Current water supply status and climate preparedness strategies for orchards and vineyards

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Agenda

Current State of Water Resources in the North Coast

- Water Supply Indices
- History of Drought and Floods
- The Hydro-Illogical Cycle

Climate Preparedness

- Social and Local Capacity
- Water Management Strategies

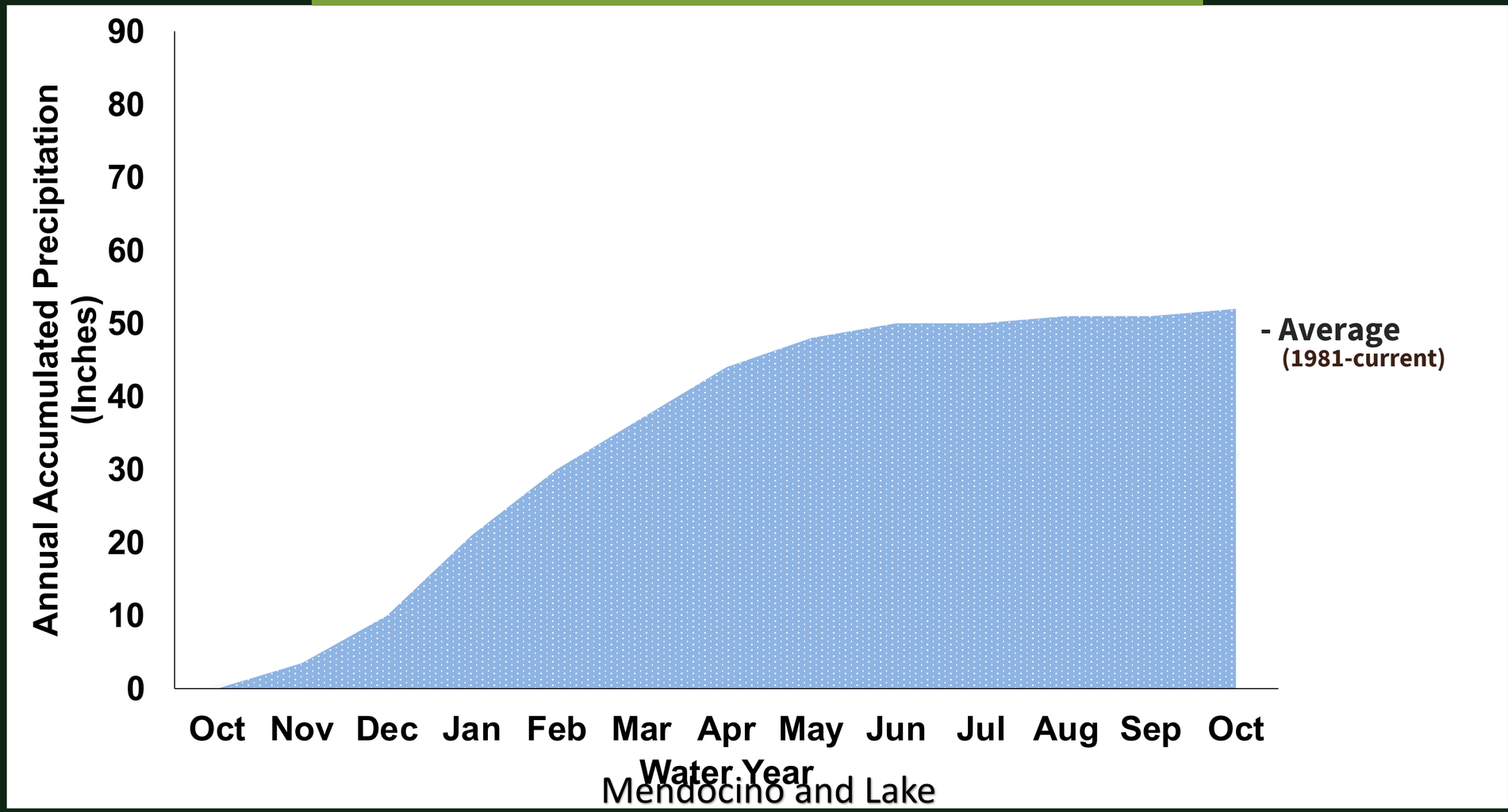
Status of Water and Climate in Mendocino and Lake Counties

Status of Water and Climate in Mendocino and Lake Counties

Are we in a
Dry, Normal or Wet year?

Are we in a dry, normal, or wet year?

Rainfall Index



Mendocino and Lake

Are we in a dry, normal, or wet year?

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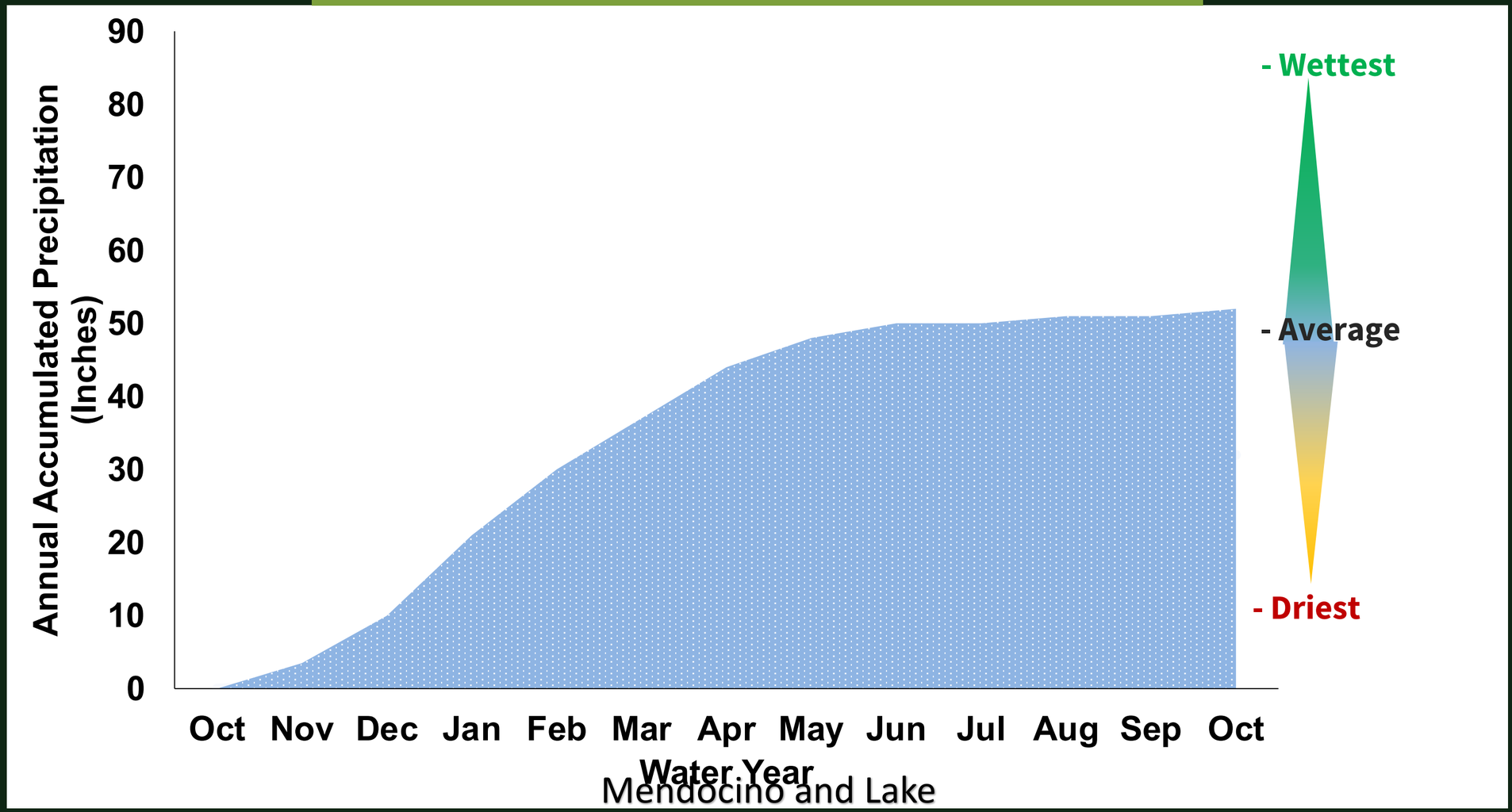

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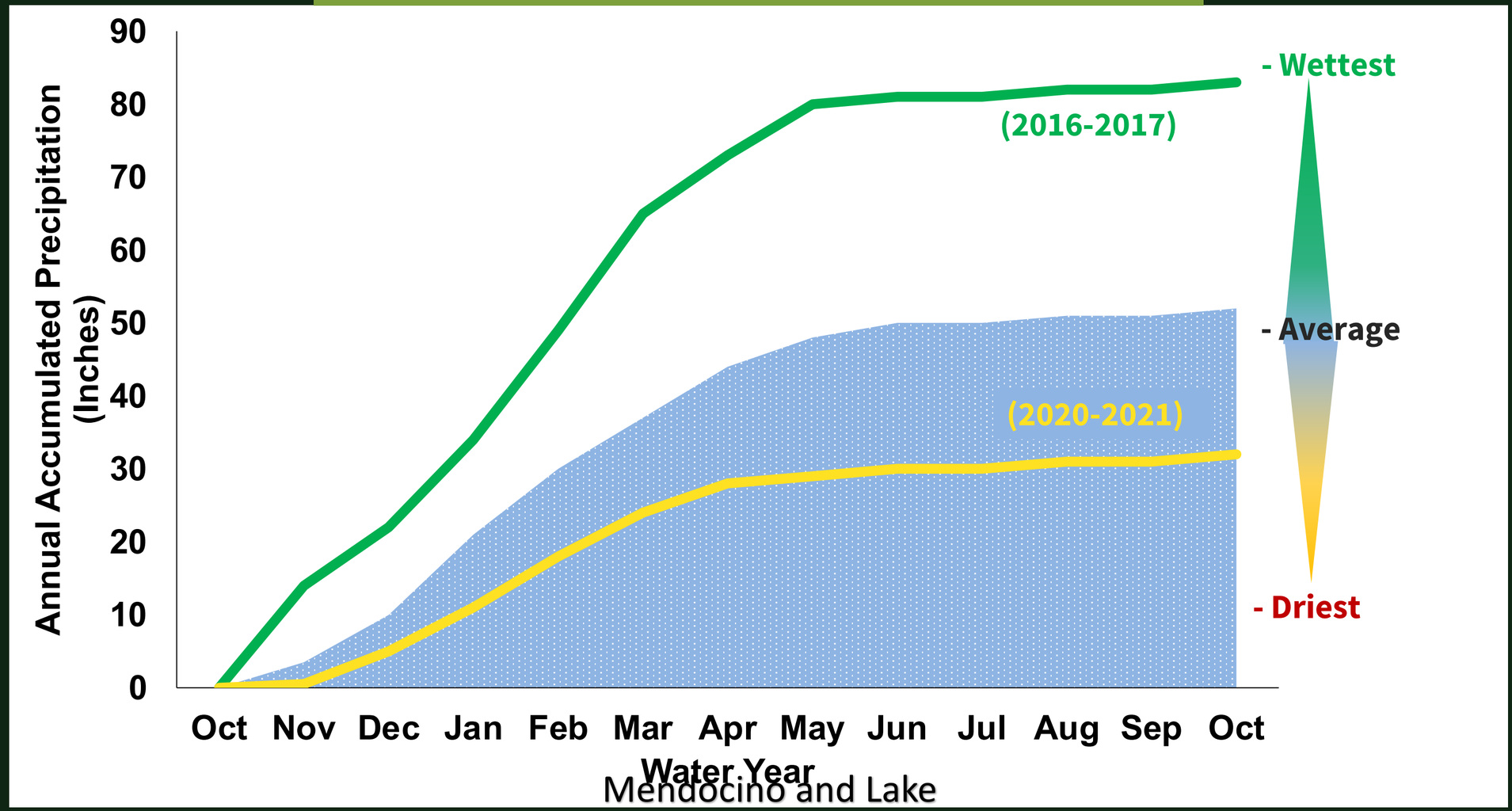

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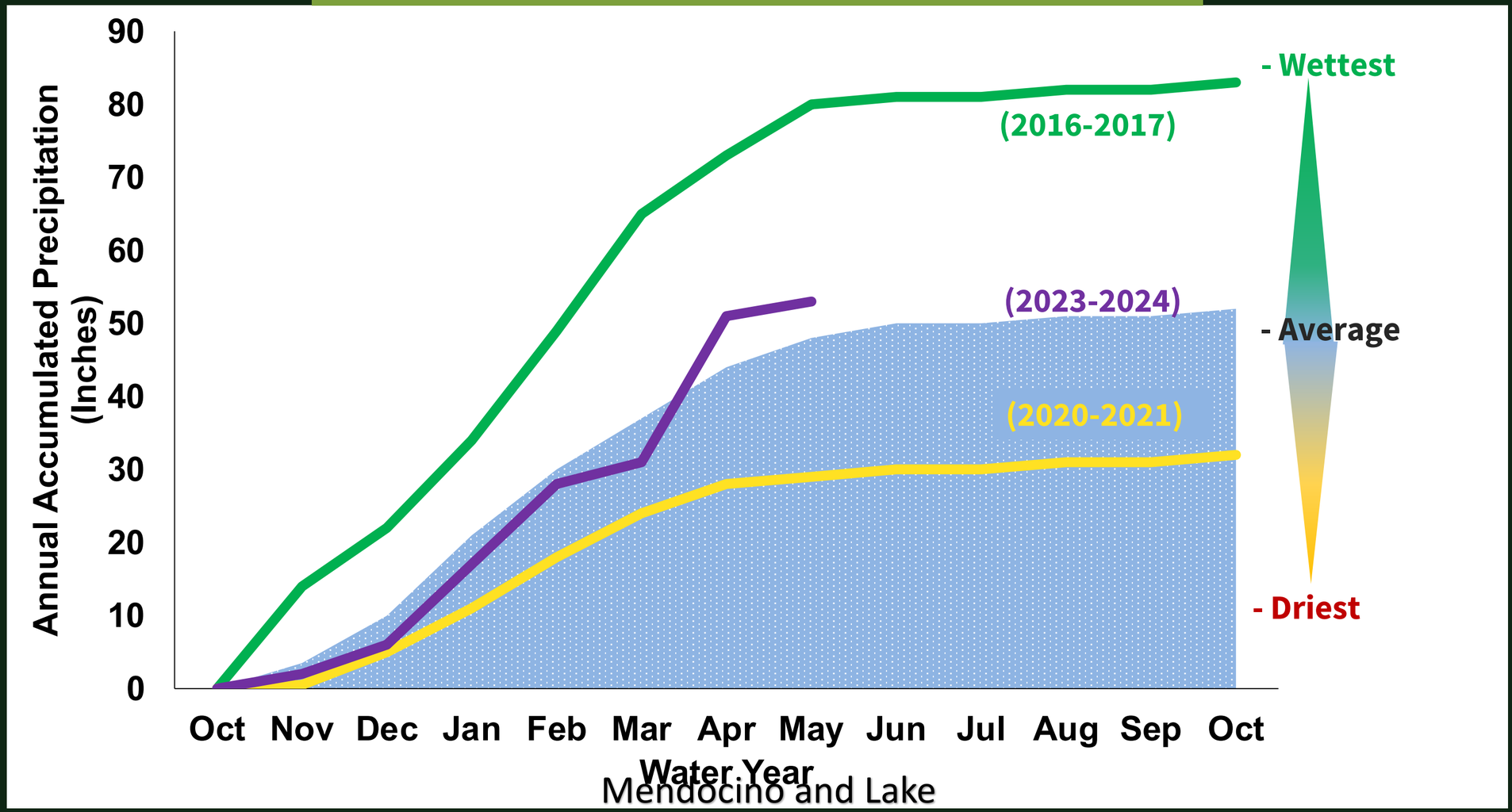

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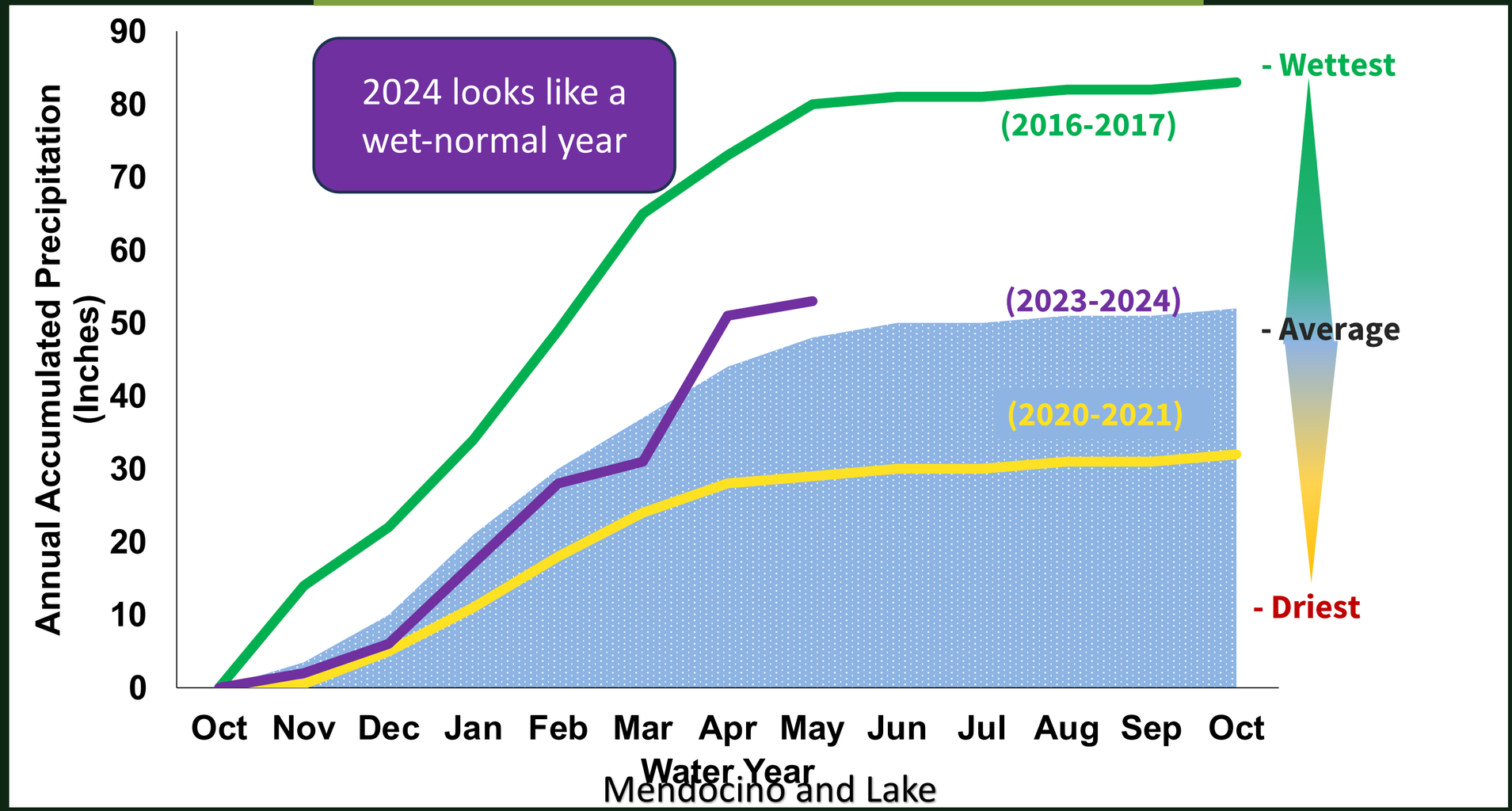

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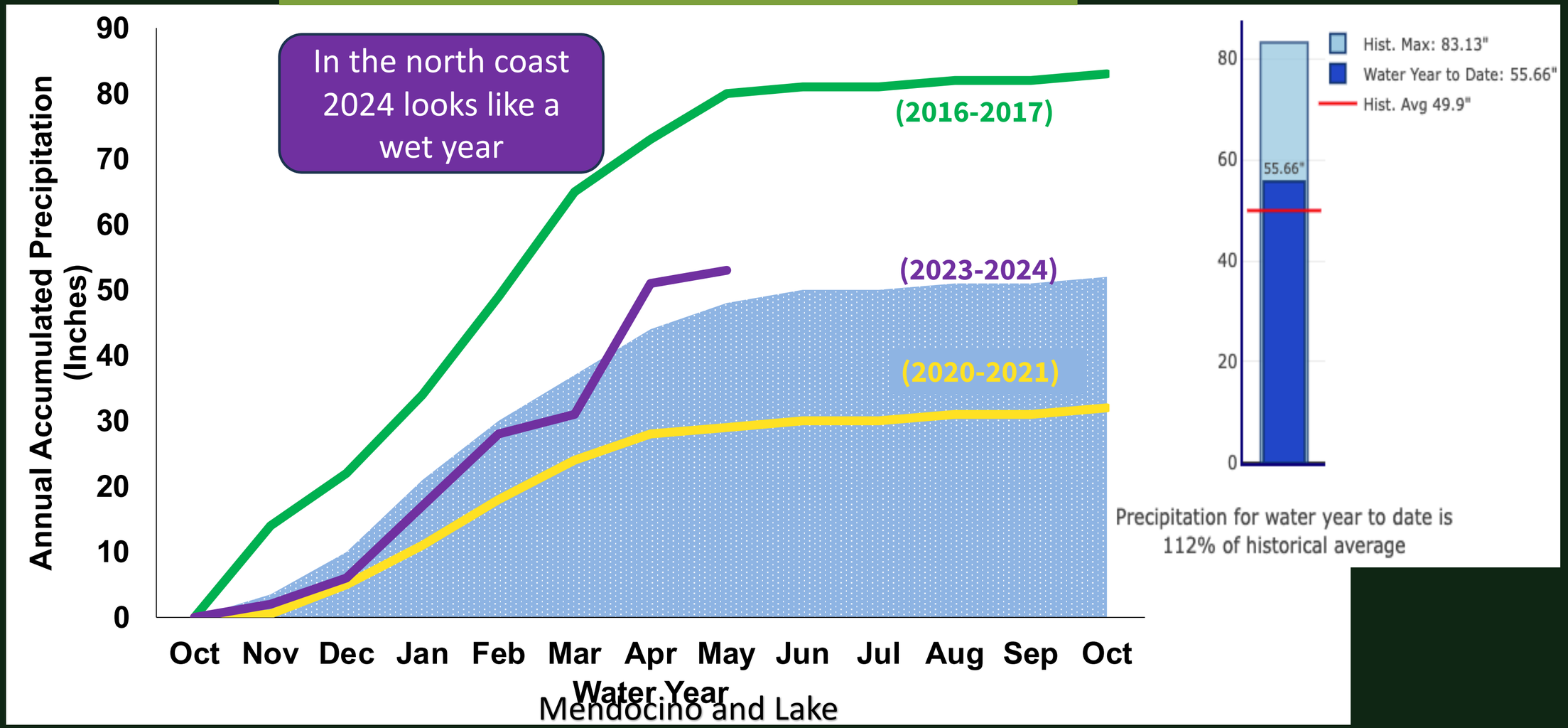

Mendocino and Lake

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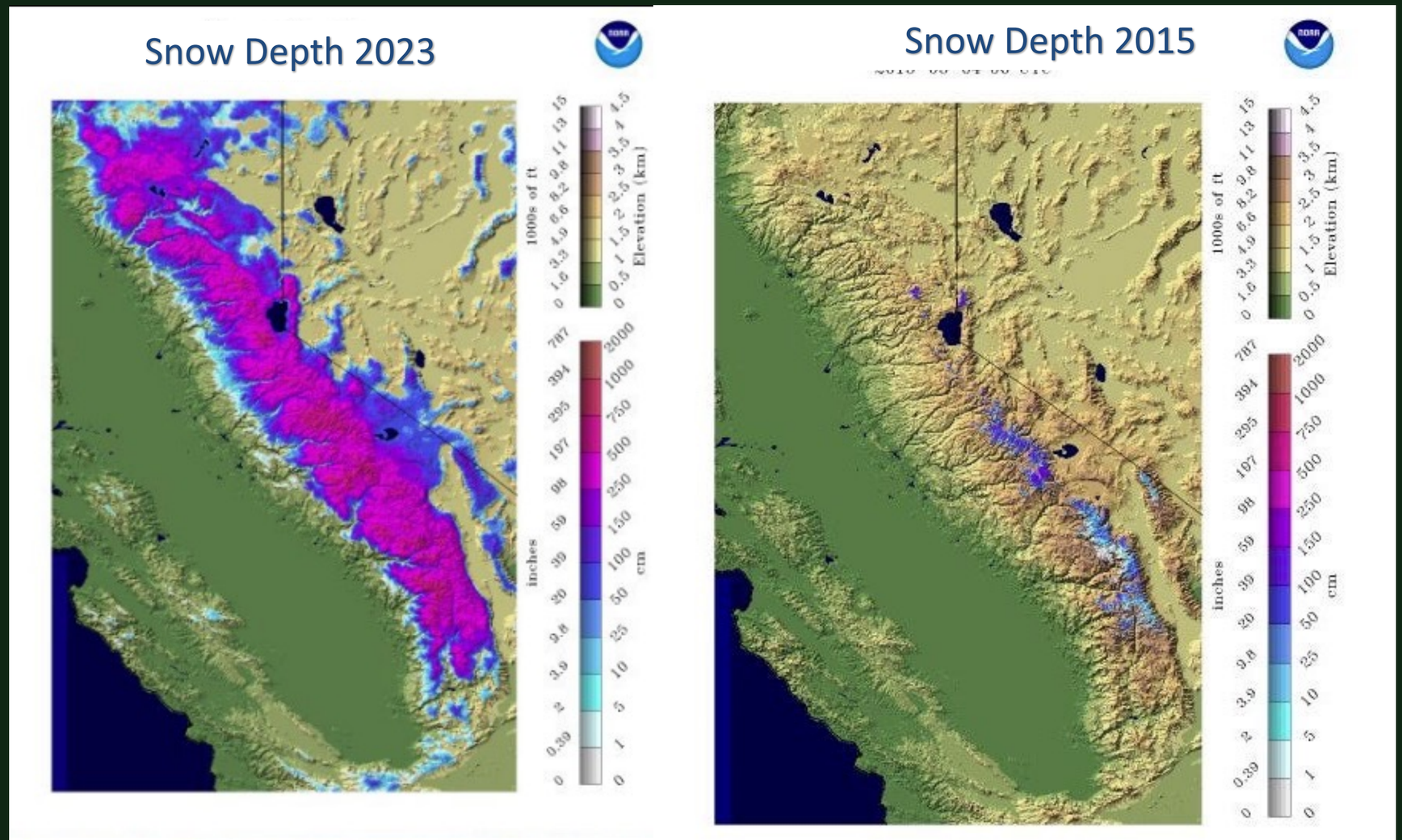
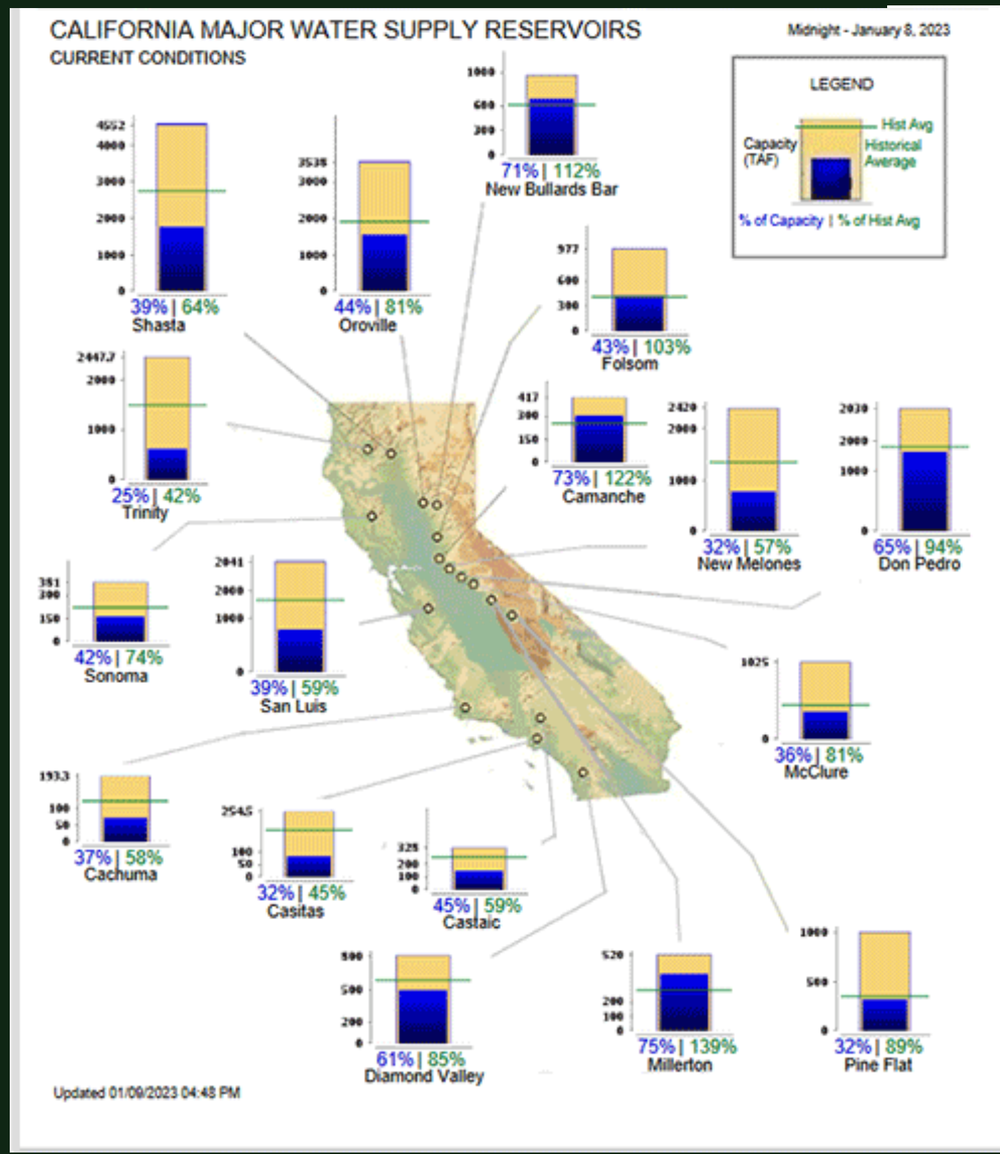
Snow Depth Index



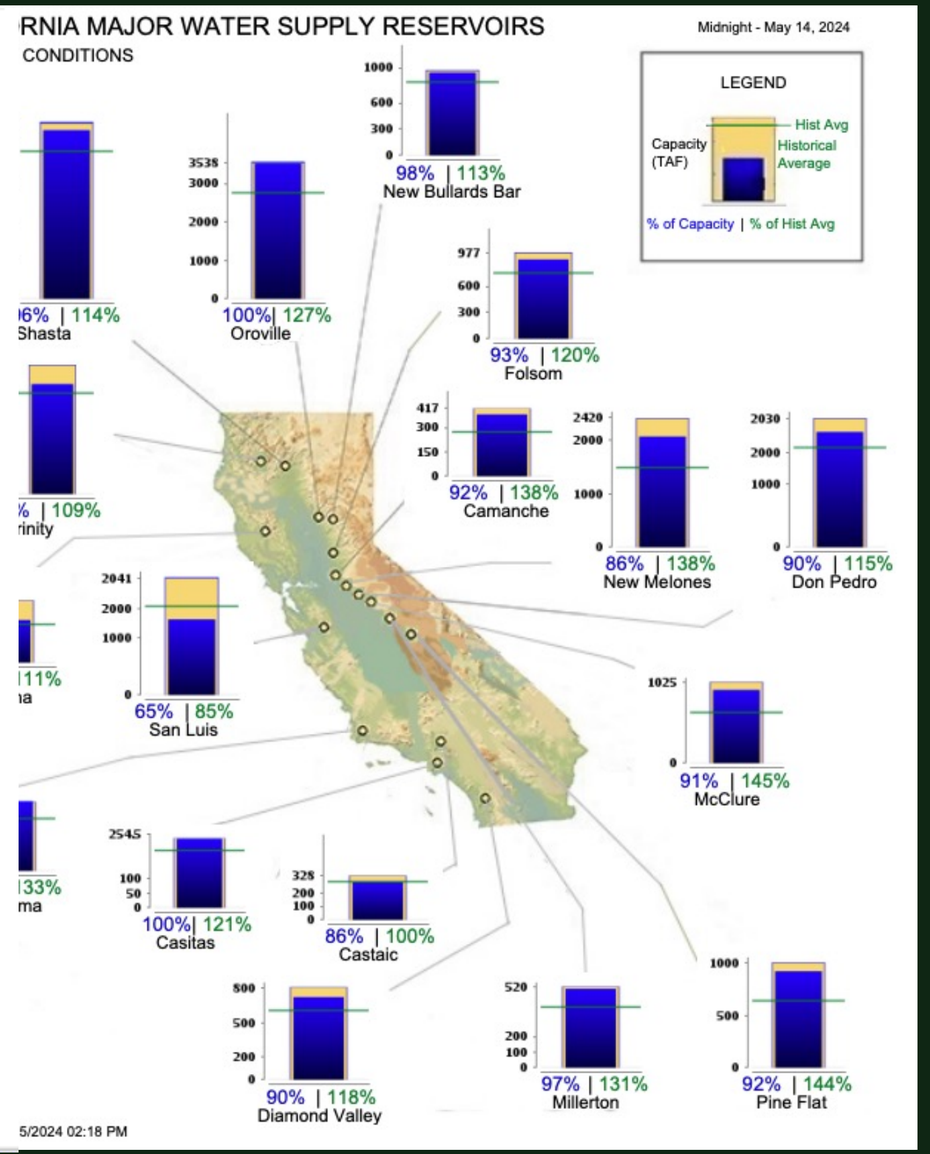
Reservoir Levels

Dry 2020
Dry 2021
Dry 2022
Wet 2023
Normal/Wet 2024

January 2023



May 2024



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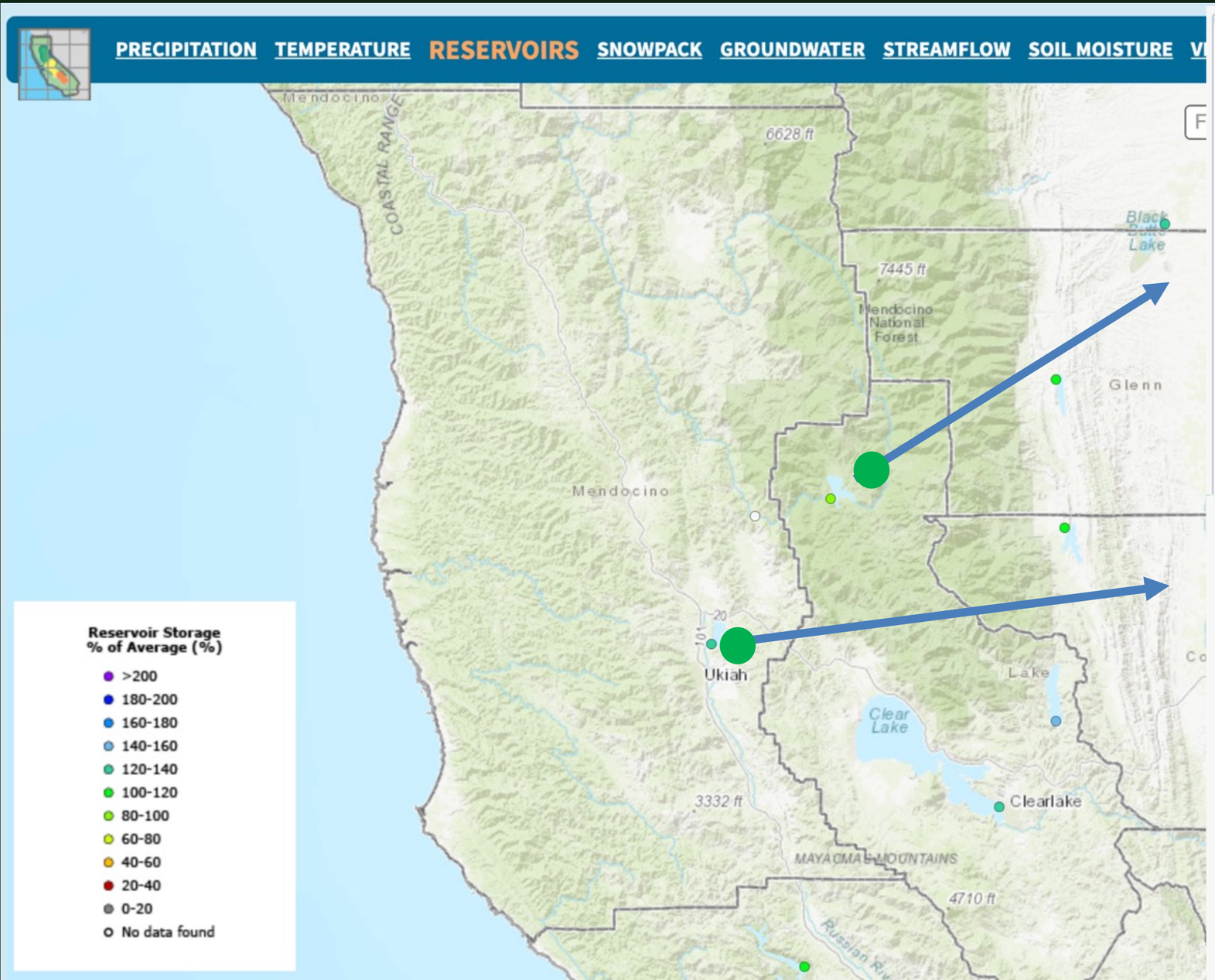

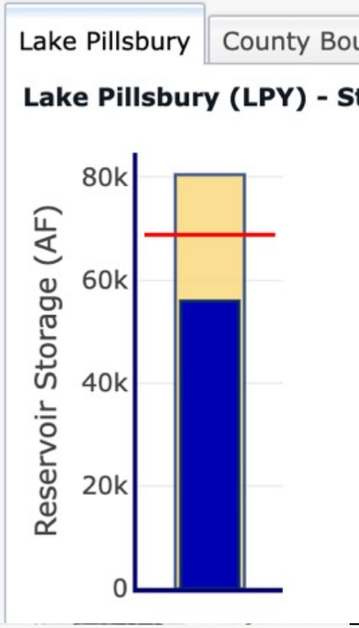

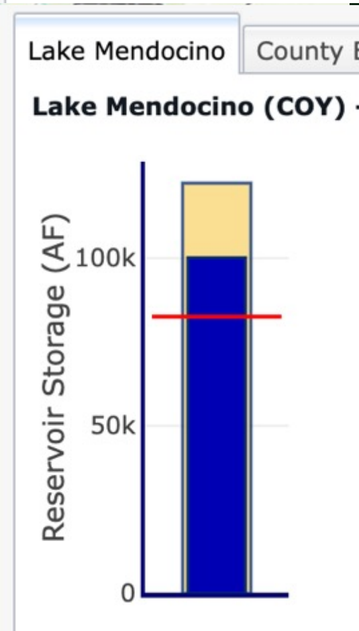

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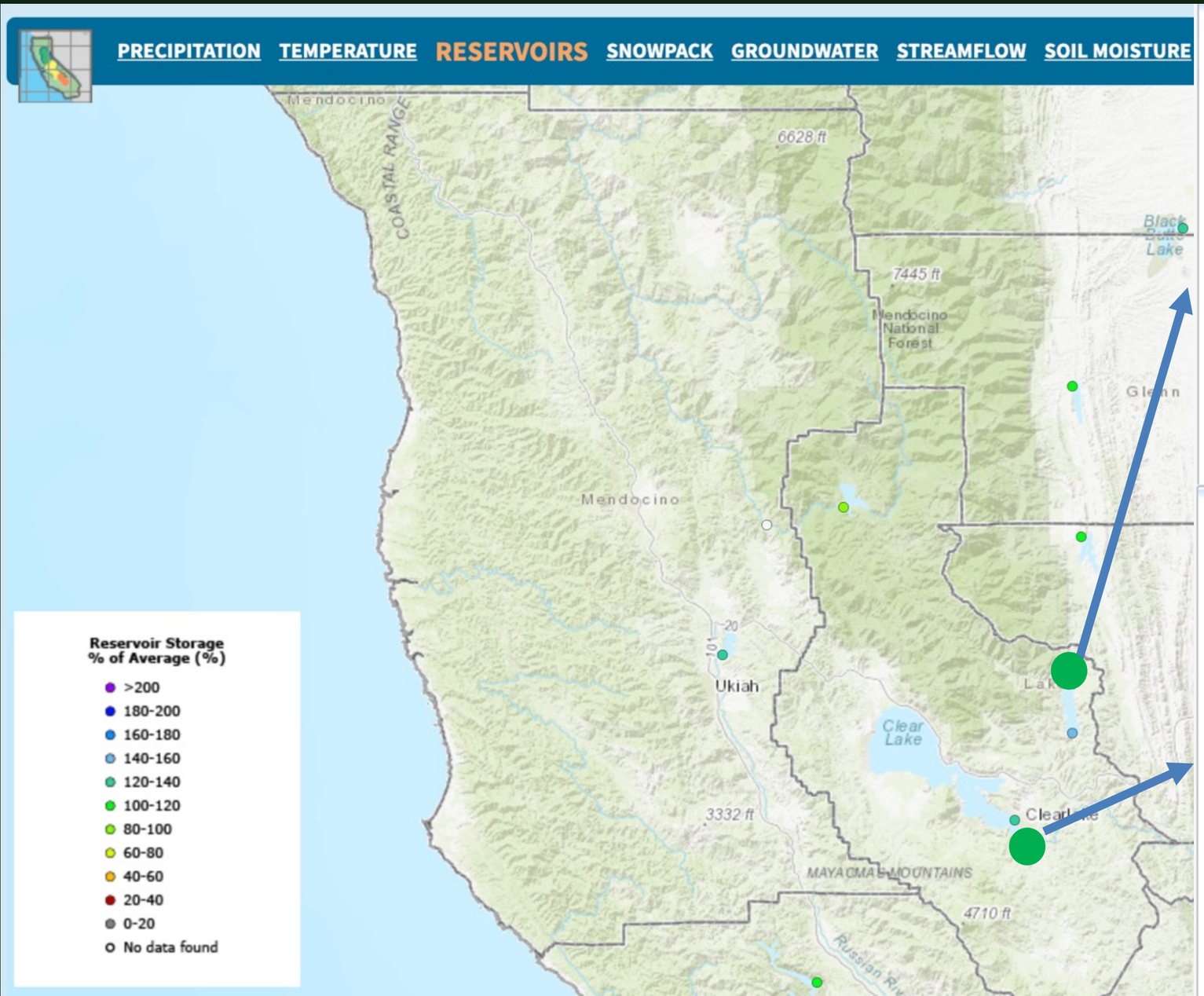
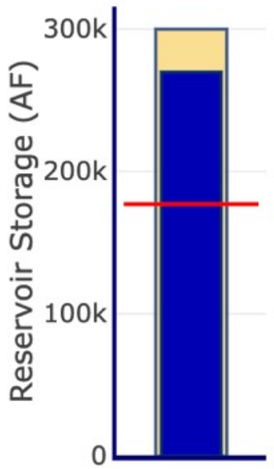


Indian Valley Reservoir | County Boundaries

Indian Valley Reservoir (INV) - Storage Conditions as of 05/21/2024



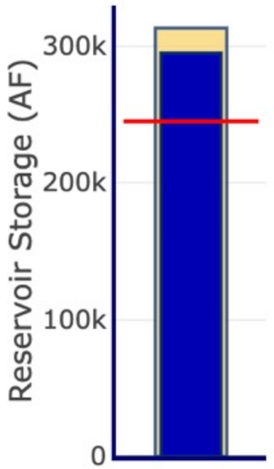
Storage: 269,818 AF
Total Capacity: 300,000
Avg. Stor. for Capacity: 177,042
Reservoir Elevation: 1502 FT

90% of Total Capacity

152% of Historical Avg. For This Date

Clear Lake | County Boundaries

Clear Lake (CLA) - Storage Conditions as of 05/22/2024



Storage: 294,754 AF
Total Capacity: 313,000
Avg. Stor. for Capacity: 244,844
Reservoir Elevation: 1336 FT

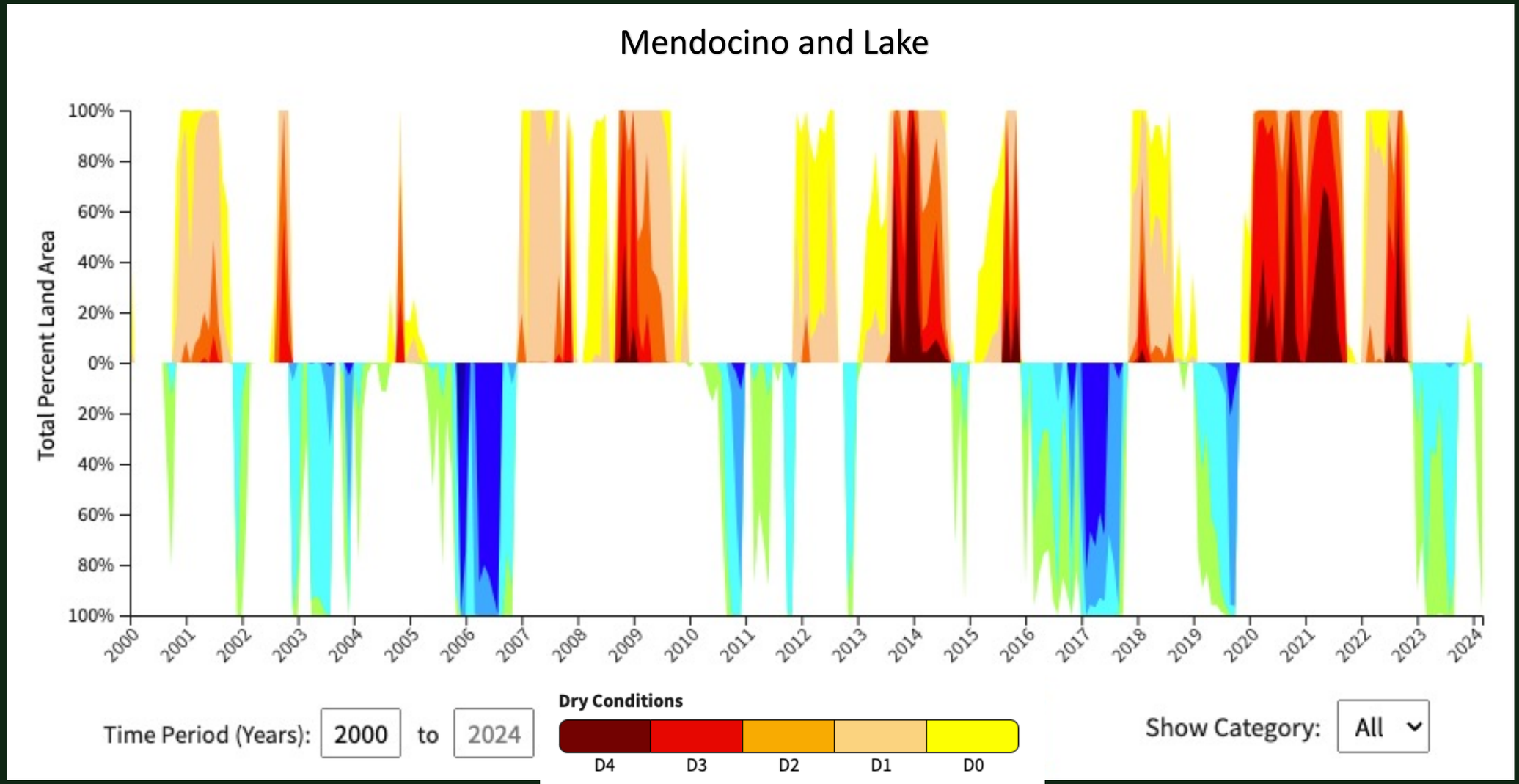
94% of Total Capacity

120% of Historical Avg. For This Date

Drought and Floods Index

Drought

Wet	2011
Dry	2012
Dry	2013
Dry	2014
Dry	2015
Dry	2016
Wettest	2017
Dry	2018
Wet	2019
Dry	2020
Dry	2021
Dry	2022
Wet	2023



Drought and Floods Index

Drought duration on average 3 years.

Drought

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Dry	2013
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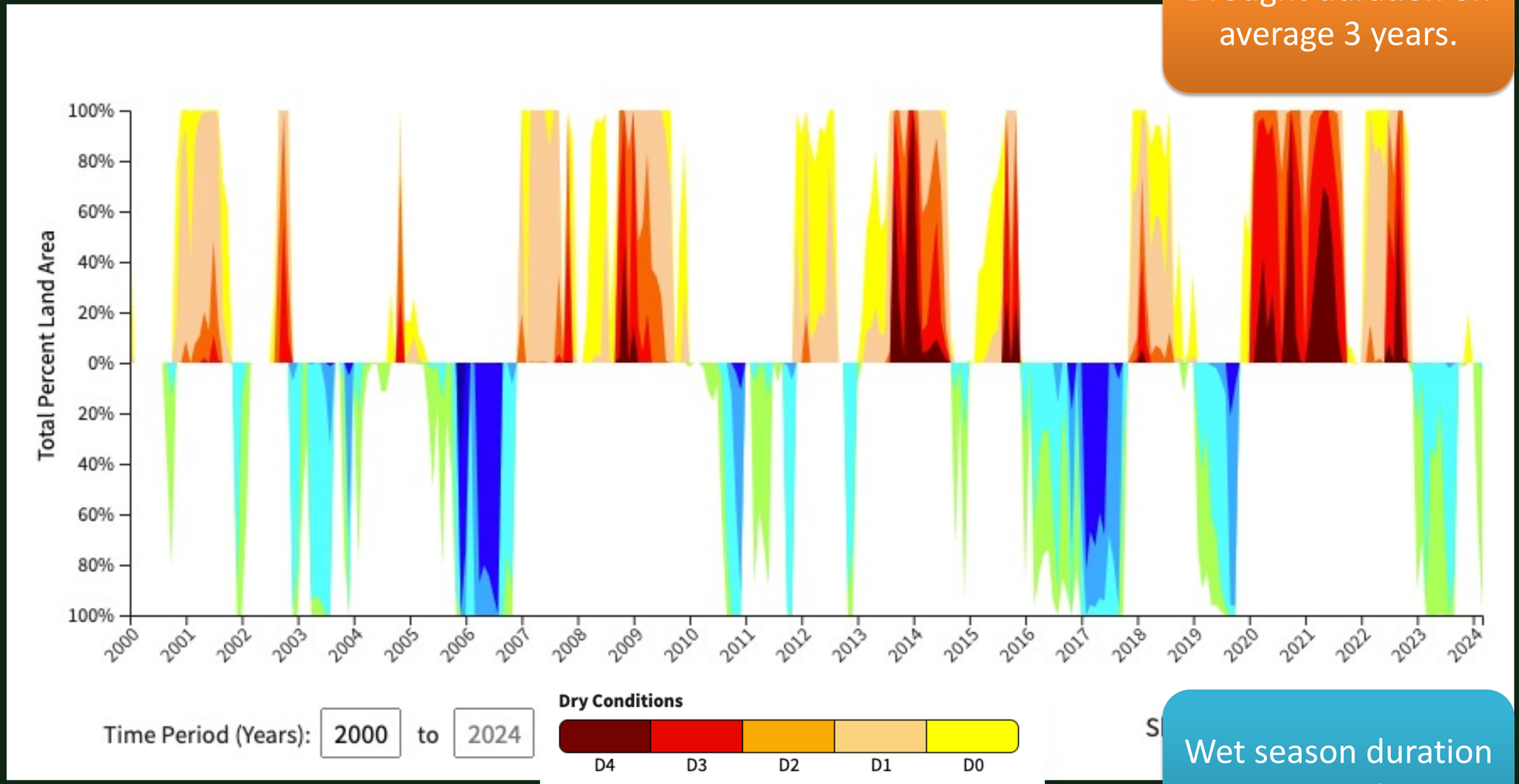
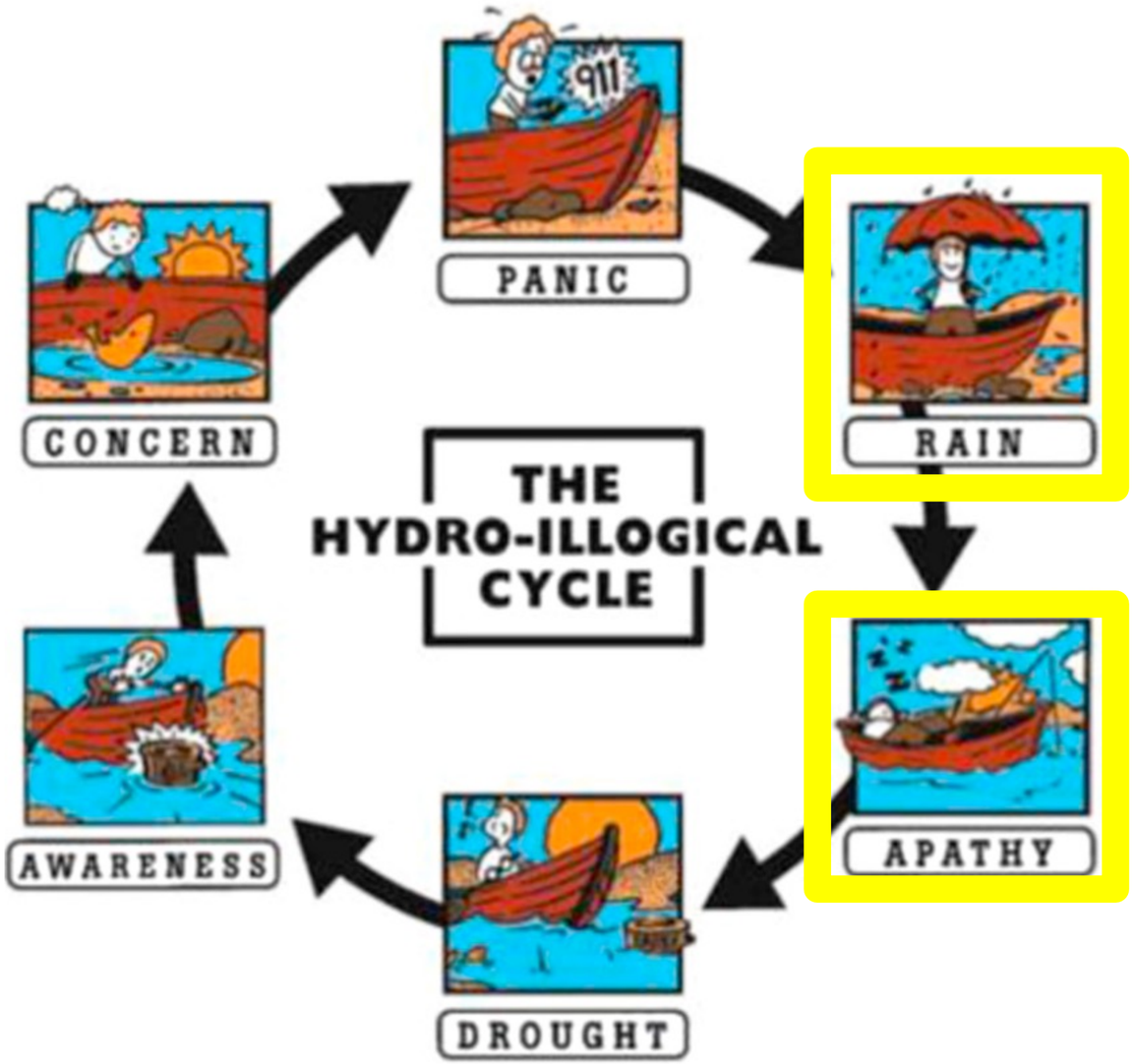


Wet season duration on average 2 years

The Hydro-Illogical Cycle



What can we do to be Climate Prepared?

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Social Capacity

Enhance the ability of communities to effectively respond and cope with extreme climate events

What can we do to be Climate Prepared?

Social Capacity

COUNTY OF MENDOCINO

Drought Resilience Development Plan and Drought Task Force Participation Project (RFP No. DOT 240004)

What can we do to be Climate Prepared?

Social Capacity

Enhance the ability of communities to effectively respond and cope with extreme climate events

Local Activities

Implementing water conservation activities and planning to enhance climatic resilience

What can we do to be Climate Prepared?

Local Activities

Portfolio of Strategies

Water demand Management

Before the Growing Season

- Winter crops, dry farming/low water use
- Regenerative Agriculture: Low/no tillage, IPM, composting, biodynamics
- Irrigation Uniformity
- Frost protection readiness

During the growing season

- Irrigation scheduling
- Deficit Irrigation
- Land rotation / Land fallowing

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Water Supply Management

Before the Growing Season

- Increase soil moisture storage
- Conjunctive use of water: Surface, Groundwater, snow, rain, fog, recycled water, desalination
- Building ponds
- Managed Aquifer Recharge

During the growing season

- Water transfers

Courtesy of Dr. Sam Sandoval

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Local Activities

Portfolio of Strategies

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Local Activities

Climate Preparedness: Know your Orchard/Vineyard water requirements

IRRIGATION SCHEDULING

Irrigation scheduling involves planning when and how much water to apply

Local Activities

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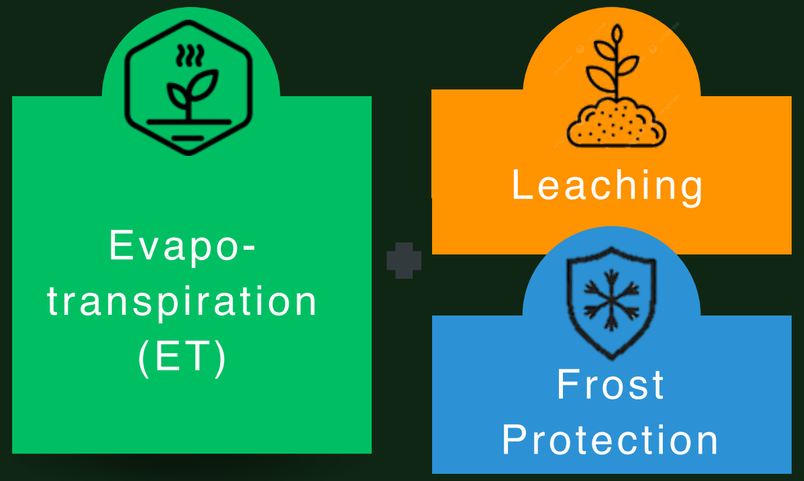
Climate Preparedness: Know your Orchard/Vineyard water requirements

CROP/IRRIGATION REQUIREMENT

Crop Requirement: Amount of water supplied by irrigation to satisfy crop needs in terms of evapotranspiration

Irrigation requirement = crop + other requirements



Local Activities

Climate Preparedness: Know your Orchard/Vineyard water requirements

CROP AND IRRIGATION REQUIREMENT

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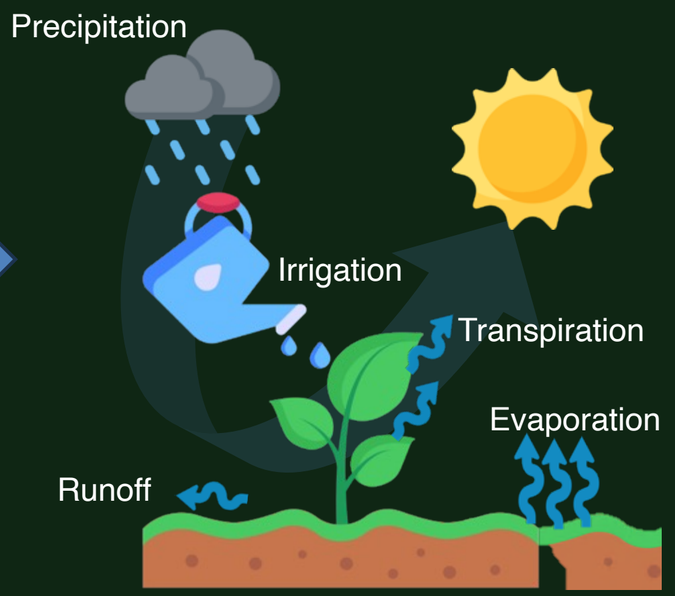
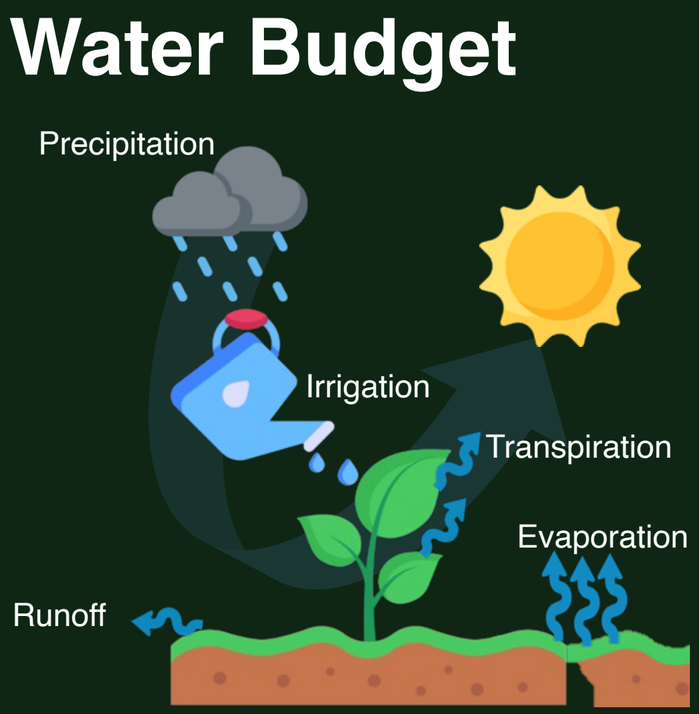
Water Budget



Water Use = Outflows - Inflows

Inflows = Precipitation and Irrigation
Outflows = Evaporation, Transpiration, Runoff, Frost Protection, Leaching

Know your Orchard/Vineyard water requirements



Evapotranspiration (ET)

Loss of water through
Evaporation + Transpiration

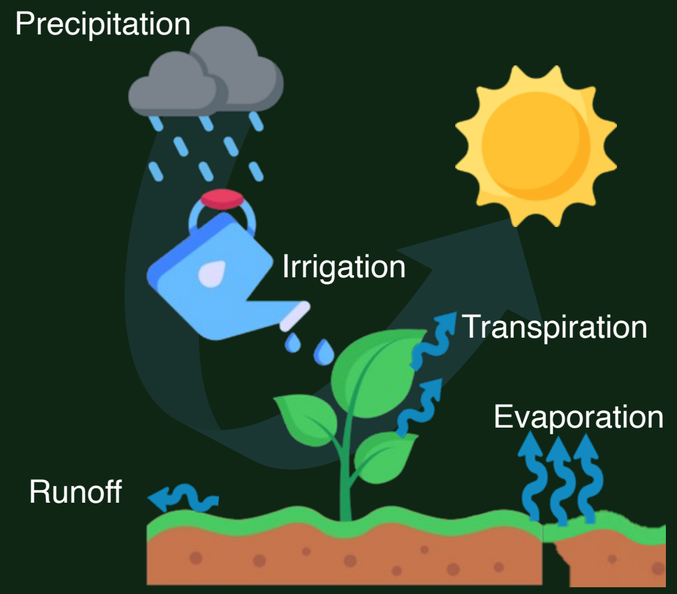
Soil

Plants

ET = Crop water needs

Know your Orchard/Vineyard water requirements

Water Budget



Evapotranspiration (ET)

Loss of water through
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Soil

Plants

ET = Crop water needs

$$ET_{crop} = ET_o \times K_{crop}$$

- ET_{crop}: Water needs of your crop
- ET_o: Water needs of grass
- K_{crop}: Your crop coefficient

Know your Orchard/Vineyard water requirements

Evapotranspiration

Crop water Needs

$$ET_{crop} = ET_o \times K_{crop}$$

Water needs of your crop

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Your crop coefficient

Know your Orchard/Vineyard water requirements

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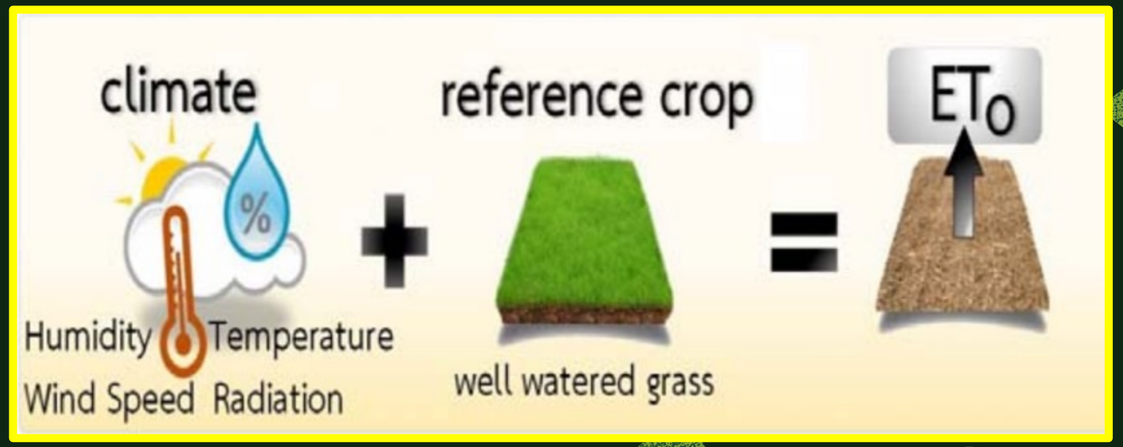

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Evapotranspiration

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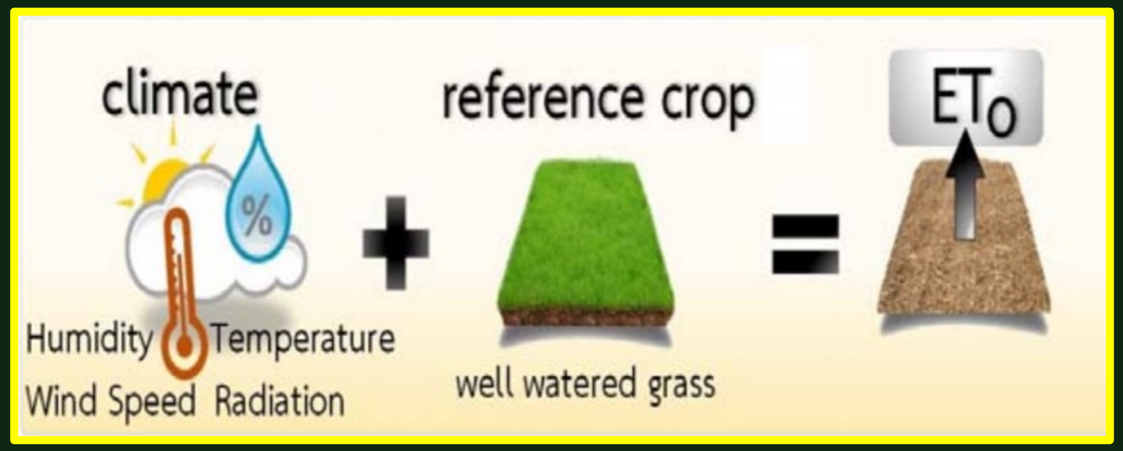

Obtain Eto using CIMIS

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Date	Precipitation (in)	Air temperature		Wind		ET_o (in)
		max (°F)	min (°F)	Direction	Speed (mph)	
7-01	0.00	95	59	NW	4	0.26
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7-03	0.00	91	52	NW	4	0.25
7-04	0.08	92	53	NW	5	0.25
7-05	0.00	88	54	N	5	0.25
7-06	0.00	91	54	NW	6	0.25
7-07	0.00	88	54	N	6	0.27
7-08	0.00	84	52	N	8	0.27
7-09	0.00	81	52	NW	8	0.23

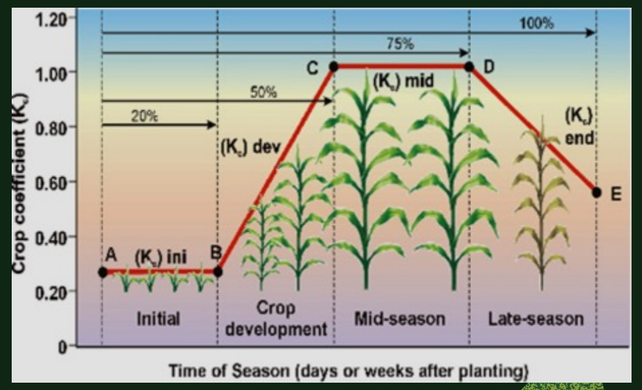
Know your Orchard/Vineyard water requirements

Evapotranspiration

Crop water Needs

$$ET_{crop} = ET_o \times K_{crop}$$

Kc is the crop coefficient. It represents the integrated changes in plant development



Date	K_c (W. Gape)
Mar 16-31	0.32
Apr 1-15	0.41
Apr 16-30	0.50
May 1-15	0.59
May 16-31	0.69
June 1-15	0.78
Jun 16-31	0.82
July 1-15	0.82
July 16-31	0.82
Aug 1-15	0.82
Aug 16-31	0.77
Sep 1-15	0.66
Sep 16-30	0.55
Oct 1-15	0.44

Crop Coefficient Values of Wine Grapes

(UC Cooperative Extension)

Know your Orchard/Vineyard water requirements

Evapotranspiration

Crop water Needs

$$ET_{crop} = ET_o \times K_{crop}$$

Historical ET

Table 9. Pear historical evapotranspiration estimates (inches during period)

Date	Lakeport	Ukiah	Courtland
Mar 16–31	—	0.25	0.83
Apr 1–15	1.65	0.86	1.28
Apr 16–30	1.44	1.46	1.77
May 1–15	1.90	1.83	2.22
May 16–31	2.28	2.21	2.68
June 1–15	2.52	2.44	2.90
June 16–30	3.14	2.87	3.31
July 1–15	3.05	2.91	3.33
July 16–31	3.14	2.87	3.31
Aug 1–15	2.79	2.64	3.05
Aug 16–31	2.52	2.40	2.77
Sept 1–15	2.20	2.11	2.46
Sept 16–30	1.61	1.53	1.79
Oct 1–15	1.16	1.13	1.26
Oct 16–31	0.82	0.79	0.88

Real-time ET

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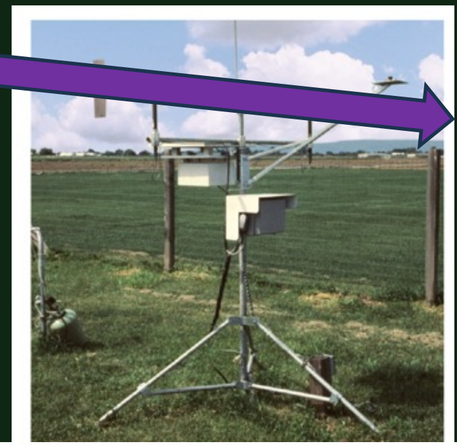

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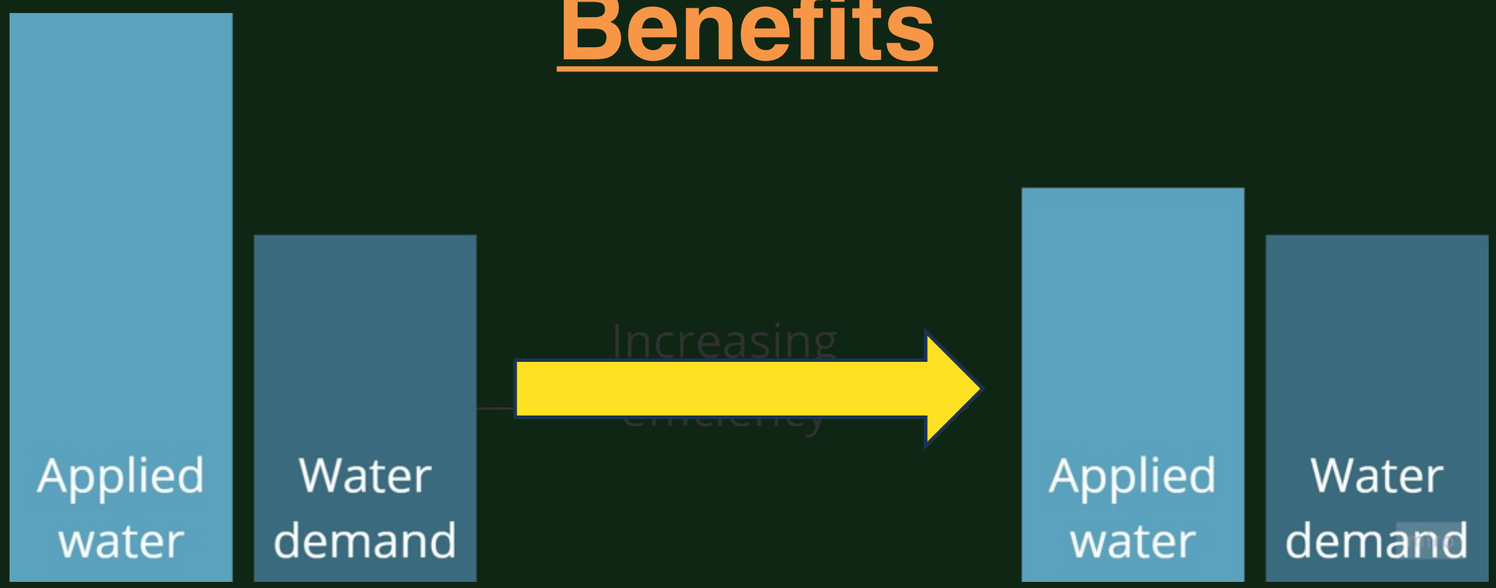
Benefits



- Conserve water
- Water rotation among various fields
- Reduce cost of water and labor
- Can increase yields and crop quality

Climate Preparedness: Winter Cover Crops

Winter Cover Cropping: Growing crops between annual production seasons or perennial tree/vines crops

Aerials photos pf orchards with and without cover crops. (Andrew Gal, UC Davis)

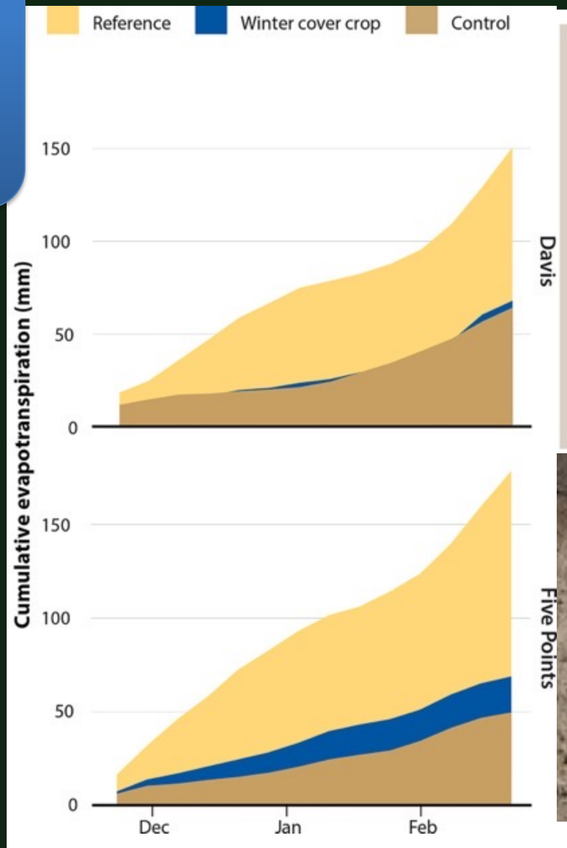
Only 5% of CA farms grow winter cover crops

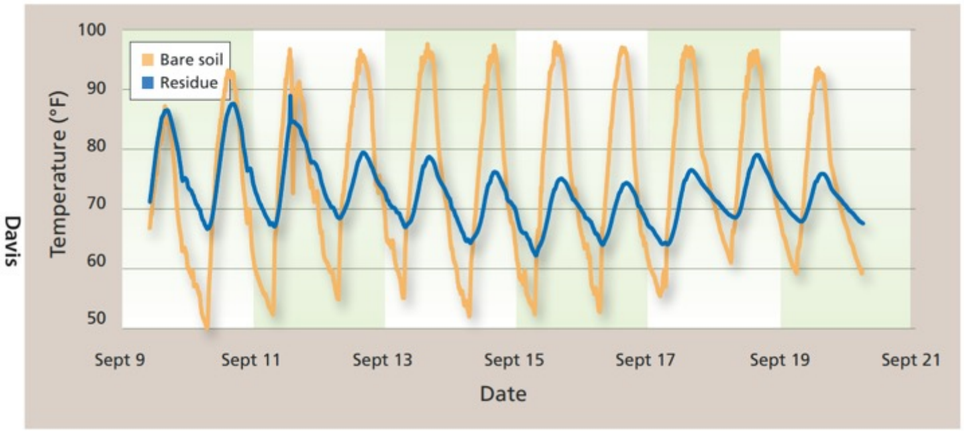
Winter Cover Crops

Cover crops are generally not substantial water users

DO NOT use more water than bare soil

In the winter, cover crop evapotranspiration is minimal…





…and if they're left as residue and combined with no-till, soil evaporation can be reduced

(DeVincentis, 2022; Mitchell, 2012)

Winter Cover Crops

Cover crops act like insurance

Enabling more infiltration if the water is available

Two adjacent plots in an almond orchard after an intense winter storm.

Donny Hicks, 2023

Cover crops have helped capture more precipitation

Water pools on the bare ground

Winter Cover Crops

Cover crops fight erosion

Cover crops can be used to meet soil conservation goals, specifically, from wind and water erosion.

Two adjacent plots in a single-year demonstration plot at the Eastern Nebraska Research. (Miller, 2017)

Winter Cover Crops

Cover crops have many benefits including:

		← Confidence Level Based on Availability of Research → Low		High
Water Budget	Inflow	Increased Fog and Dew Capture		Increased Infiltration
	Storage	Increased Percolation	Increased Soil Moisture and Water Storage	
	Outflow		Increased Evapotranspiration (ET)	Decreased Runoff
Water Quality Benefits			Increased Nutrient Scavenging	Decreased Erosion

- ✓ Improve air quality
- ✓ Quicker field access
- ✓ Increase biodiversity
- ✓ Provide food for pollinators
- ✓ Increased water productivity (in pistachios)
- ✓ Nitrogen fixation (depending on species)
- ✓ Soil carbon accumulation in no-till systems

Winter Cover Crops

Implementing Cover Crops:

- Seeds: Kamprath (supply), Seeds for Bees (free), USDA & CDFA (cost share)
- Specialized seeders needed based on cropping system
- Cover Crop Decision Support Tool will be released in October

CONCLUSION

Staying informed about our water supply and understanding climate change events like droughts and floods is crucial for building resilience.

Learning about strategies for drought preparedness plays a crucial role in enhancing our ability to withstand periods of water scarcity.

Thanks!

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