

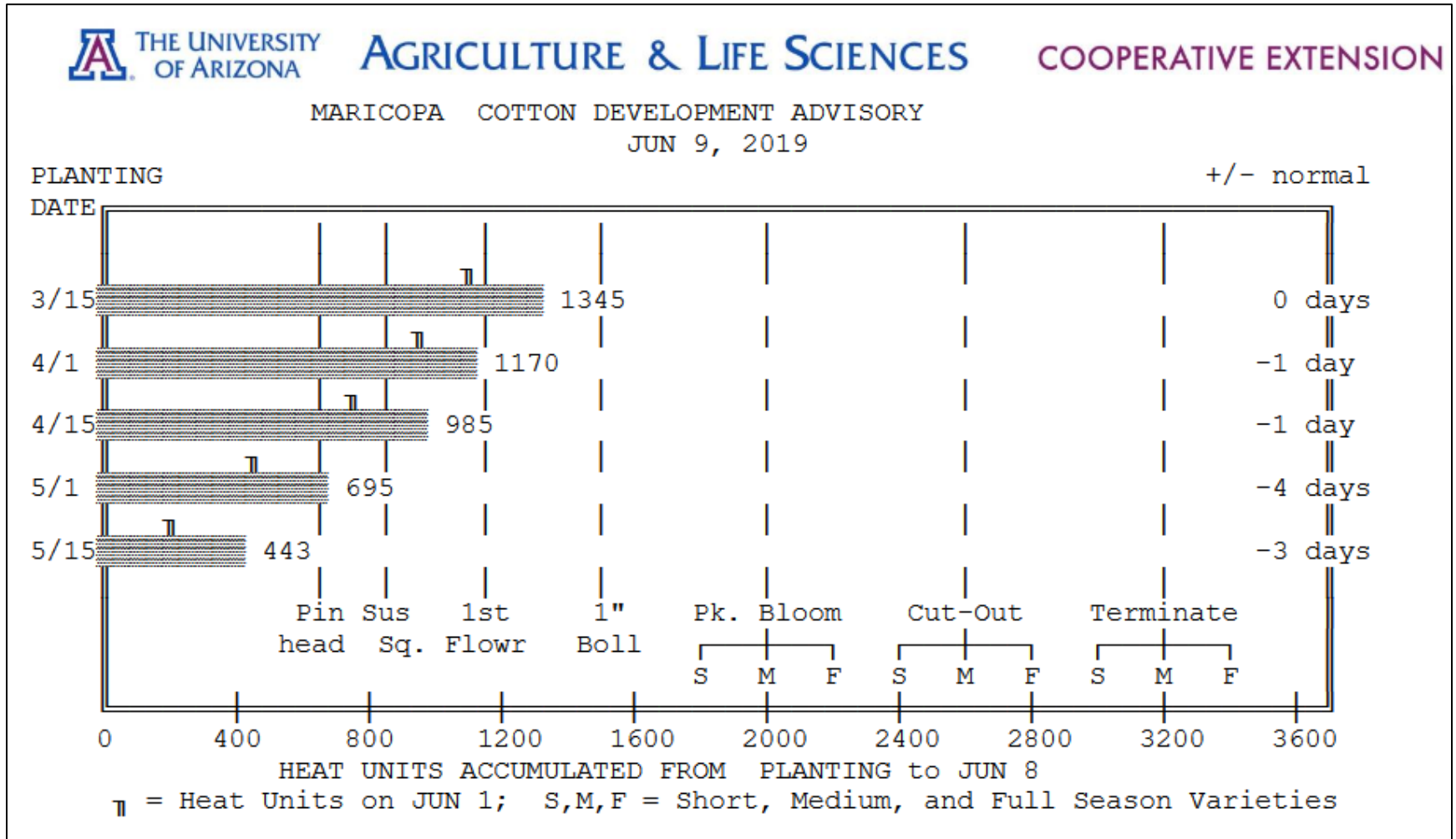
# **Extension Silage Development Advisories & Arizona Water Supply Update**

**Paul Brown**

**Extension Specialist & Program Director**

**Arizona Cooperative Extension**

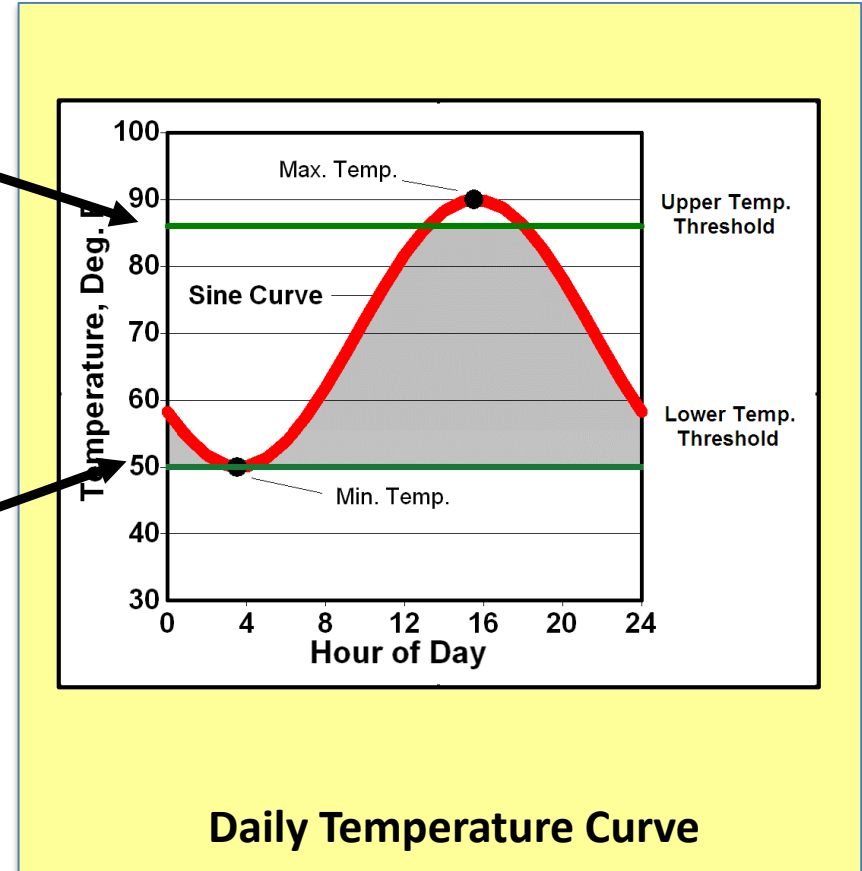
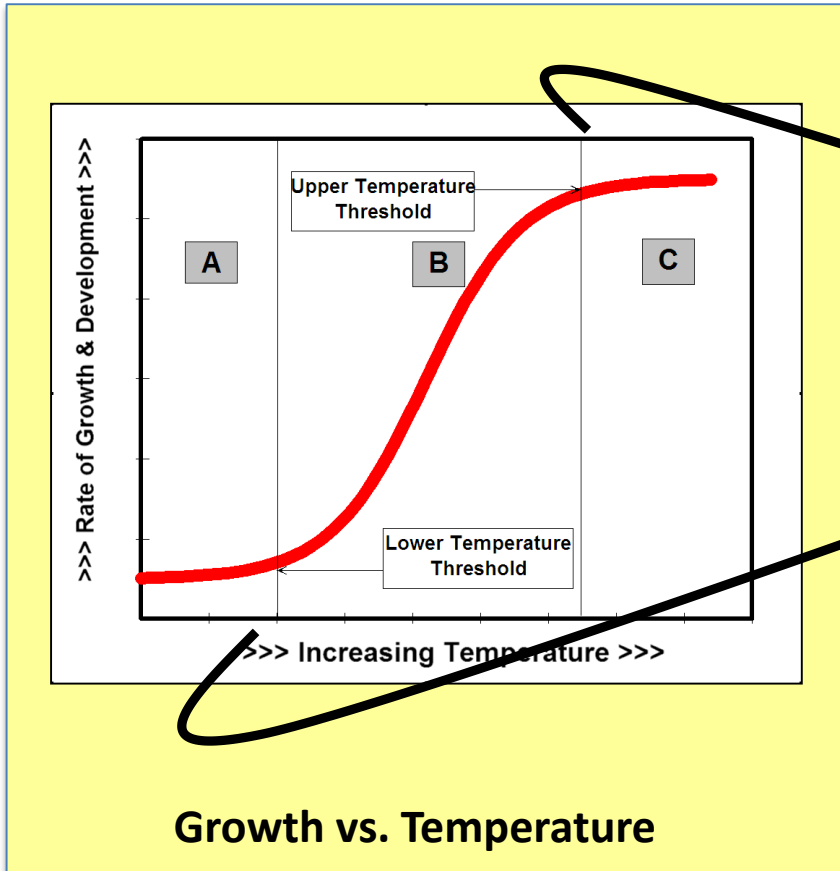
# Soil on Dev Deptment Med Advisors Since 2019



Weather data obtained from local AZMET weather stations

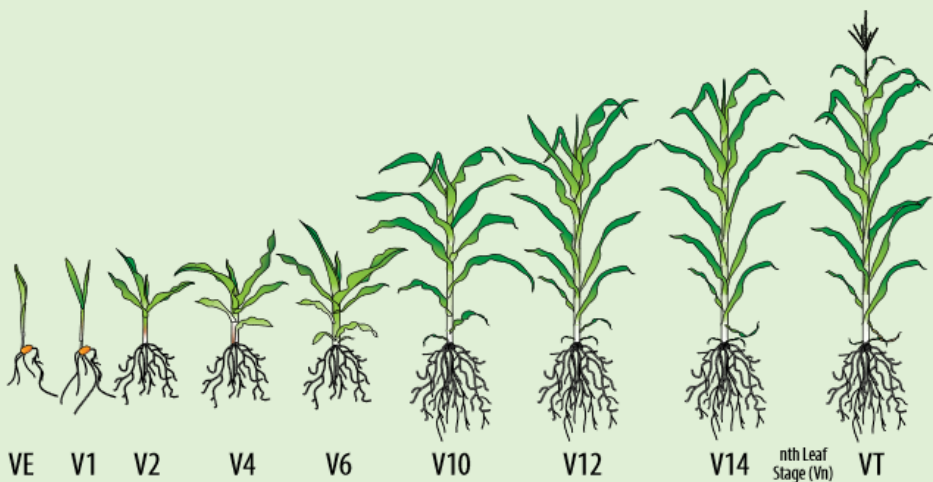
# Growing Degree Days vs Heat Units

## Different Terms for Same Thing!



Temperature thresholds for growth transferred to daily temperature curve. Grey area represents temperatures that contribute to growth (referred to as degree days or heat units).

# Corn Growth and Development



Vegetative



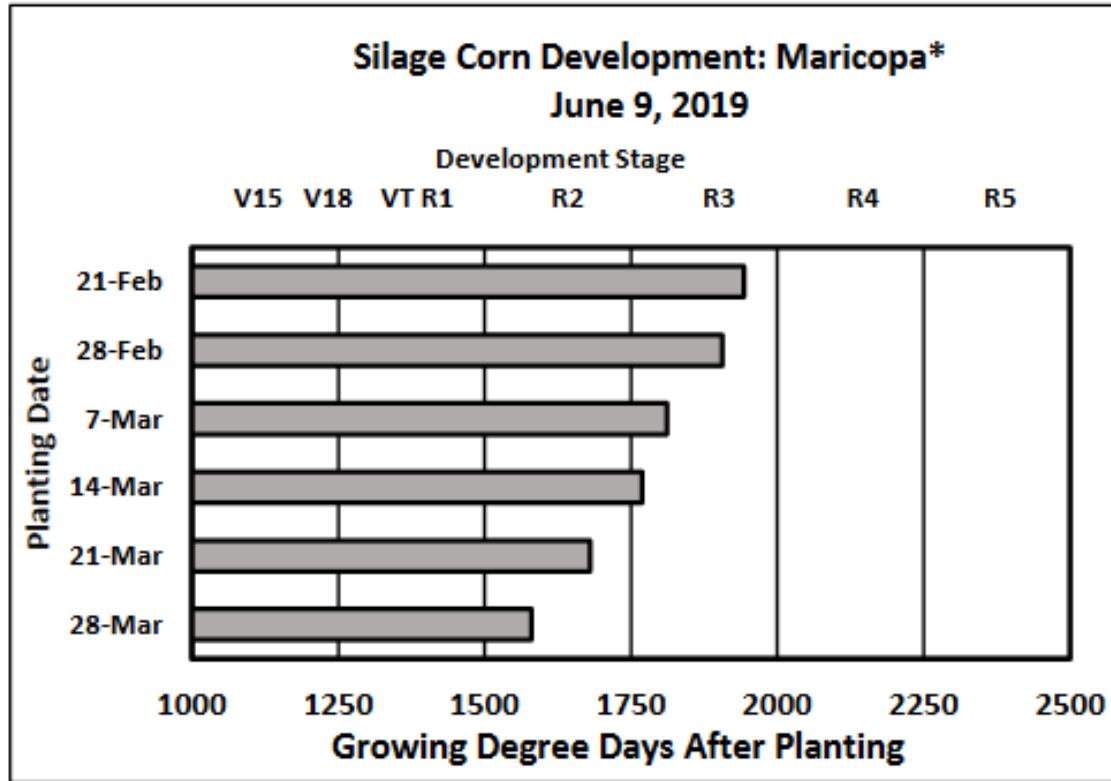
Reproductive

**Table 2.1.** Approximate GDD needed to reach different growth stages of a corn crop (planted at the normal time, using a hybrid that requires 2,700 GDD to reach maturity).

Stage	GDD from planting	Stage	GDD from planting
VE	115	V13	995
V1	155	V14	1,045
V2	235	V15	1,095
V3	315	V16	1,140
V4	395	V17	1,180
V5	475	V18	1,220
V6	555	VT (tassel)	1,350
V7	635	R1 (silk)	1,400
V8	715	R2 (blister)	1,660
V9	795	R3 (milk)	1,925
V10	845	R4 (dough)	2,190
V11	895	R5 (dent)	2,450
V12	945	R6 (mature)	2,700

Source: Illinois Agronomy Notebook

# Silage Advisory: Page 1



\*Development for variety with relative maturity rating of 115 days

VE: Emergence	V6: 6 Leaves	V12: 12 Leaves	VT: Tasseling	R3: Milk
V2: 2 Leaves	V8: 8 Leaves	V15: 15 Leaves	R1: Silking	R4: Dough
V4: 4 Leaves	V10: 10 leaves	V18: 18 Leaves	R2: Blister	R5: Dent

Estimated Crop Development Using Growing Degree Day for CRM of 115 Days

# Silage Advisory: Page 1

Corn Growing Degree Day (GDD) Accumulation: Maricopa, AZ													
-----Planting Date-----							-----Planting Date-----						
Date	<u>21-Feb</u>	<u>28-Feb</u>	<u>7-Mar</u>	<u>14-Mar</u>	<u>21-Mar</u>	<u>28-Mar</u>	Date	<u>21-Feb</u>	<u>28-Feb</u>	<u>7-Mar</u>	<u>14-Mar</u>	<u>21-Mar</u>	<u>28-Mar</u>
1-May	1032	995	901	858	769	669	4-Jun	1796	1758	1664	1622	1533	1432
2-May	1055	1017	923	880	792	691	5-Jun	1825	1787	1693	1650	1562	1461
3-May	1077	1040	946	903	814	714	6-Jun	1855	1817	1723	1680	1591	1491
4-May	1103	1065	972	929	840	739	7-Jun	1884	1847	1753	1710	1621	1521
5-May	1129	1092	998	955	866	766	8-Jun	1916	1879	1785	1742	1653	1553
6-May	1152	1114	1020	978	889	788	9-Jun	1943	1906	1812	1769	1680	1580
7-May	1170	1132	1038	995	906	806	10-Jun						
8-May	1192	1154	1061	1018	929	828	11-Jun						
9-May	1213	1175	1081	1039	950	849	12-Jun						
10-May	1234	1196	1102	1060	971	870	13-Jun						
11-May	1254	1217	1123	1080	991	891	14-Jun						
12-May	1275	1238	1144	1101	1012	912	15-Jun						
13-May	1298	1260	1166	1124	1035	934	16-Jun						
14-May	1326	1288	1194	1151	1063	962	17-Jun						
15-May	1355	1317	1224	1181	1092	991	18-Jun						
16-May	1384	1346	1252	1210	1121	1020	19-Jun						
17-May	1403	1365	1272	1229	1140	1039	20-Jun						
18-May	1422	1384	1291	1248	1159	1058	21-Jun						
19-May	1444	1407	1313	1270	1181	1081	22-Jun						
20-May	1459	1422	1328	1285	1196	1096	23-Jun						
21-May	1476	1438	1345	1302	1213	1112	24-Jun						
22-May	1492	1455	1361	1318	1229	1129	25-Jun						
23-May	1507	1470	1376	1333	1244	1144	26-Jun						
24-May	1527	1490	1396	1353	1264	1164	27-Jun						
25-May	1549	1511	1417	1375	1286	1185	28-Jun						
26-May	1570	1532	1438	1395	1306	1206	29-Jun						
27-May	1588	1550	1457	1414	1325	1224	30-Jun						
28-May	1606	1569	1475	1432	1343	1243	1-Jul						
29-May	1629	1591	1498	1455	1366	1265	2-Jul						
30-May	1655	1617	1523	1480	1391	1291	3-Jul						
31-May	1682	1645	1551	1508	1419	1319	4-Jul						
1-Jun	1709	1671	1577	1535	1446	1345	5-Jul						
2-Jun	1738	1700	1606	1564	1475	1374	6-Jul						
3-Jun	1767	1729	1635	1593	1504	1403	7-Jul						

**Growing Degree Day Accumulation From Scenario Planting Dates**

# Silage Advisory: Page 2

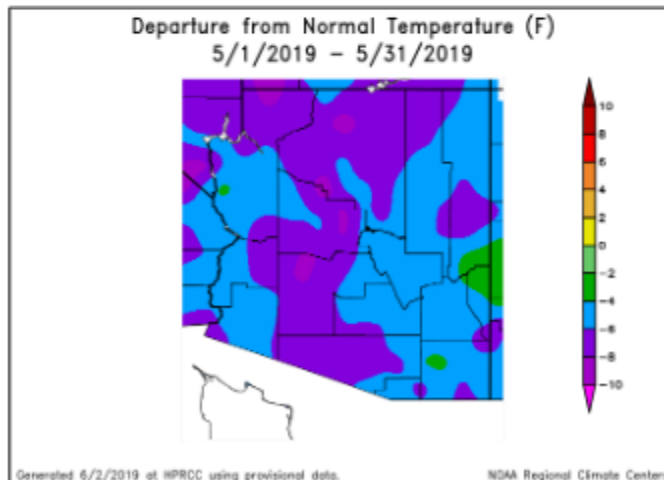
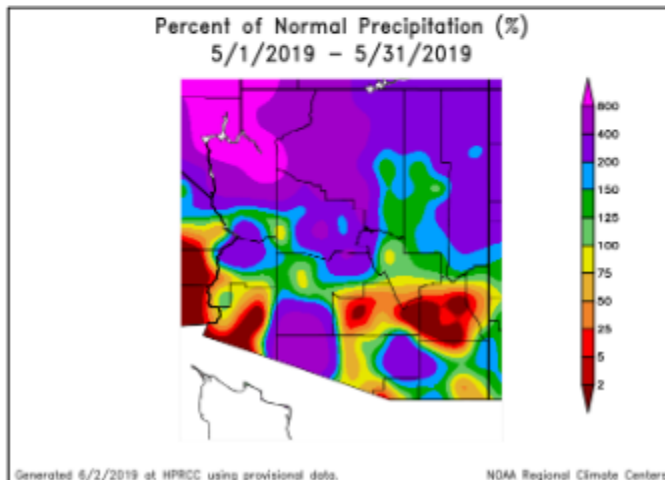
--High pressure will develop over AZ mid-week, resulting in very hot & dry conditions. Expect daytime temperatures above 100F in most production areas Tuesday-Thursday with readings above 110F in low elevation areas. Normal temperatures will return this weekend with the passage of a trough of low pressure through the Great Basin.

--The upcoming week will feature above normal levels of evaporative demand -- the first such week of the current growing season. Growers are encouraged to monitor soil moisture & avoid water stress which can reduce yields.

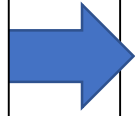
--The spring flow forecast for the Colorado River was increased to 10.3 MAF on 1 June, 1.0 MAF above the May 1 projection & 3.2 MAF above average. Snow melt is proceeding at a rapid pace; the elevation of Lake Powell increased by more than a foot on Sunday.

## Temperature & Growing Degree Days

Last Week					This Week			
	Max	Min	GDDs	Rain		Max	Min	GDDs
Actual	99	67	206	0.00	2018	102	72	217
Normals	100	65	199		Normals	102	66	204




**Pinal/Pima Co.  
Crop Rotator  
Newsletter**



## SILAGE CORN ADVISORY

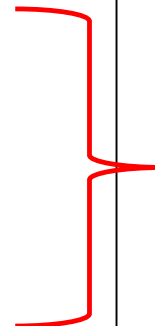
---

Below are links to the Silage Corn advisory for the University's Maricopa and Coolidge AZMET weather stations.



- [Coolidge](#)
- [Maricopa](#)
- [Paloma](#)
- [Buckeye](#)
- [Queen Creek](#)
- [Kansas Settlement](#)

[Click here](#) for instructions on how the AZMET Silage Corn Development Advisory works



**6 Locations**

**Maricopa Co.  
AZAG  
Newsletter**



### AZMET Silage Corn Development Advisory:

The new Silage Corn Development Advisory is now available. This tool is designed to allow growers to track the maturity of their silage corn based on Growing Degree Days (GDD) accumulation in **6 common corn silage growing areas**. **These locations are Coolidge, Paloma Ranch, Buckeye, Maricopa, Queen Creek, and Kansas Settlement (Wilcox bench)**. When you click the links below, you will find a graph and a table for each location. The dates on the left side of each graph (Y axis) are a 6 week range of common planting dates for each individual location. GDD accumulations are tracked across the bottom of the graph (X axis) that correspond to the developmental stage on the top of the graph, of a 115 day to maturity variety. There is a legend at the bottom of the advisory that explains what each of the maturity abbreviations stand for with the abbreviation scheme as follows:

Abbreviation	Stage	Range on graph
V	Vegetative Stage	VE Emergence, V2-18 number of leaves, VT Tasseling
R	Reproductive Stage	R1 Silking; Target silage harvest maturity

The bars of the graphs on the left will progress as GDDs accumulate throughout the season, and the graphs will be adjusted mid-season to extend out to harvest maturity (~2700 HUs; R6 stage). Each graph will be followed by a table that shows a running tally of GDD accumulations allowing individuals to track daily totals throughout the growing season for hybrids with different maturity ratings (GDD requirements).

The links below are for the silage corn development advisories for **June 2, 2019** for different production region in Arizona:

- [Paloma](#)
- [Buckeye](#)
- [Queen Creek](#)
- [Maricopa](#)
- [Coolidge](#)
- [Kansas Settlement](#)

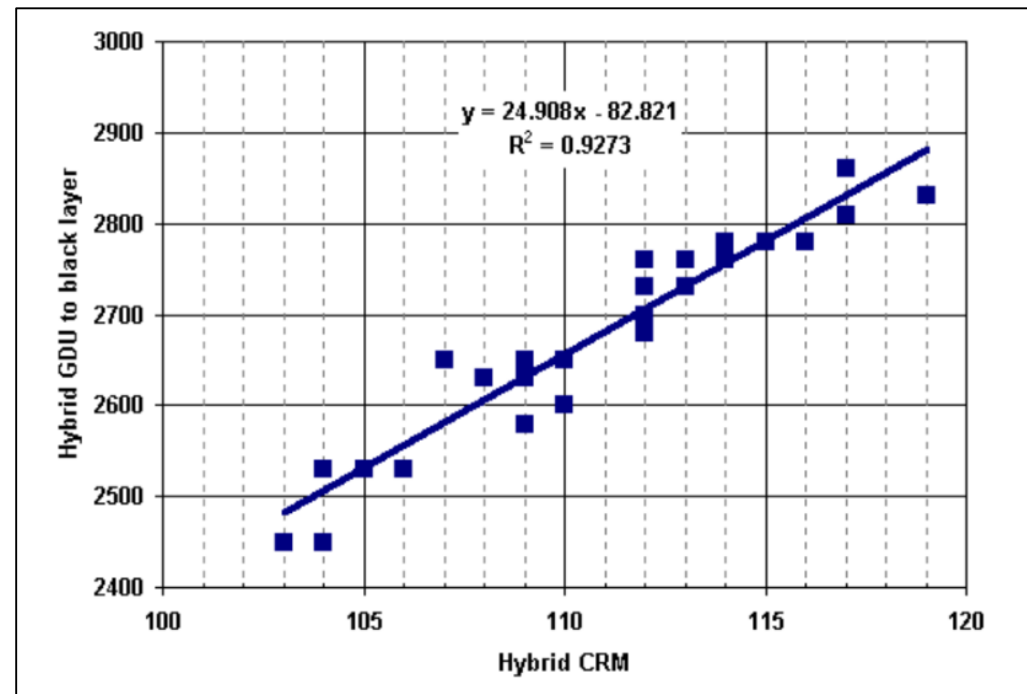
This is the first iteration of the Silage Corn Development Advisory and we would like feedback from silage corn growers on ways to improve this tool and make it as useful as possible.



# Corn Maturity Assessment

## Growing Degree Days vs Corn Relative Maturity

- **Relative Maturity**
  - Grain Moisture (~22-25%)
  - Rating Company Hybrids
  - Company Specific?
  - Assume Normal Weather
  - Silage CRM Ratings
    - 8-10 Day Before Mature
  
- **Growing Degree Days**
  - Considered Better
  - Adjusts for Weather
  - Most Seed Rated
    - @ Silking
    - @ Black Layer



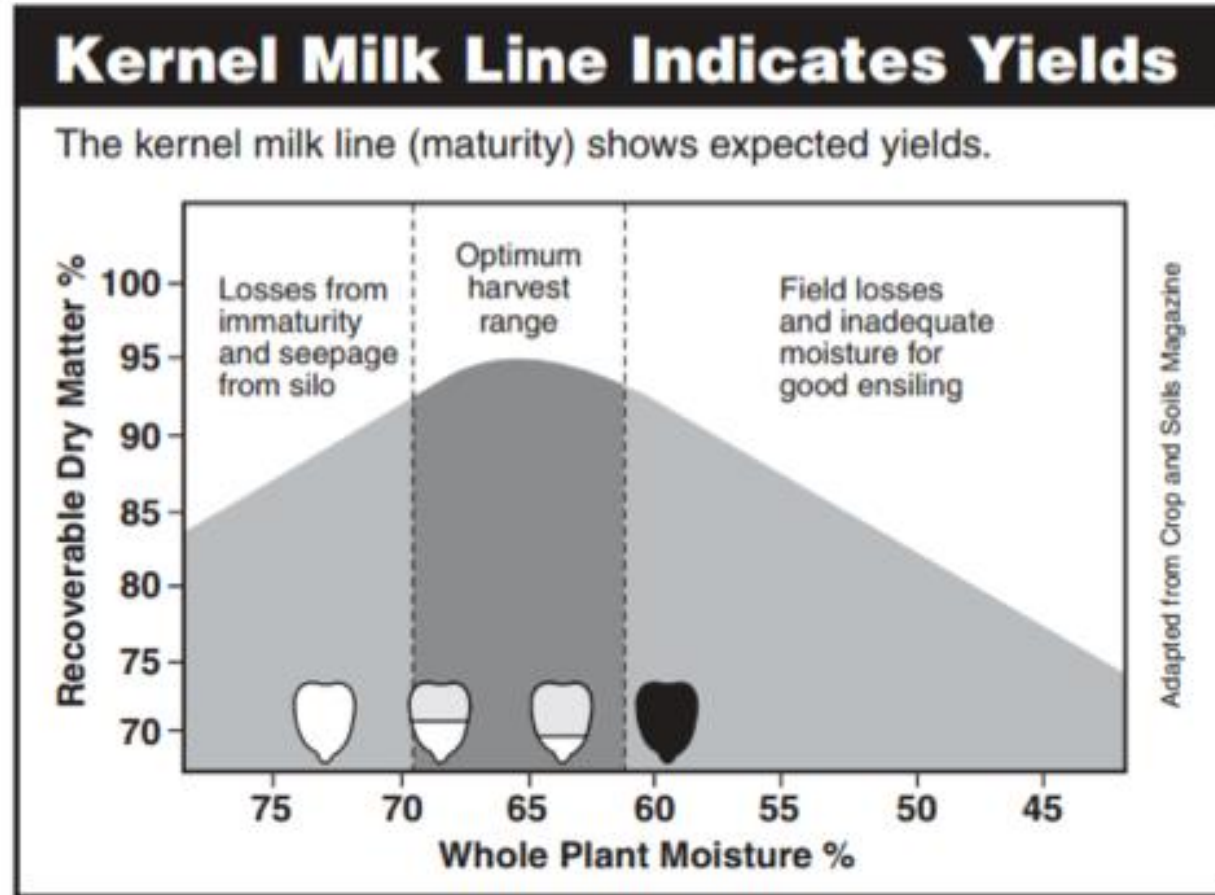
# Most Corn Varieties Have GDD or GDU Rating

CROPLAN		2019 Corn Product														NEW COOPERATIVE INC.						
BRAND	RM	RESPONSE SCORES				AGRONOMIC CHARACTERISTICS									GROWTH CHARACTERISTICS							
		RTP	RTN	RTCC	RTF	Seedling Vigor	Stalk Quality	Root Strength	Staygreen	Drydown	Drought Tolerance	Test Weight	Gray Leaf Spot	NCLB	Goss's Wilt	GDU to Maturity	Plant Height	Ear Height	Cob Color	Ear Flex	Flower Date	Kernel Rows
4079SS/RIB* [VT2P/RIB]	100	M	H	H	H	2	3	1	3	2	2	3	3	3	2	2350	M-T	M	Red	SF	M	14-16
4099SS/RIB*	100	H	H	M	M	1	2	1	3	3	2	3	4	4	3	2460	M-T	M	PINK	SF	L	16-20
4188SS/RIB* [VT2P/RIB*]	101	TBD	TBD	TBD	TBD	1	2	1	1	3	2	1	3	2	2	2350	M	M	RED	SF	M	16-18
4199SS/RIB* [VT2P/RIB]*	101	H	M	M	M	1	1	1	3	3	1	3	3	3	4	2420	M	M	RED	SF	L	16-18
4350SS/RIB* [DGV2P/RIB]*	102	M	M	M	M	2	3	1	2	3	2	3	3	2	2	2430	M-S	M-L	RED	SF	E-M	16-18
4975VT3P/RIB* [VT2P/RIB]*	102	H	H	M	H	2	3	2	4	2	3	3	3	3	3	2500	M-T	M	RED	SF	M	14-16
4488SS/RIB* [VT2P/RIB]	104	H	H	H	H	3	3	2	3	2	2	2	3	3	2	2465	T	M-H	RED	SF	M	16-18
4549SS/RIB* [VT2P/RIB*, CONV]	105	H	H	L	H	1	2	2	3	2	2	2	3	2	2	2496	T	M-H	RED	SF	E-M	16-18
4644DGV2P/RIB*	106	M	M	L	H	1	3	3	3	3	3	3	3	3	3	2700	M-T	M	RED	SF	M	16-18
5412SS/RIB* [VT2P/RIB]*	106	M	M	H	M	3	3	3	3	3	2	3	3	3	1	2590	M	M	RED	SF	M	14-16
4895SS/RIB* [VT2P/RIB]*	108	M	M	L	L	2	2	1	3	2	2	3	3	3	4	2540	M	M-L	PINK	SF	M	16-18
5887VT3P/RIB* [VT2P/RIB]*	108	L	H	L	H	3	3	2	3	1	2	1	4	3	3	2580	M	M	RED	FL	M	14-18
4997VT2P/RIB*	109	H	H	L	L	2	2	2	2	2	2	3	3	2	2	2550	T	M-H	RED	SF	M	16-18
5975VT3P/RIB*	109	M	M	H	H	2	2	1	2	2	2	3	3	3	3	2640	M	M	RED	SF	M	16-18
5073SS/RIB*	110	TBD	TBD	TBD	TBD	2	3	2	2	2	2	2	3	2	3	2640	M	M-H	RED	SF	M	16-18
6110SS/RIB* [VT2P/RIB]*	110	M	M	M	M	2	3	1	2	3	1	3	4	2	3	2600	M	M	RED	SF	M	16-18
6065VT2P/RIB*	111	H	H	M	M	1	2	1	1	3	2	2	3	3	3	2700	M-T	M-H	RED	SF	M	16-18
5252VT2P/RIB*	112	M	H	M	M	2	2	2	1	2	2	2	3	3	3	2750	M	M	RED	SF	M	14-18
5290SS/RIB* [DGV2P/RIB*, Conv]	112	M	H	M	H	1	3	3	3	2	3	1	2	3	3	2610	M	M	RED	SF	M	14-16
6265SS/RIB* [VT2P/RIB]*	112	H	H	H	L	1	2	1	2	3	2	2	3	4	4	2730	M	M	PINK	SF	M-L	16-18
5335SS/RIB* [VT2P/RIB*]	113	TBD	TBD	TBD	TBD	2	1	2	2	2	2	1	3	2	2	2728	M-T	M	PINK	SF	M	16-18
6594SS/RIB* [VT2P/RIB]*	113	M	M	H	M	2	1	1	2	2	2	2	3	3	3	2690	M	M	RED	SF	M	16-18
5678SS/RIB* [VT2P/RIB]	116	M	H	M	M	3	3	3	3	3	2	2	3	3	3	2790	M	M	RED	SF	M	14-16



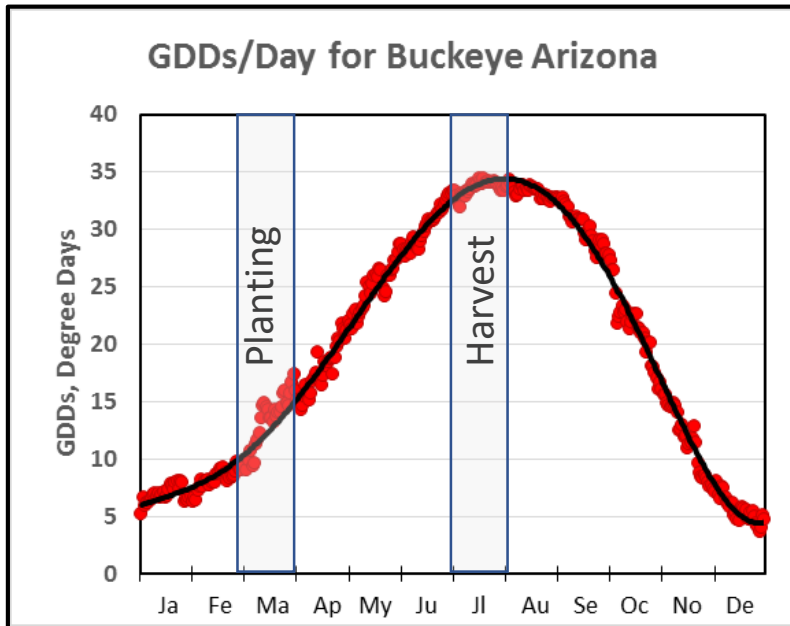
# Using Growing Degree Days to Project Harvest Dates

- Document Silking Date
- ½ Milk Stage
  - 900 GDDs After Silking
- Monitor Fields
  - Moisture
  - 1/3 Milk Stage



Source: University of Illinois at <https://dairyfocus.illinois.edu/content/get-ready-go-its-corn-silage-time>

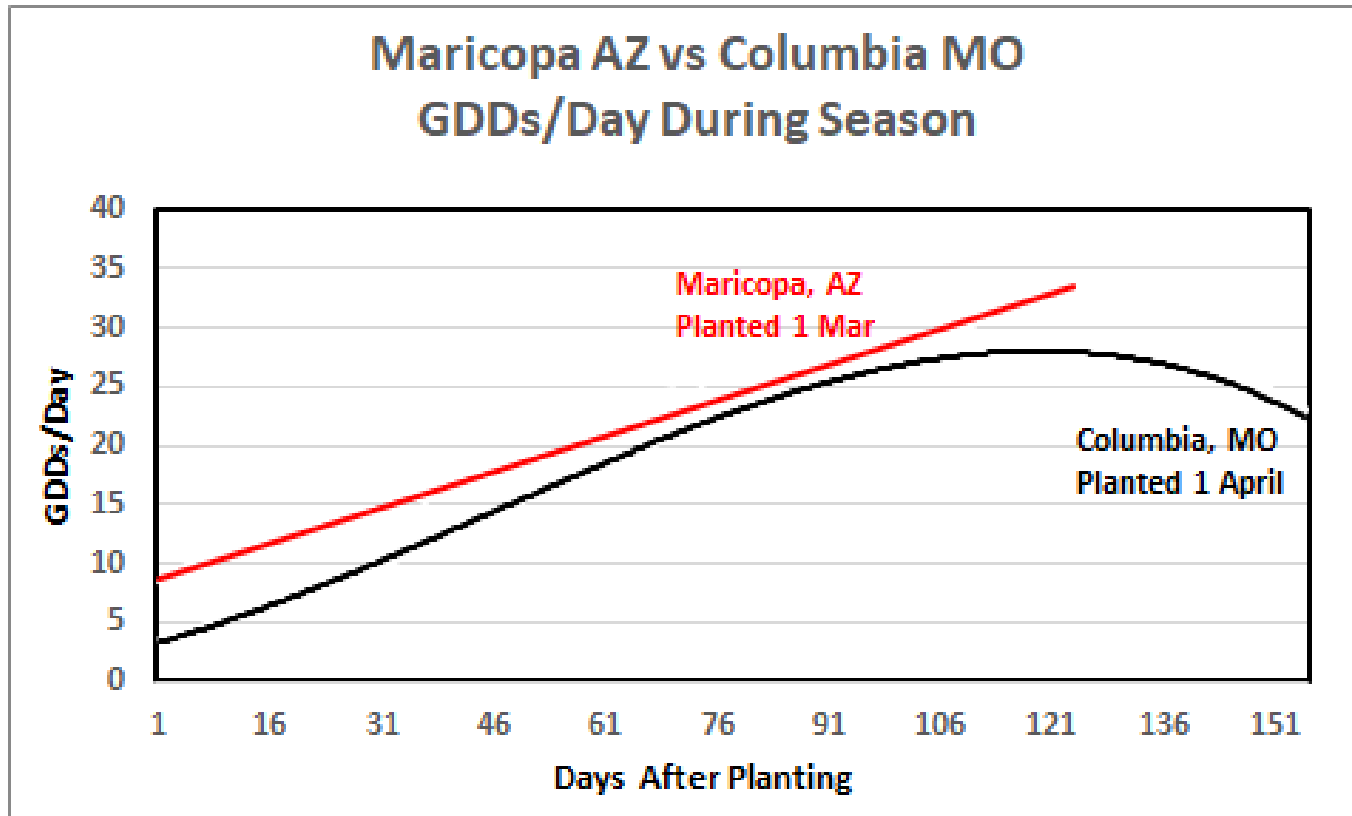
# Silage Planting Plan/Harvest Schedule Using GDDs



Planting Date	Est. Harvest
22 February	3 July
1 March	5 July
8 March	8 July
15 March	10 July
22 March	13 July

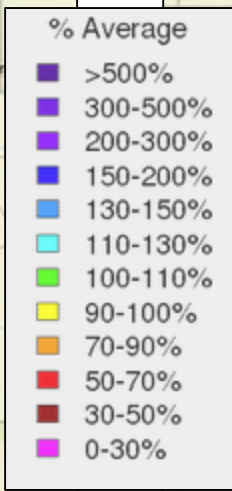
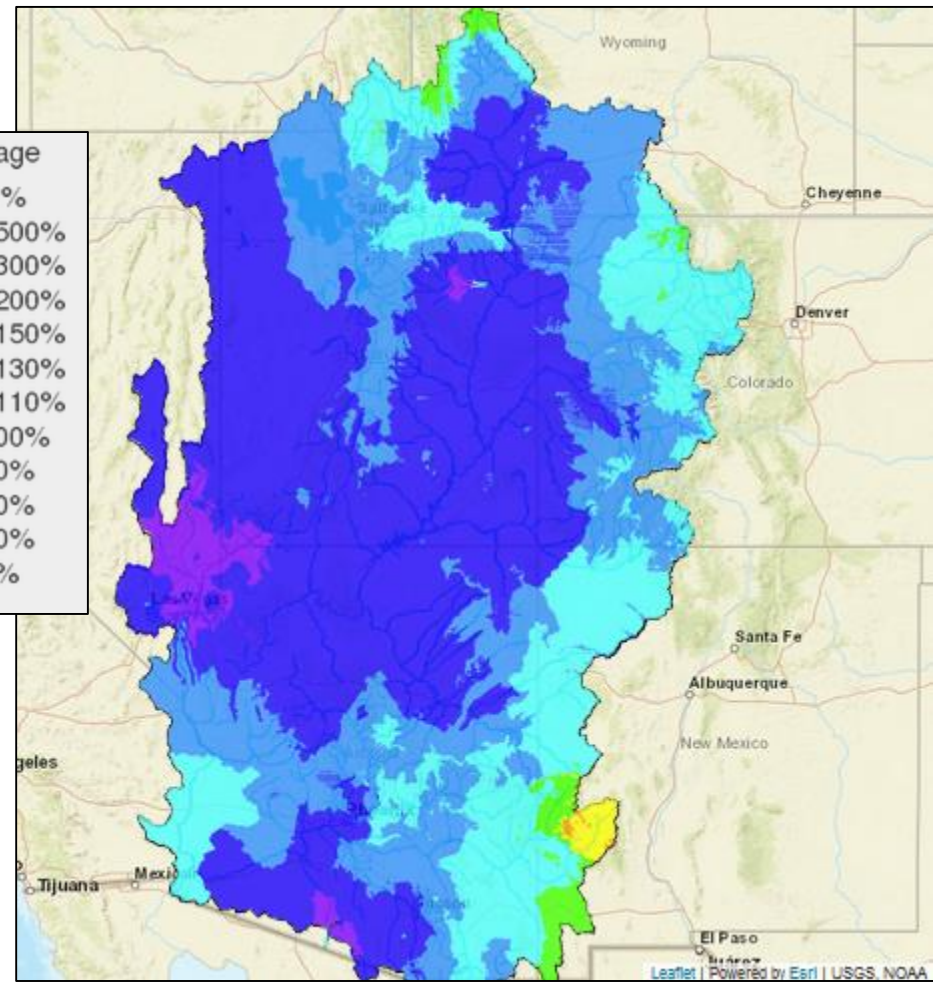
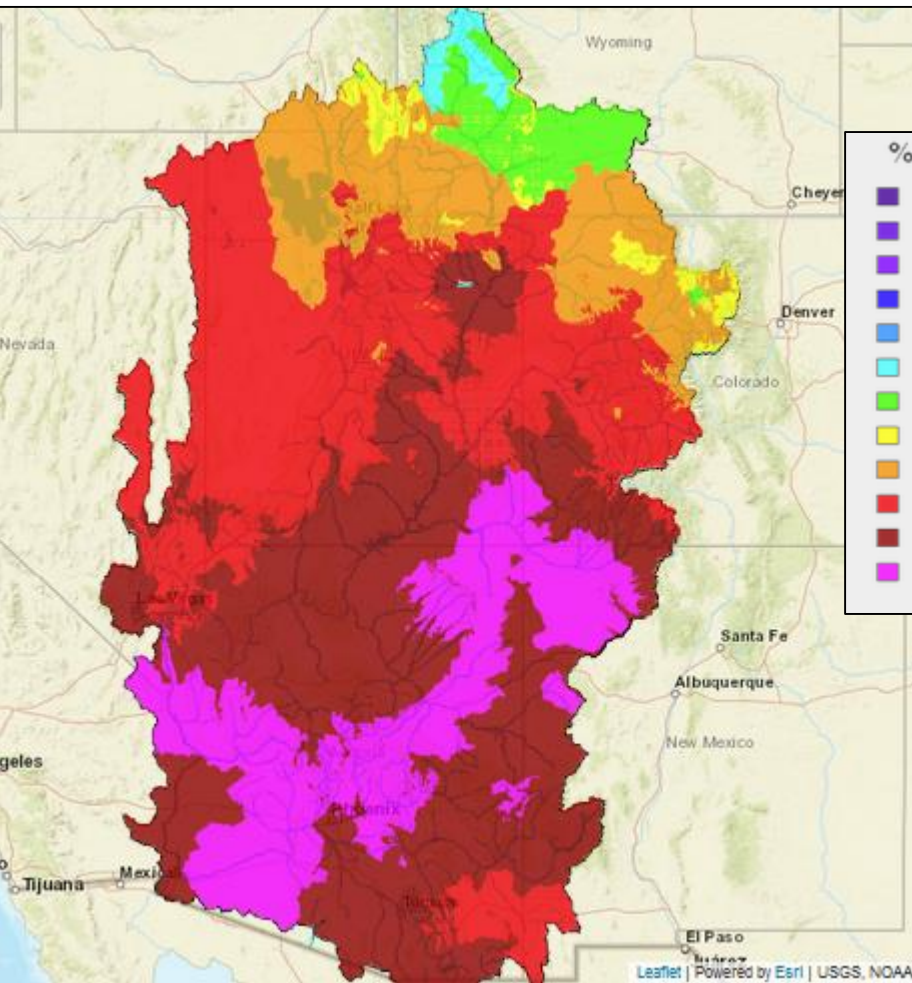
**A week separation in spring planting date becomes a 2-3 day difference in harvest due to low GDD values in spring, resulting in a compression of harvest dates.**

# Some Caution!



- AZ is much hotter than even the southern Midwest
- We harvest when heat and gdds are at their seasonal peaks
- Still some validation work required

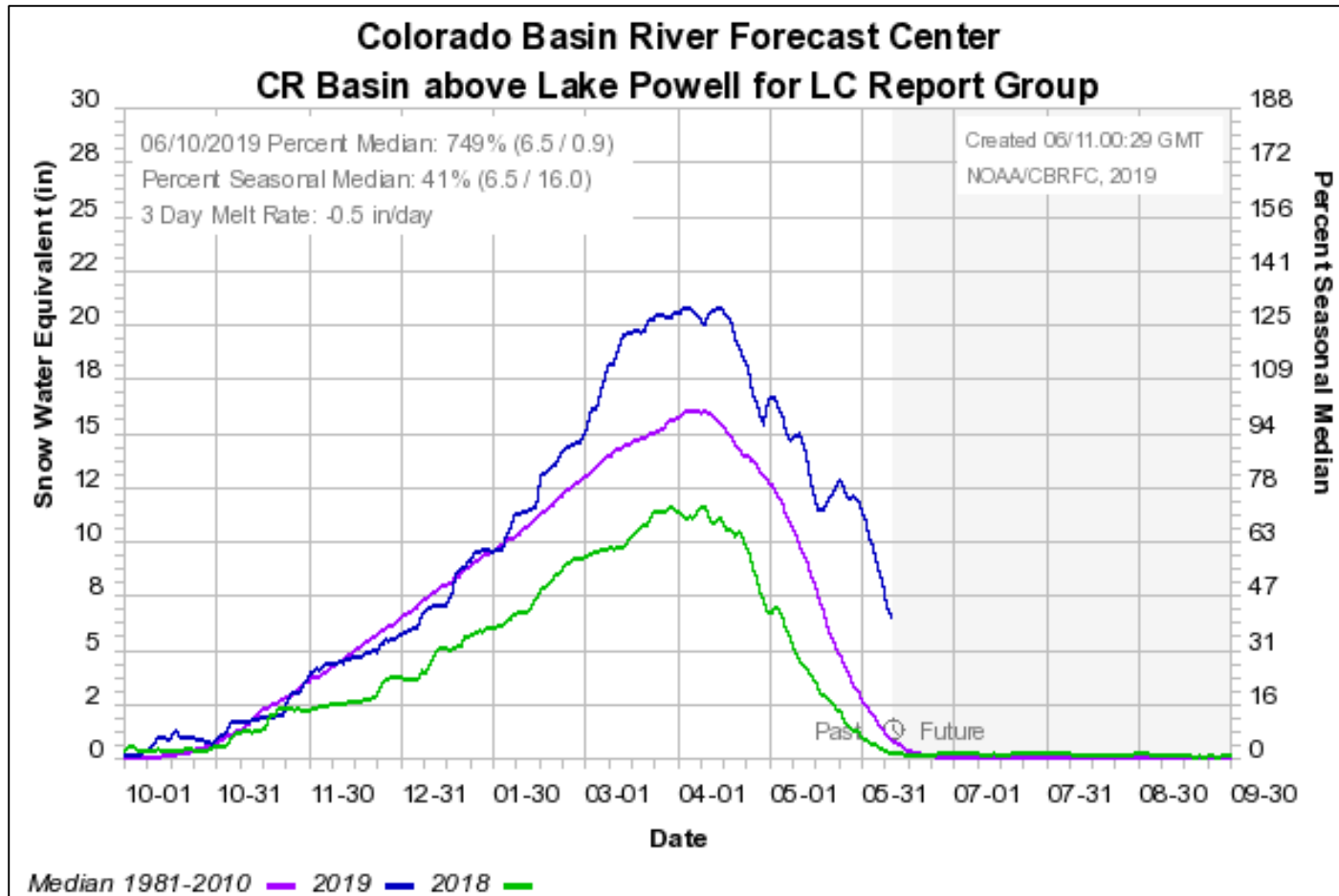
# Water Supply Update



Precipitation: Oct 2017 – May 2018

Precipitation: Oct 2018 – May 2019

# Excellent Snow Pack!

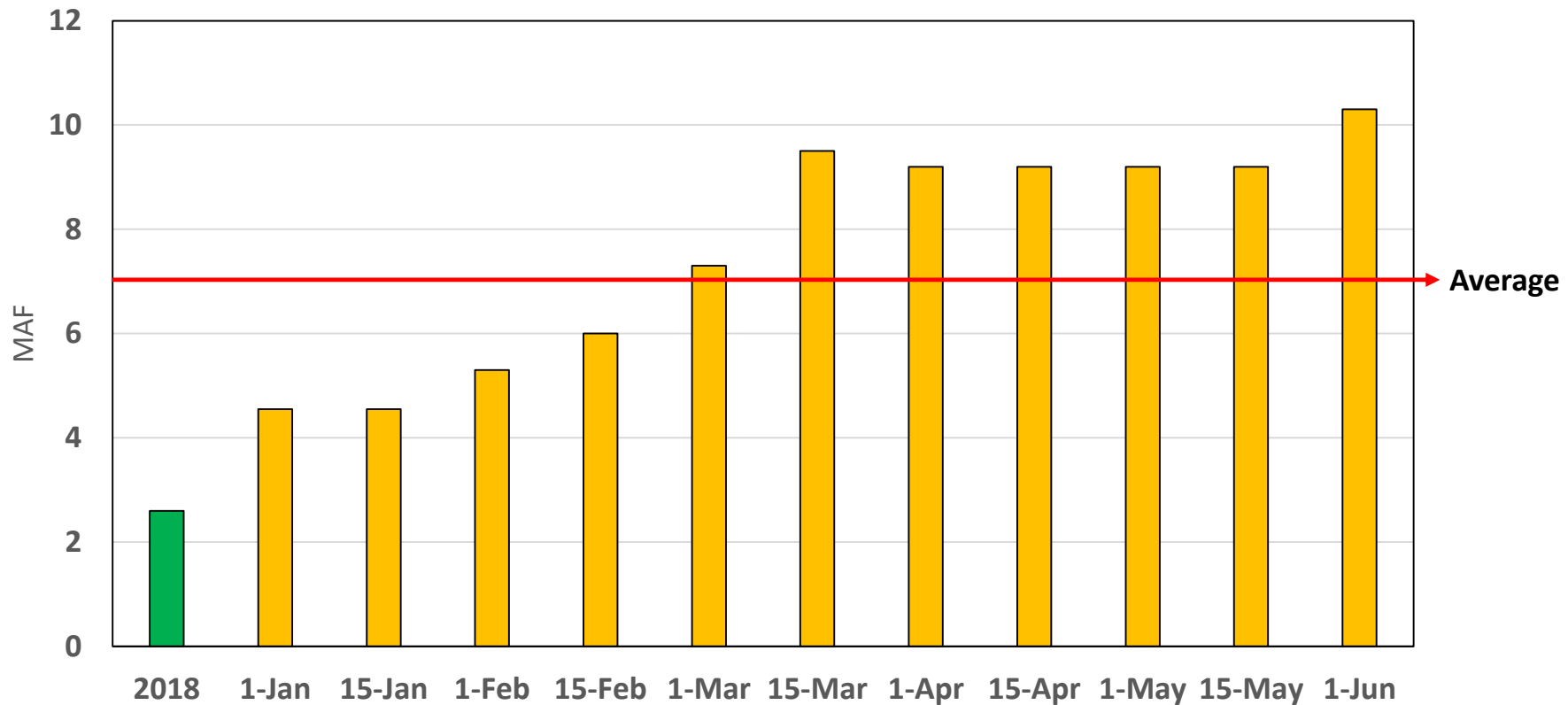


- 2019 Snow Pack Was Nearly Doubled Relative to 2018
- 1/3 of Snow Pack Remains, Well Above Long-Term Median

# Improving Colorado River Forecast

## Spring Flow Into Lake Powell

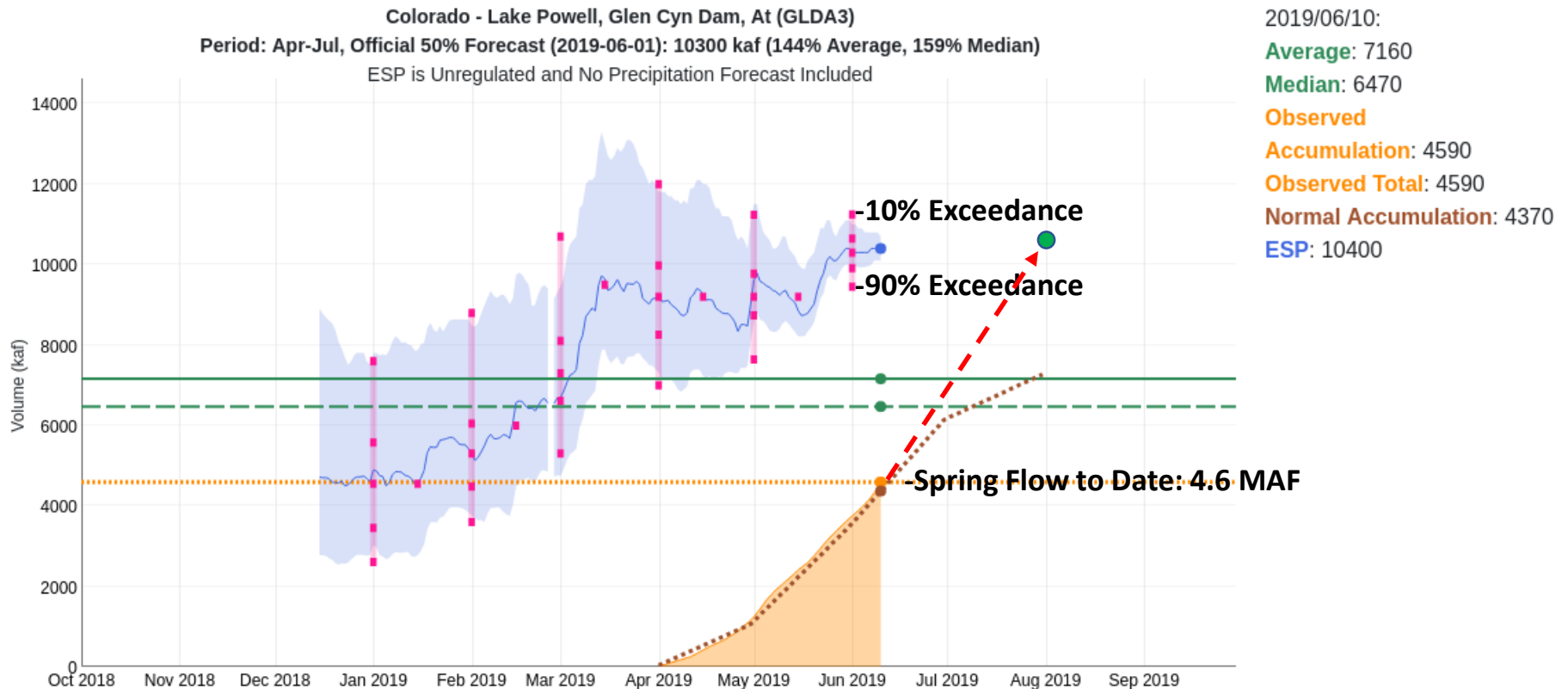
Spring Flow Projections: Colorado River



**Above average & more than 4 times 2018 flow**



# Colorado River Flow



# Does The Wet Winter Put Off Shortage?

## Water Budget at Lake Mead

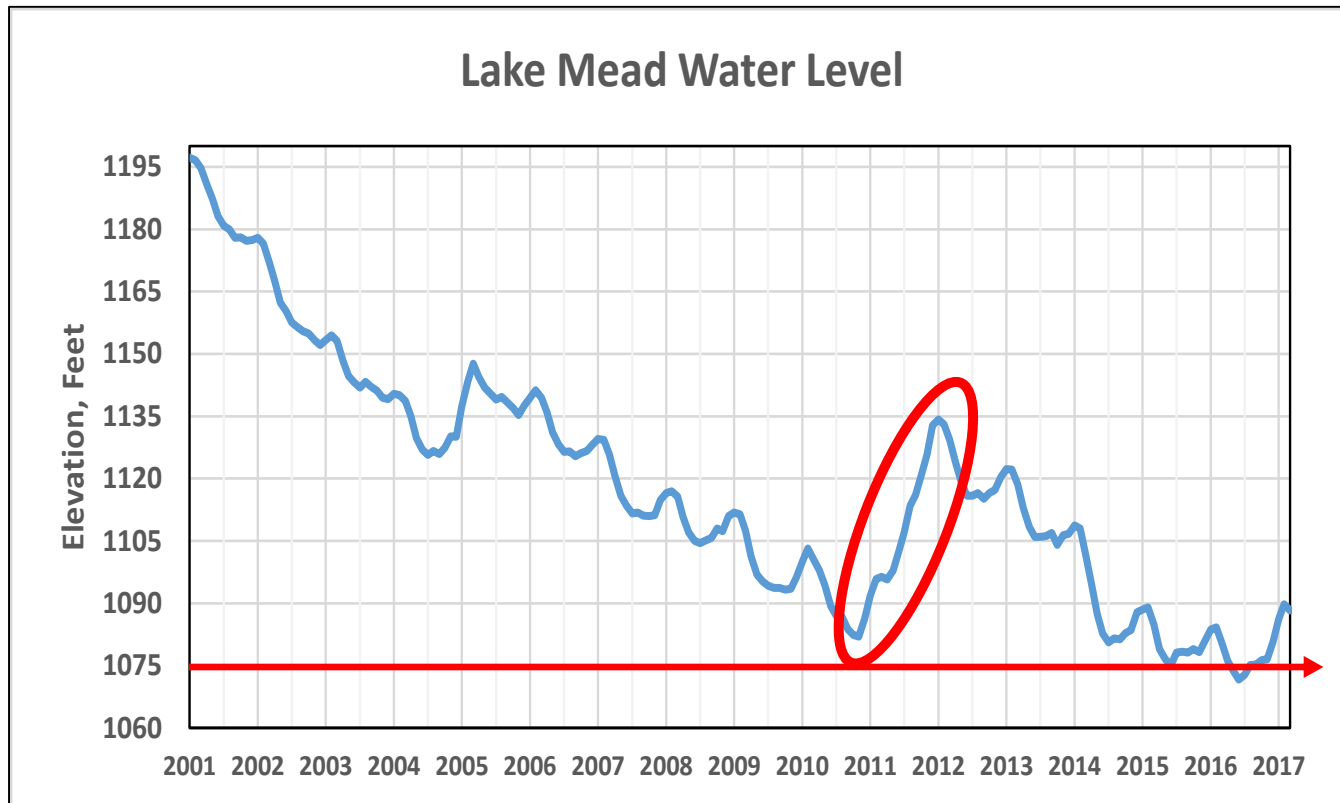
▪ Inflow (release from Powell + side inflows)	= 9.0 maf	+10.1 maf
▪ Outflow (AZ, CA, NV, and Mexico delivery + downstream regulation and gains/losses)	= - 9.6 maf	-8.9 maf
▪ Mead evaporation losses	= - 0.6 maf	-0.55 maf
▪ Balance	= - 1.2 maf	+0.65 maf

Given basic apportionments in the Lower Basin, the allotment to Mexico, and an 8.23 maf release from Lake Powell, Lake Mead storage declines about 12 feet each year

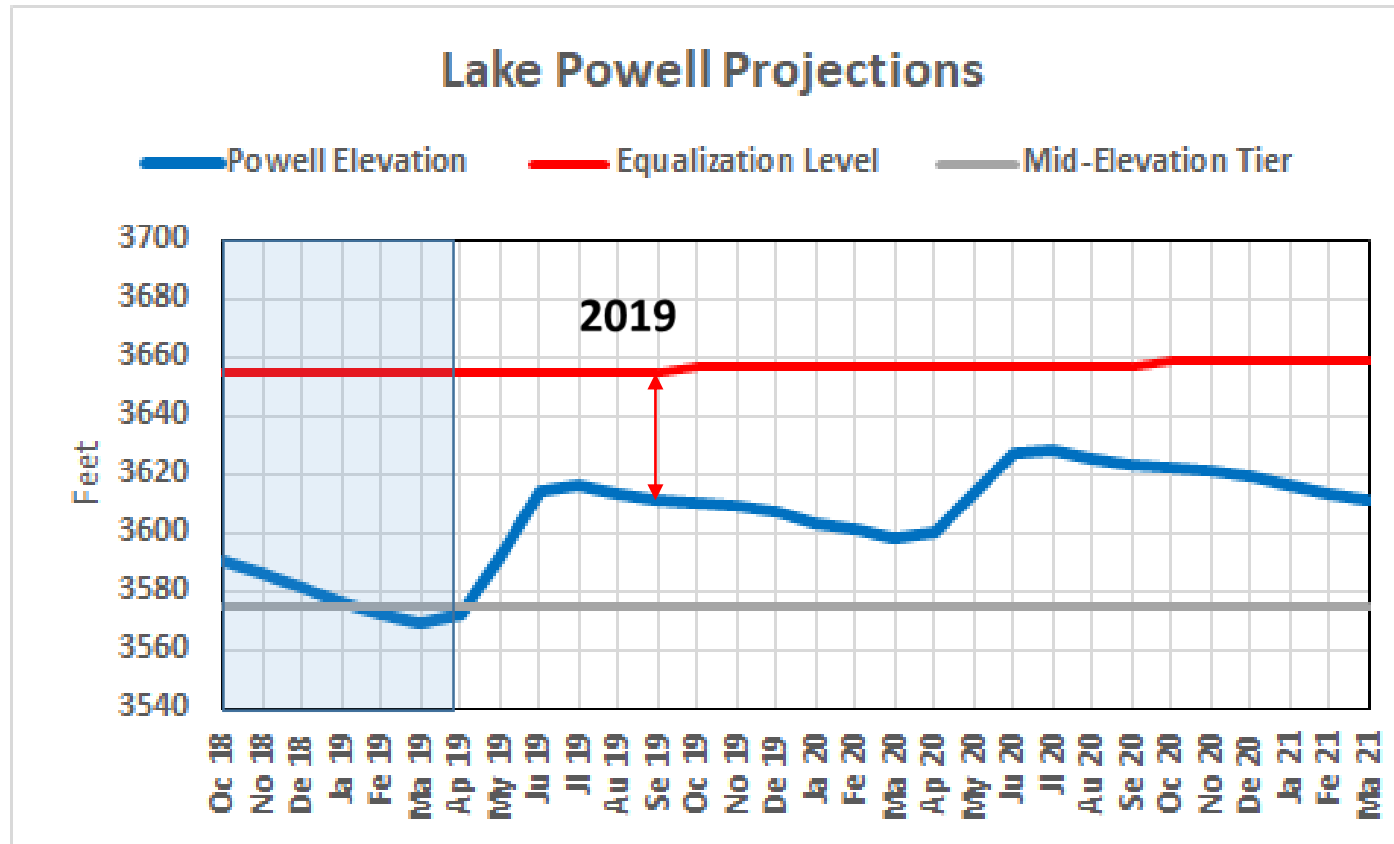
RECLAMATION

**Yes, for at least a year...Lake Mead forecast to end 2019 at 1084.9' (~10' above shortage)**

# Equalization Release?



# No Equalization Release



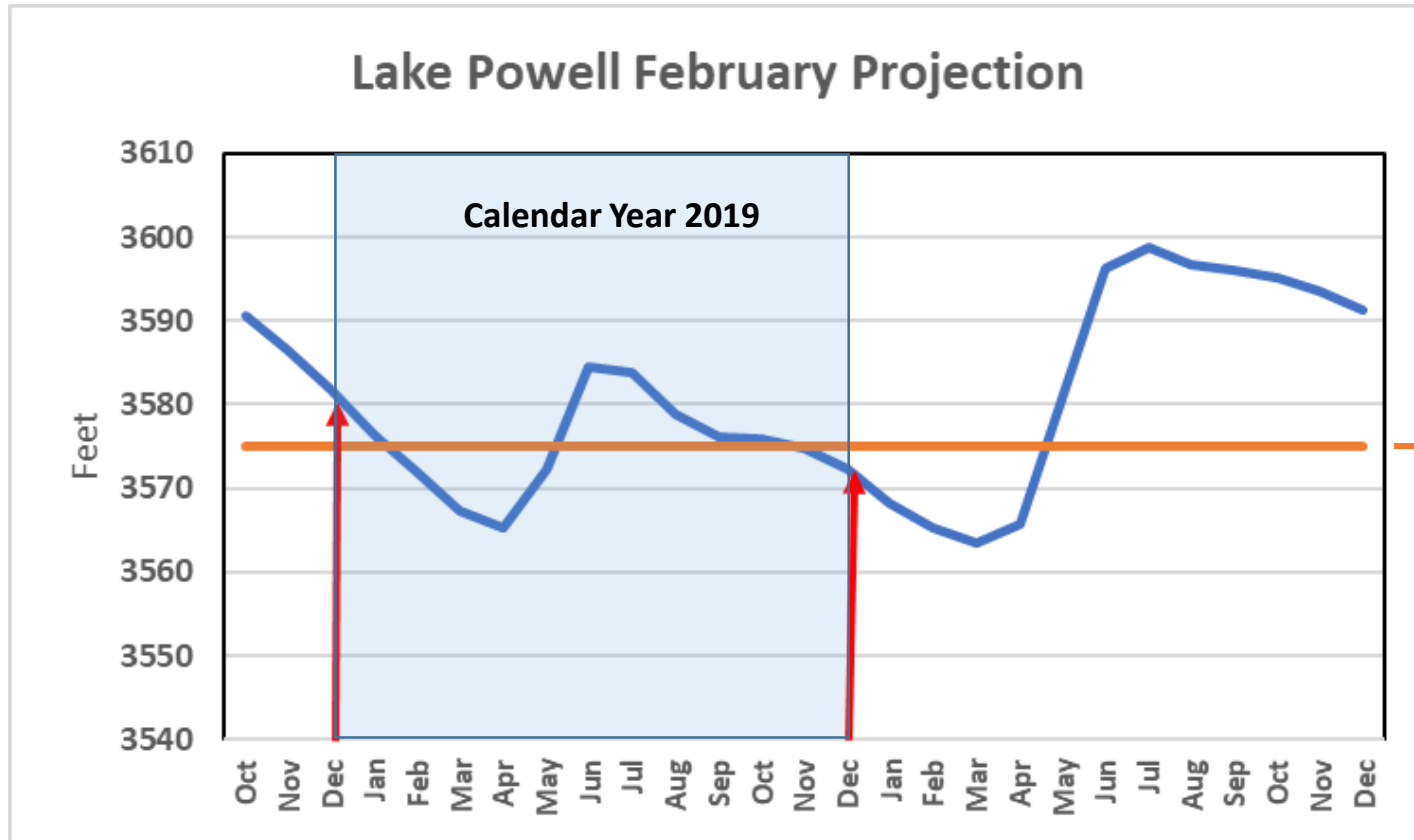
- April projection for September 30 level must exceed 3655'.
- We fell 44' short of Equalization Level.
- Need 2020 to be a repeat of 2019.

# Important Lake Water Levels

- **Lake Powell**
  - **3655'**
    - **Equalization Level**
      - **Higher Release to Mead**
      - **Too Much Water!**
  - **3575'**
    - **Lower Water Releases from Powell to Mead**
      - **>3575': 8.23-9.00 MAF**
      - **<3575': 7.48-8.23 MAF**
- **Lake Mead**
  - **1075' (Tier 1 Shortage)**
    - **Reductions in Water for AZ, NV, MX**
  - **1090'**
    - **Drought Conservation Plan (Lowers AZ, NV MX Use)**

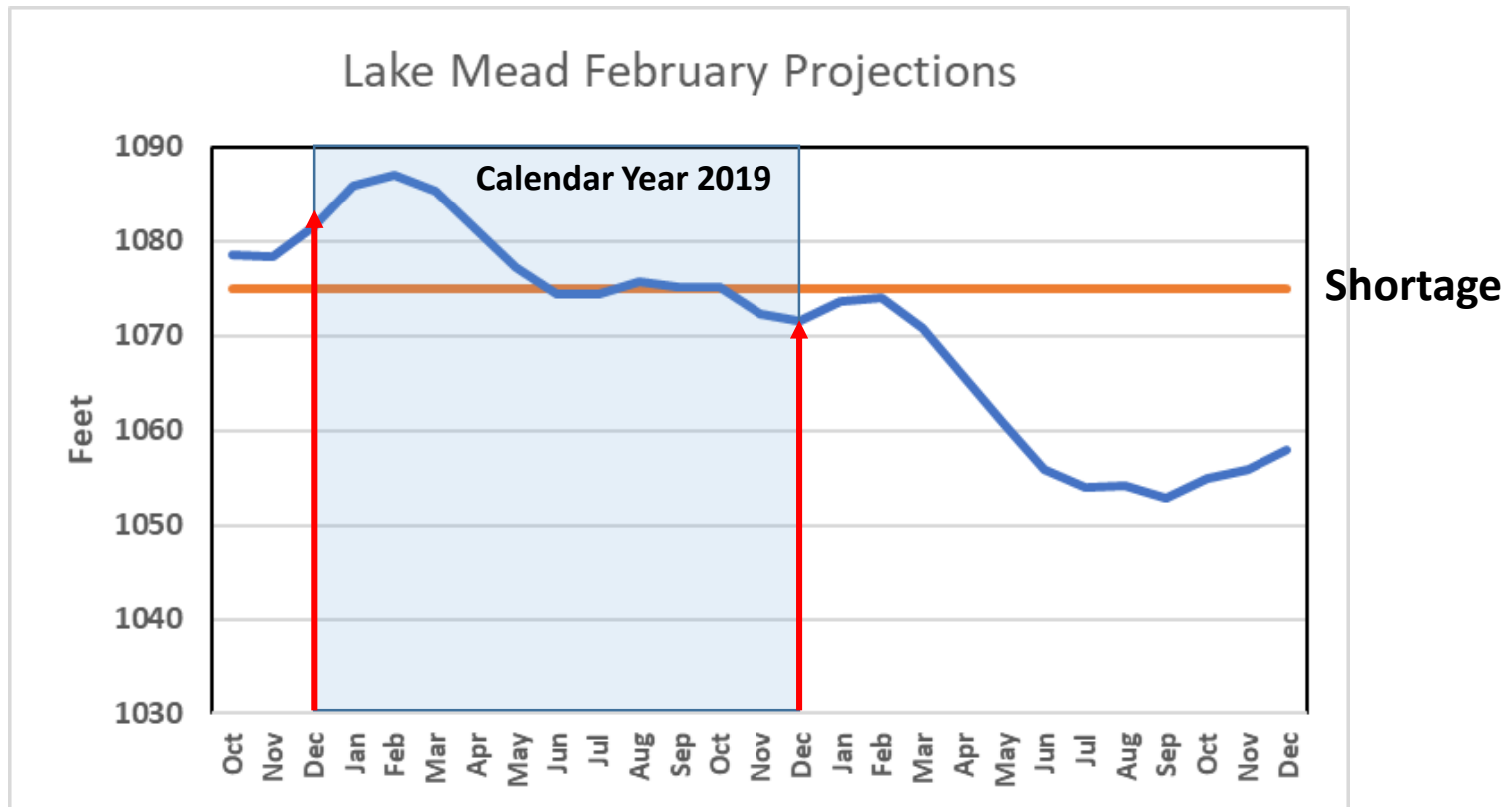
# We Were In Trouble

## Before Wet Winter



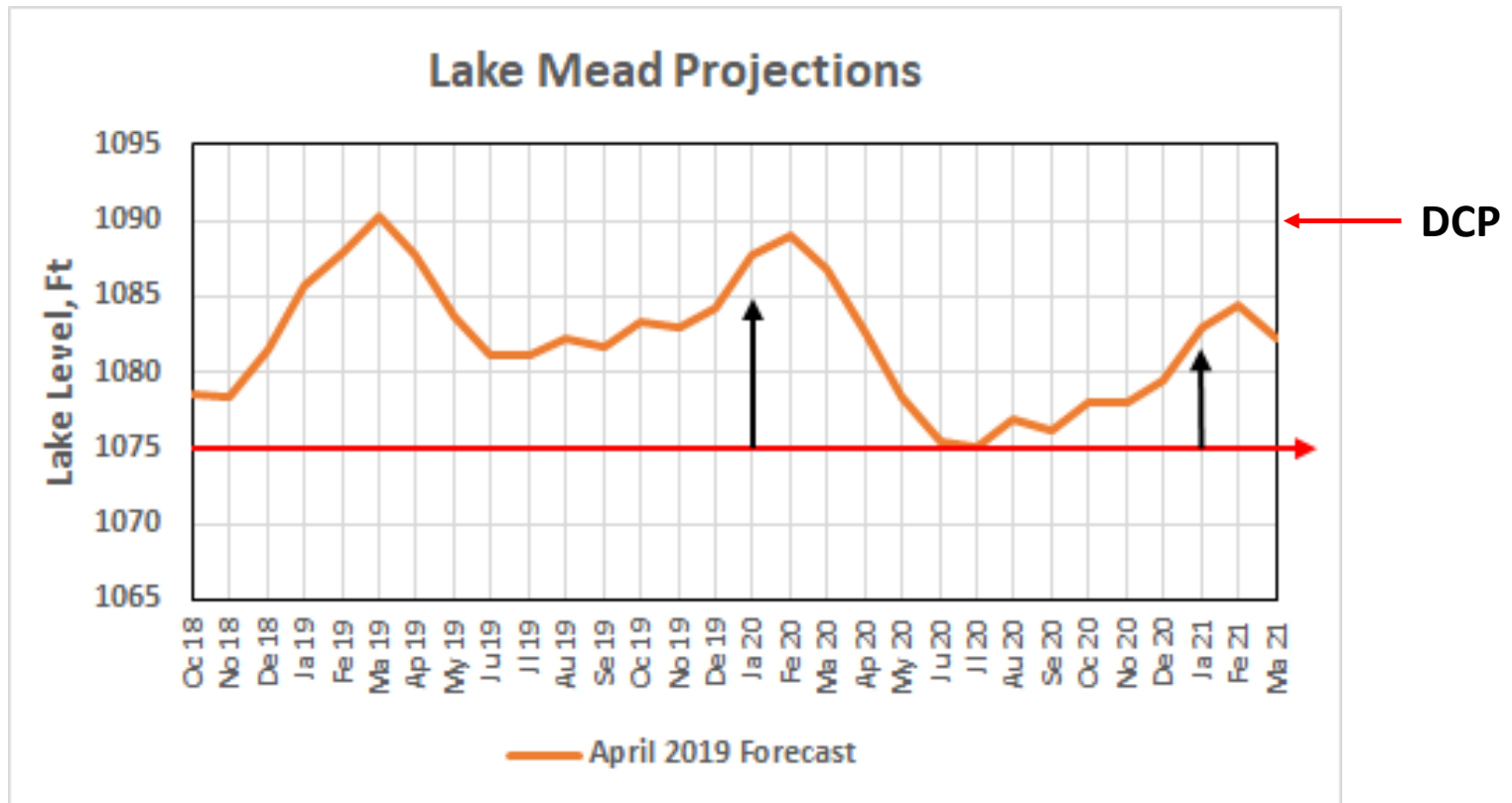
- If August projection for Lake Powell is below 3575'
- Water release from Powell reduced 0.75-1.5 MAF
- February projection below 3575', release just 7.48 MAF

# Resulting Lake Mead Projections



Reduce water release from Powell produced forecasted shortage (Mead 1071')

# April Projections: Lake Mead

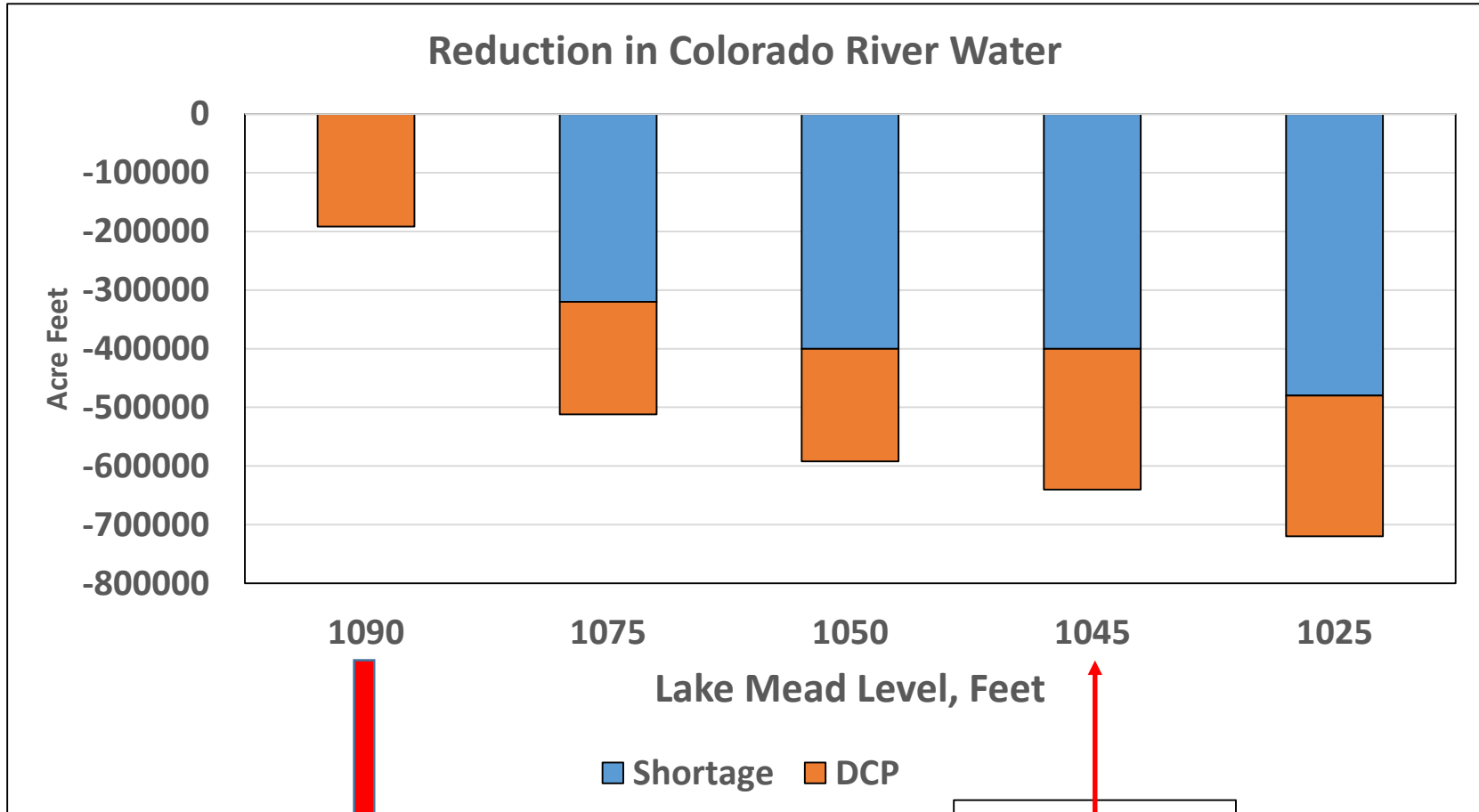


**No shortage projected for 2020 and even for 2021!**

**Projections remain below 1090', Drought Contingency Plan**



# AZ Shortage + DCP Contributions

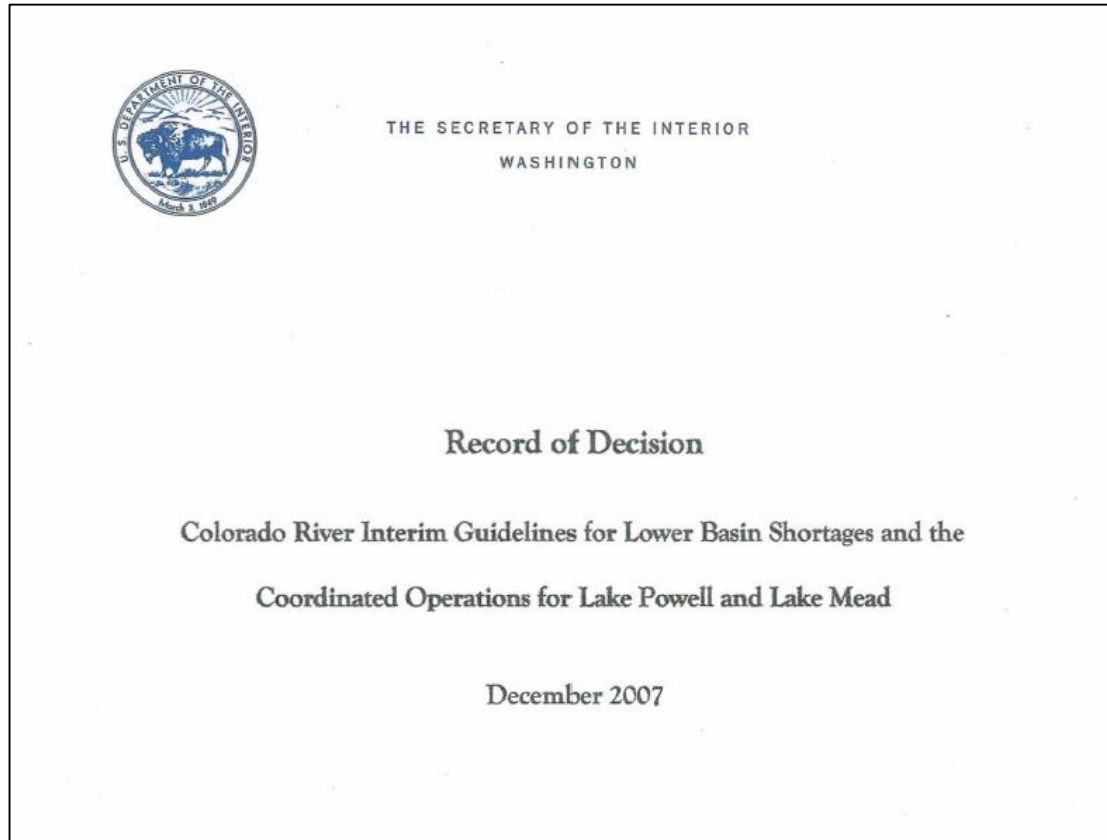


BR Projects...

**2019 AZ Water Use 293,000 AF Below Allocation**

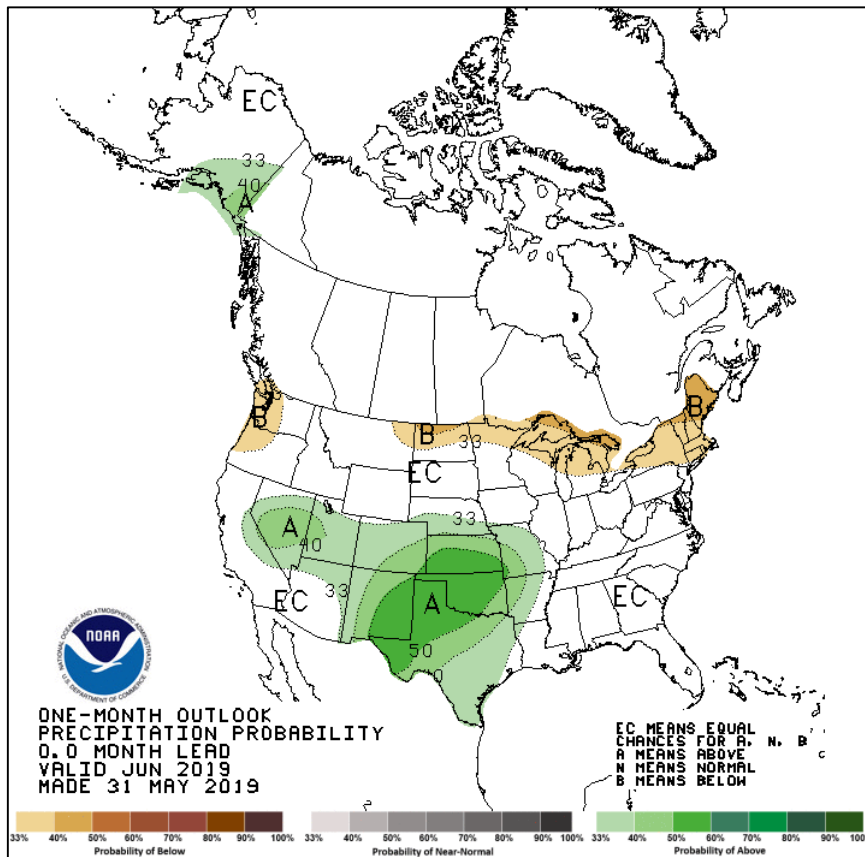
**California Reduction 200,000 AF**

# Interim Guidelines Expire in 2026

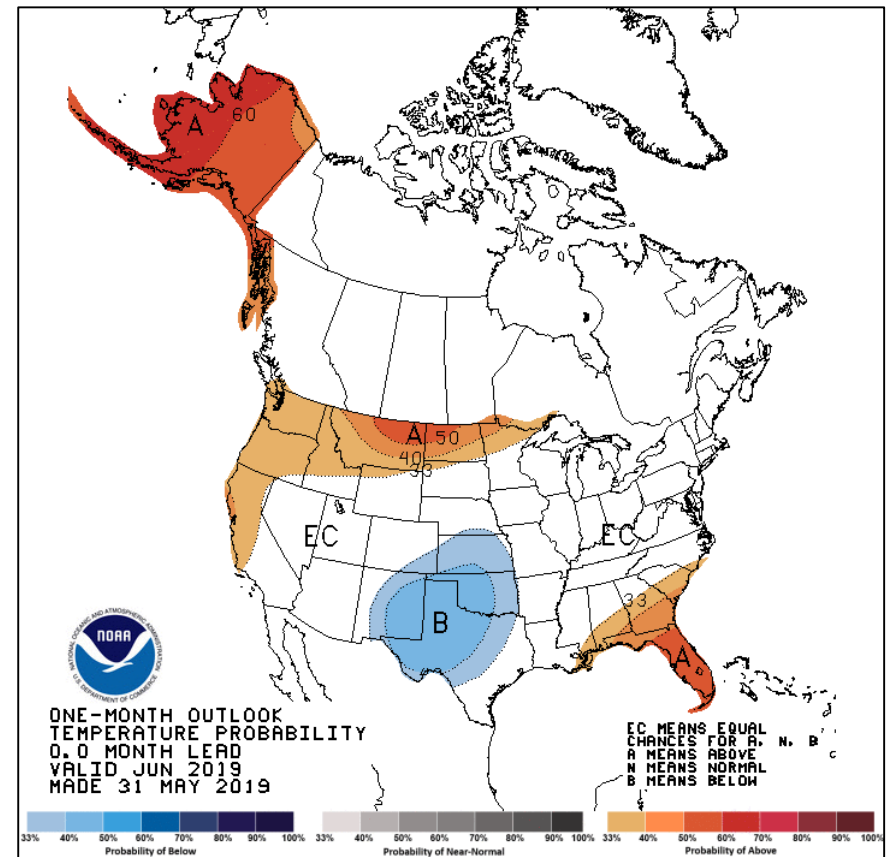


**The process will begin again!**

# June Forecast

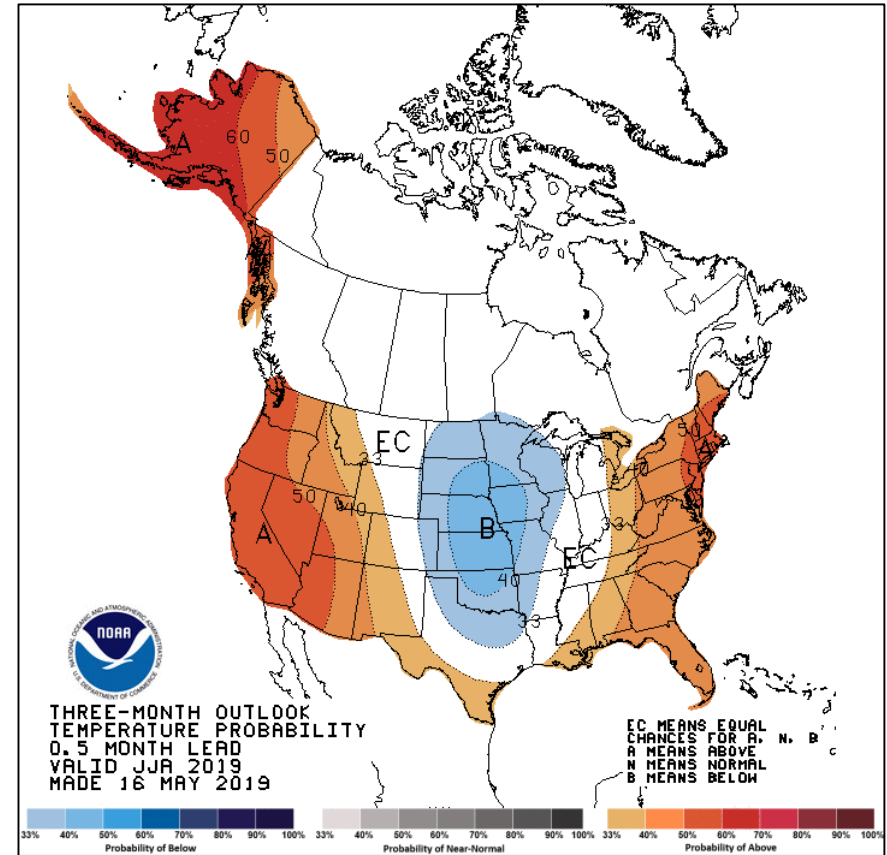
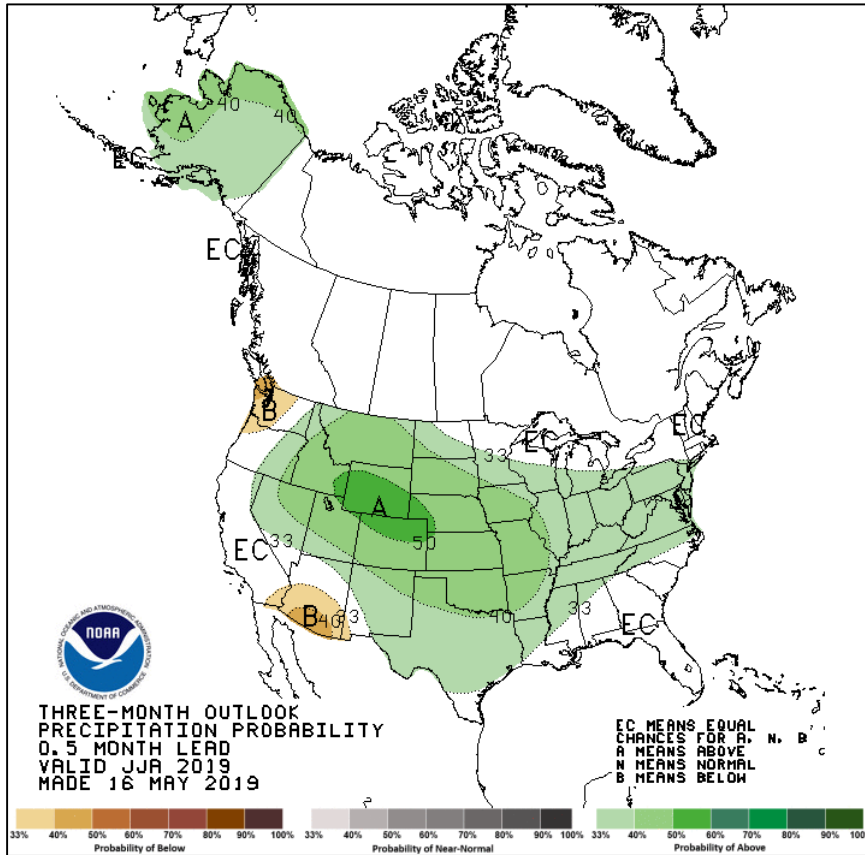


**Precipitation: Weak Wet Bias  
 East & North AZ**



**Temperatures: Normal**

# July-September Forecast

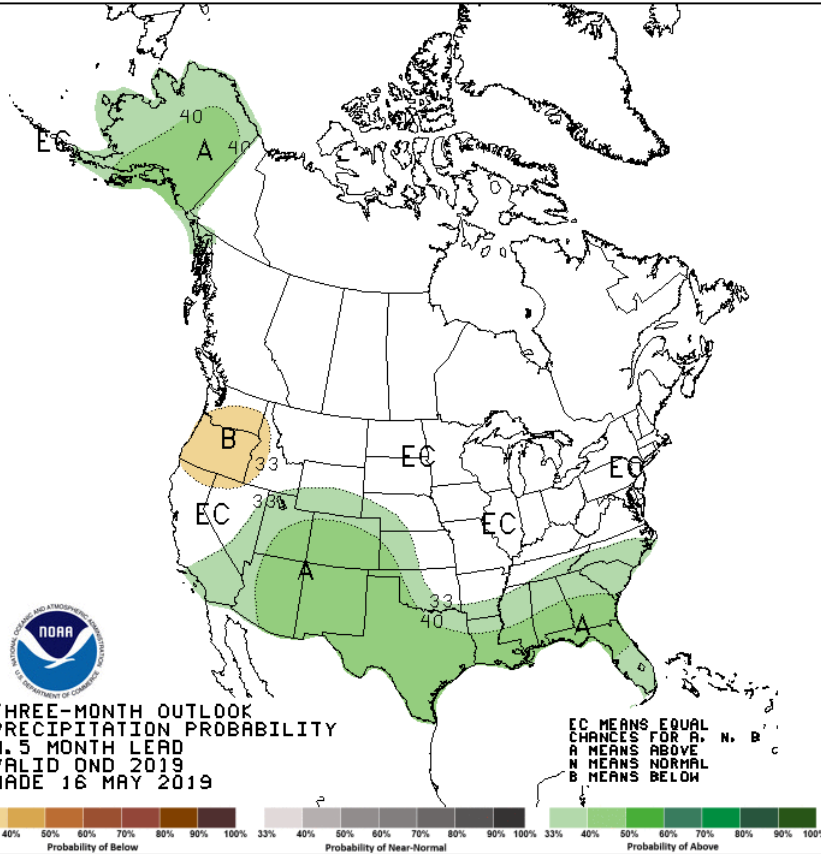


**Precipitation: Weak/Moderate Dry Bias;  
Wet Bias in Basin**

**Temperature: Moderate/Strong  
Warm Bias**

# October-December Forecast

## El Niño Lives!!!

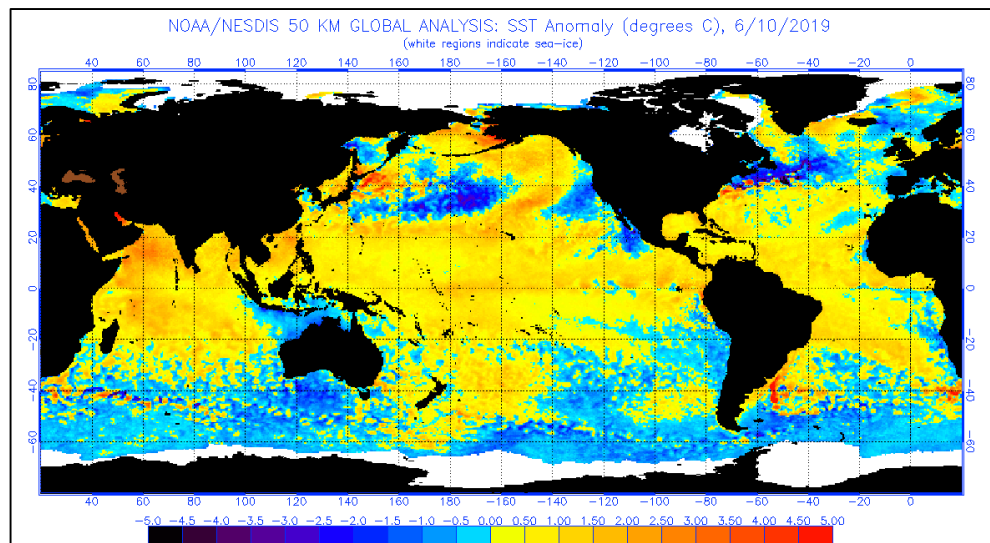


### EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by  
CLIMATE PREDICTION CENTER/NCEP/NWS  
and the International Research Institute for Climate and Society  
9 May 2019

**ENSO Alert System Status: El Niño Advisory**

**Synopsis: El Niño is likely to continue through the Northern Hemisphere summer 2019 (70% chance) and fall (55-60% chance).**



**Precipitation: Weak/Moderate Wet Bias**