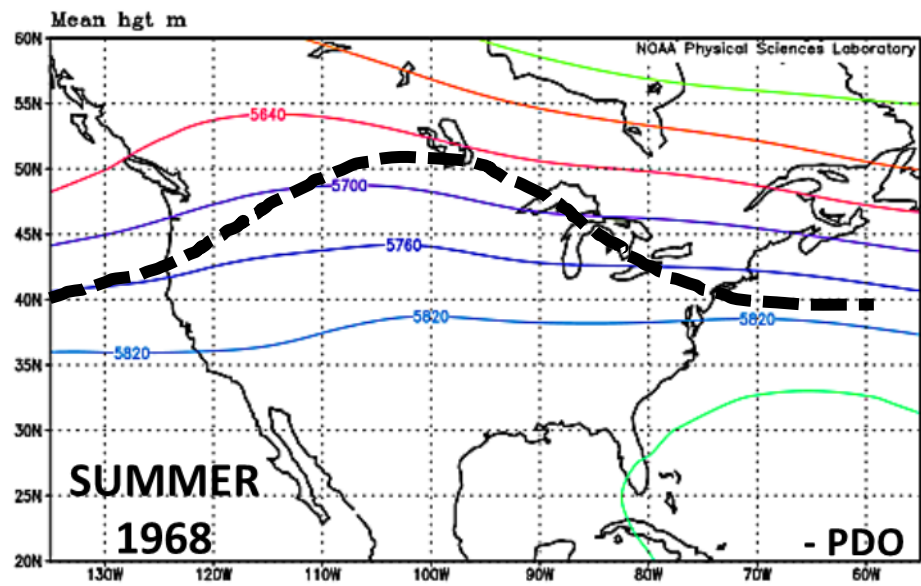


Summer 2022 would normally have a weather pattern similar to that of 1968 that might lead to some net drying in the northeastern states and a little greater than usual precipitation in a part of the Cascade Mountains and the northern Rocky Mountain region. However, if negative PDO remains (as it should) and possibly strengthens there may be more heat and dryness in the central U.S. and less in the northeastern states.

## PRECIPITATION ANOMALIES ASSOCIATED WITH PDO PHASES



PDO in summer 2022 could help induce a stronger ridge of high pressure over the central part of North America resulting in milder weather in the northeastern states with less rain while the far western states are seasonably dry and warm.



Neutral ENSO With Slight El Nino Bias



# ***WEATHER OUTLOOK 2021-22***

***PRESENTED BY***



**WorldWeather** Inc.

Predicting The Impact of Nature

**WEBSITE:**

<http://www.worldweather.cc>

**EMAIL:**

[worldweather@bizkc.rr.com](mailto:worldweather@bizkc.rr.com)

**Telephone: 913-383-1161**

**Fax Number: 913-383-1198**

