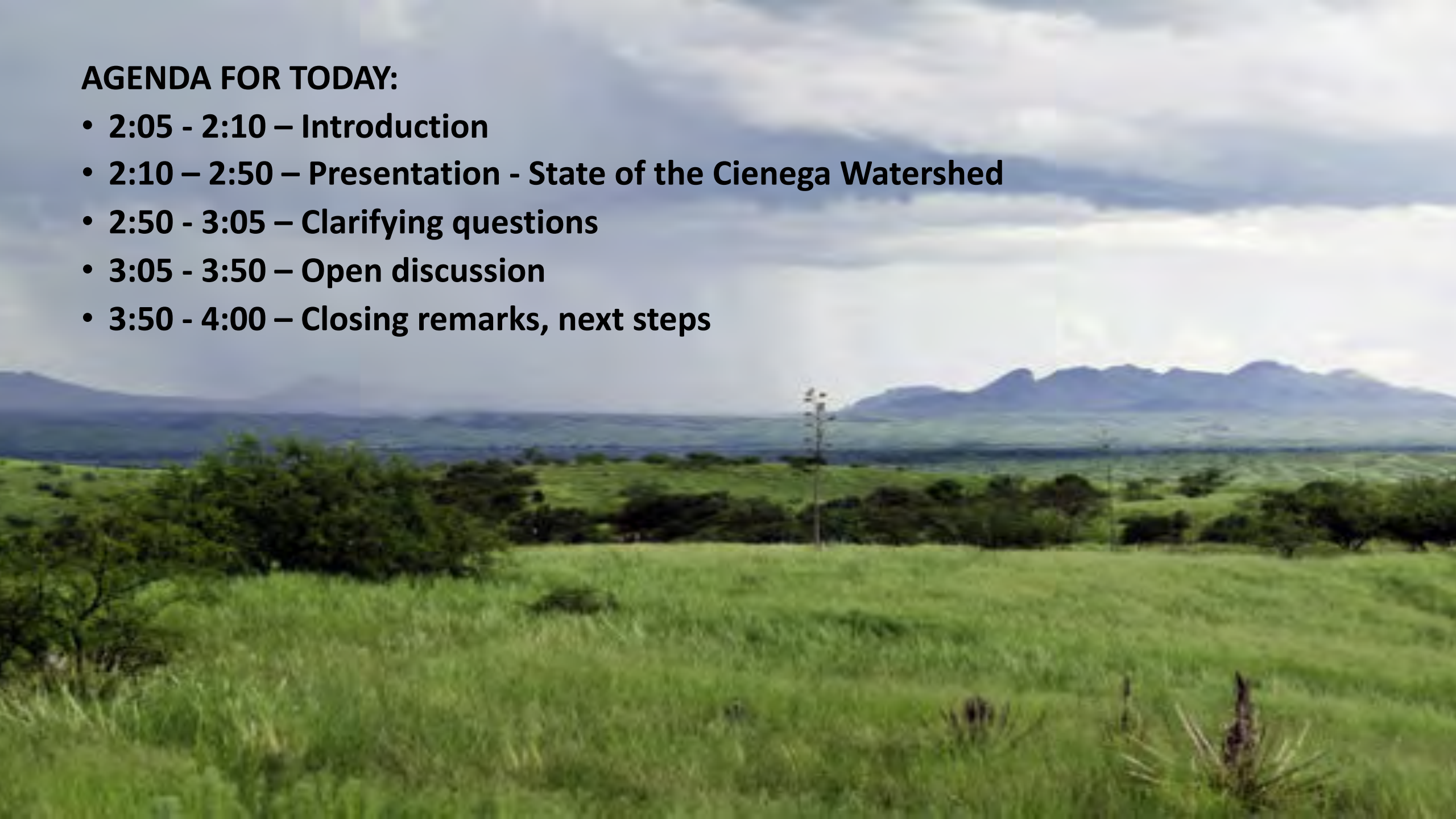
State of the Cienega Watershed

Presented by **Adriana Zuniga-Teran** and **Larry Fisher**

Created by: Larry Fisher – UA/CWP, **Tom Meixner** – UA/CWP, **Adriana Zuniga-Teran** – UArizona, **and many others**

December 1, 2023



AGENDA FOR TODAY:

- **2:05 - 2:10 – Introduction**
- **2:10 – 2:50 – Presentation - State of the Cienega Watershed**
- **2:50 - 3:05 – Clarifying questions**
- **3:05 - 3:50 – Open discussion**
- **3:50 - 4:00 – Closing remarks, next steps**

In memory of Tom Meixner

Support the Tom Meixner trail:

https://www.gofundme.com/f/expand-the-train-track-trail-to-honor-tom-meixner?utm_campaign=p_cp+share-sheet&utm_medium=copy_link_all&utm_source=customer

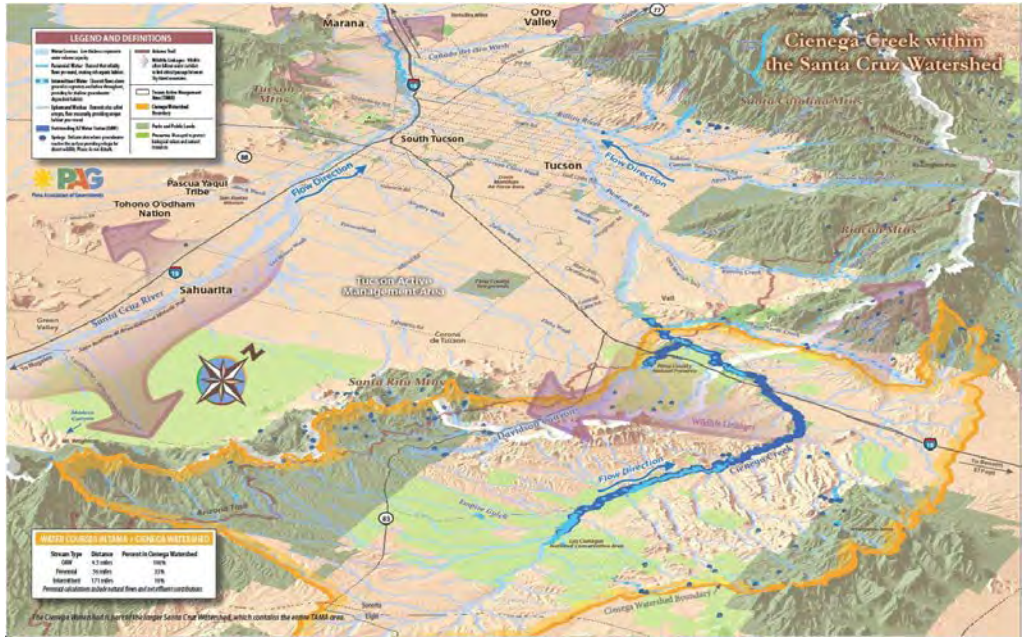
Cienega Watershed

- Includes five of the rarest habitat types in the American Southwest:
  - Cienegas (marshlands)
  - Cottonwood-willow riparian forests
  - Sacaton grasslands
  - Mesquite bosques
  - Semi-desert grasslands

- Cienega Creek – one of the few remaining perennial streams in Arizona, providing critical habitat for wildlife (threatened & endangered species).
- Historically important ranching operations, important cultural/archeological resources.
- Attractive visitor destination, for its scenic landscapes, natural beauty, and cultural heritage.
- Water source for Tucson Metropolitan Area (groundwater).

Objectives

- Monitor the state of the Cienega Watershed through a common set of overarching indicators
- To provide a regular mechanism for evaluating watershed health
- Communicate this assessment to program partners and the community at large
- Guide the implementation and adaptation of CWP program priorities and actions to meet changing conditions.
- Making the SOW more relevant to management and Biological Planning on the NCA



Source: Pima Association of Governments

- Provide an example that can be replicated and adapted in other (neighboring) watersheds

Methods and approach

- Initial tasks
  - Develop criteria for evaluating indicators
  - Identify and prioritize indicators
  - Electronic survey of CWP partners
  - Identify sources of data
  - Determine appropriate ways to present results

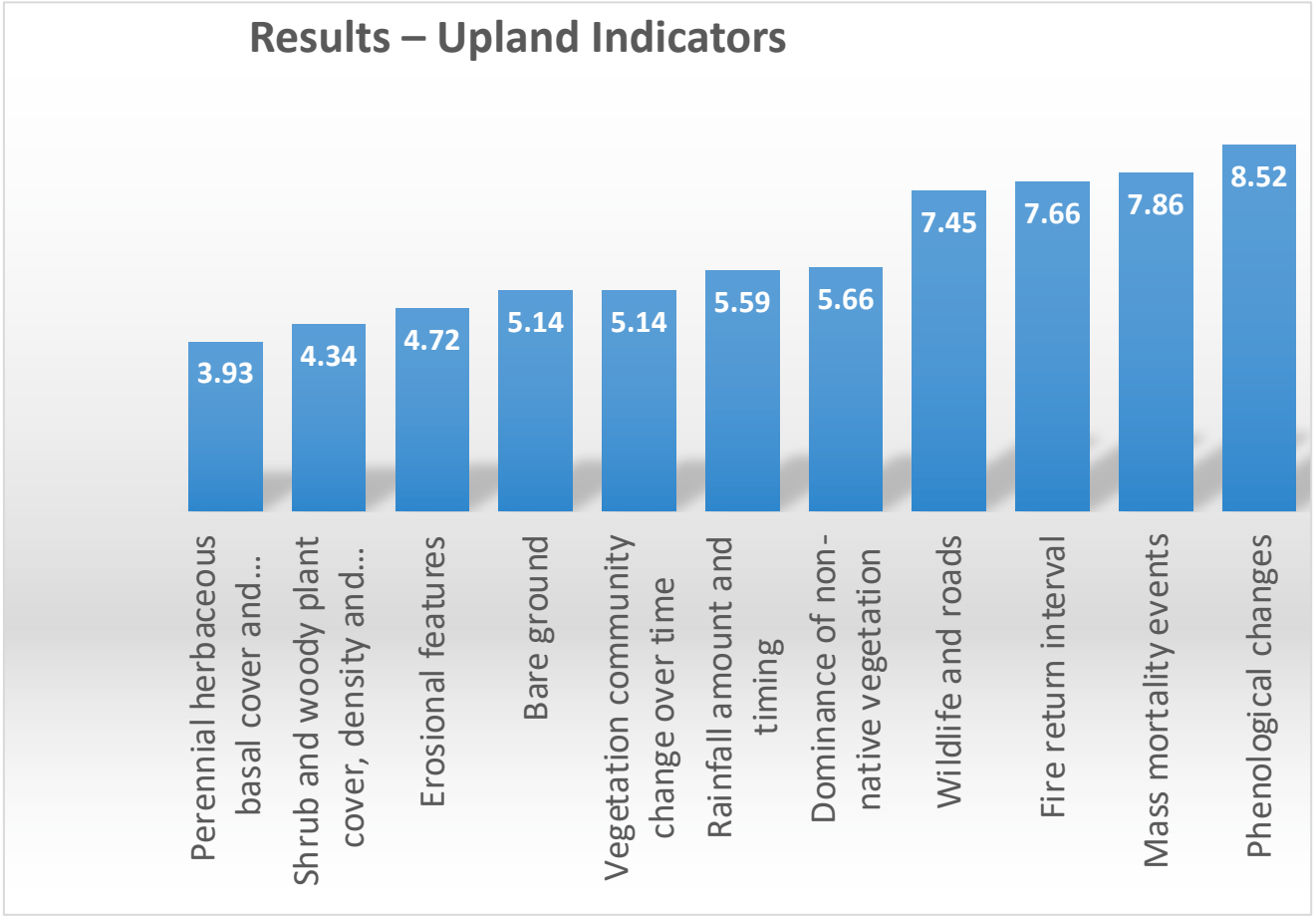
- Three plenary workshops with CWP partners

- Periodic meetings of four working groups (tech teams)
  - Landscape
  - Riparian/water
  - Uplands
  - Social/cultural

- Annual review and update of data, analysis, and presentations

Selection Criteria

- Measures impacts of change
- Produces useful information for management
- Repeatable, comparable, consistent
- Simple, cost effective to collect (readily available)
- Can expose threats and vulnerability
- Quantifiable
- Applicable to management across jurisdictions
- Data speaks to the public



Category	Indicator	No.	Description	
Climate	Precipitation	1	Historic data on mean precipitation summer vs. winter	
	Temperature	2	Historic data on mean temperature	
	Drought	3	Standardized Precipitation Evapotranspiration Index for drought over time	
Water	Groundwater levels	4	Change of groundwater levels over time	
		5	~~Wetlands – spatial location and extension of wetlands~~	No data collected
	Surface water quantity	6	Wet-dry mapping (June –worst case)	
		7	Gauges (Narrows and Pantano Dam)	
		8	Monthly Flows/ base flows	
	Water quality	9	TDS, dissolved oxygen (fish), PH	
Ecological	Veg. volume/composition/cover	10	Land cover	
	Wildlife	11	Pronghorn	
		12	Fish	
		13	Frogs	
	Fire	14	Coverage	
	Birds	**15**	Number of individuals	
	Riparian greenness	**16**	Time series of NDVI	
Socio-cultural	~~Economic vitality~~	~~17~~	~~Median household income, median home values, unemployment, residents below poverty level~~	Every 10 yrs
	~~Population density and growth~~	~~18~~	~~Changes in population density according to Census data~~	Every 10 yrs
	~~Land use land cover change~~	~~19~~	~~Land use and land cover change~~	Every 10 yrs
	Number of wells	20	Number of wells installed within the watershed and buffer area of 10 mi	
	Archaeological site conditions	21	Trend in site conditions, both human and natural-caused damage.	
	Number of recreational permits	22	Number of recreational permits over time	
	Stewardship engagement programs	23	Number of opportunities for active engagement	

N=23

Acknowledgments

Alvarez, Melanie	Pima Association of Governments
Baker, Jody	Bureau of Land Management
Bauder, Javan	CWP – Frog Project
Behrend, Matthew	Arizona State Land Department
Bodner, Gita	The Nature Conservancy
Bunting, Alison	Empire Ranch Foundation
Burns, Emily	Sky Island Alliance
Burroughs, Wendy	Pima County Natural Resources
Condo, Theresa	Bureau of Land Management
Corella, Emilio	Bureau of Land Management
Christensen, Peter	Bureau of Land Management
Dalton, Clint	Bureau of Land Management
Dubertret, Fabrice	iGlobes, CNRS
Fonseca, Julia	Retired from Pima County
Gicklhorn, Jeff	Pima County
Hall, David	CWP- Frog project
Hammer, Sami	Pima County
Hartfield, Kyle	Arizona Remote Sensing Center
Horst, Jonathan	Audubon Society
Jones, Scott	University of Arizona
Lamb, J.J.	Vail Preservation Society
List, Mike	Pima County
Le Tourneau, F-Michel	iGlobes, CNRS
MacFarland, Jennie	Audubon
Mehalic, Dave	US Forest
Mendoza, Francisco	Bureau o
Mier, Mead	Pima Ass
Monkemeier, Margaret	Bureau of Land Management
Murray, Dave	Bureau of Land Management
Murray, Ian	Pima County
Norman, Laura	US Geological Survey
Peretz, Aaron	Bureau of Land Management
Perez, Christina	Bureau of Land Management
Postillion, Frank	Pima C. Regional Flood Control District
Powell, Brian	Pima County
Quintana, Dan	Bureau of Land Management
Rose, Courtney	Pima County
Rutherford, Austin	USDA – Agricultural Research Service
Salywon, Andrew	Desert Botanical Garden
Sanchez, Melissa	Pima County Parks and Rec
Scalero, David	Pima C. Regional Flood Control District
Schrager, Chris	Bureau of Land Management
Simms, Jeff	Bureau of Land Management
Simms, Karen	Pima County
Tiller, Ron	Desert Botanical Garden
Tucker, Rana	Arizona Game and Fish Department
Van Leeuwen, Wim	Arizona Remote Sensing Center
Verlander, Tiffany	Bureau of Land Management
Walter, Robert	Bureau of Land Management

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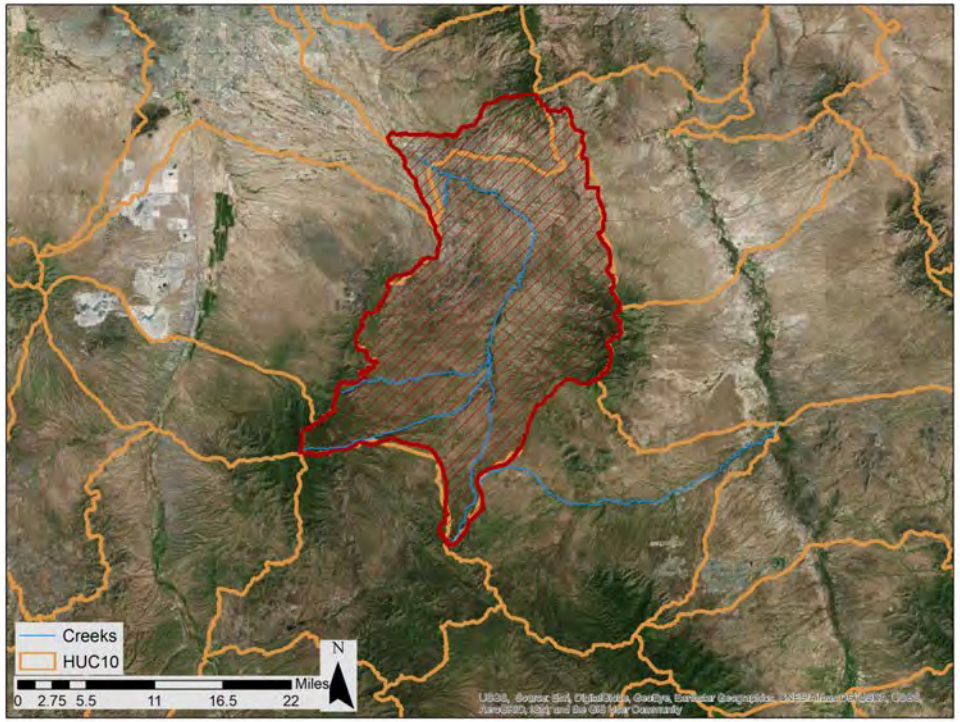
Cienega Watershed



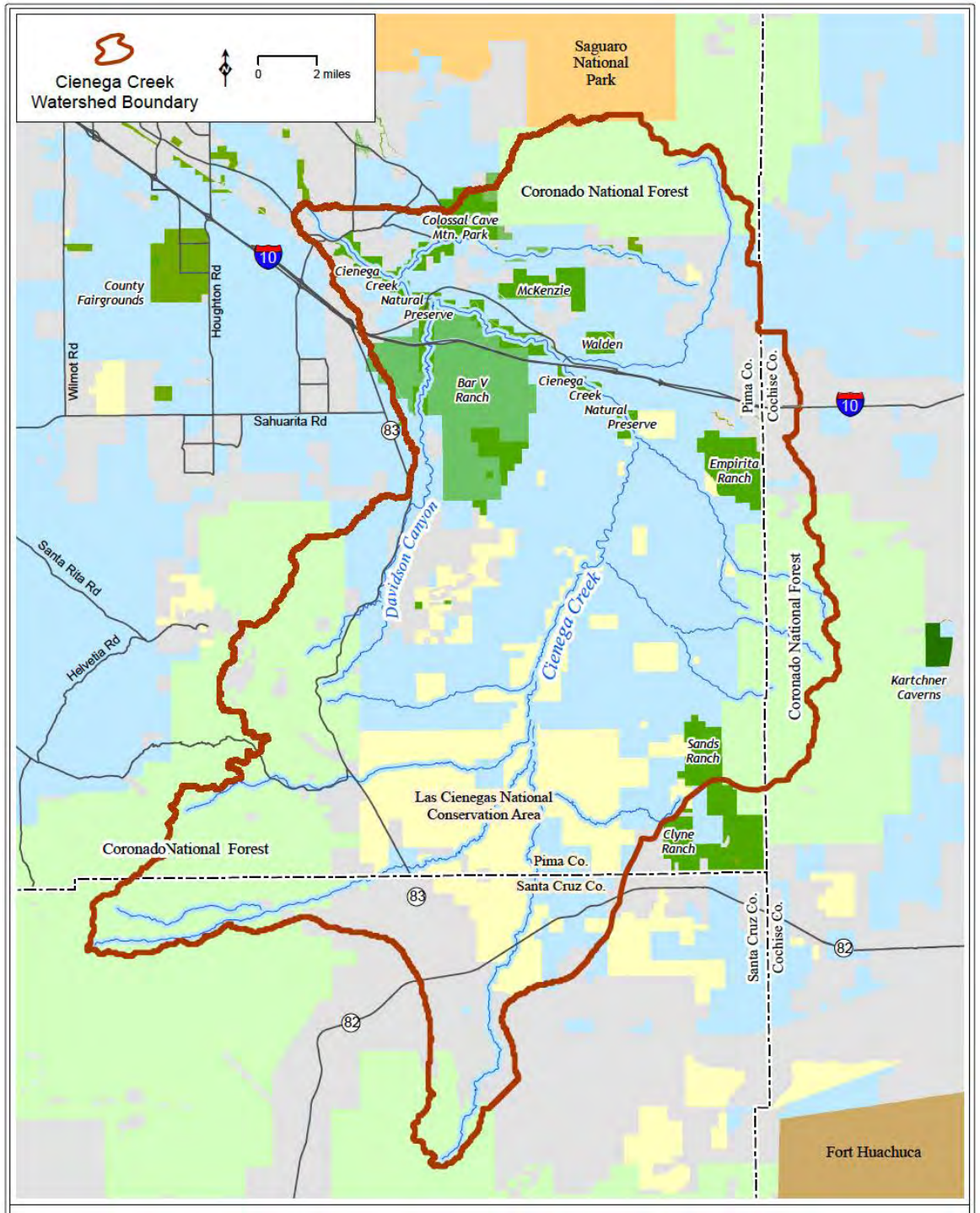
Boundary:

- Shapefile provided by Brian Powell (Pima County)
- Partially corresponds with USGS – NHD_HUC 10

Land Ownership in the Cienega Watershed

- Pima County Fee Simple
- Pima County Lease
- Private Land
- State Trust Land
- State Park
- BLM
- National Forest
- National Park
- Military

Source: Mike List (Pima County)



Climate

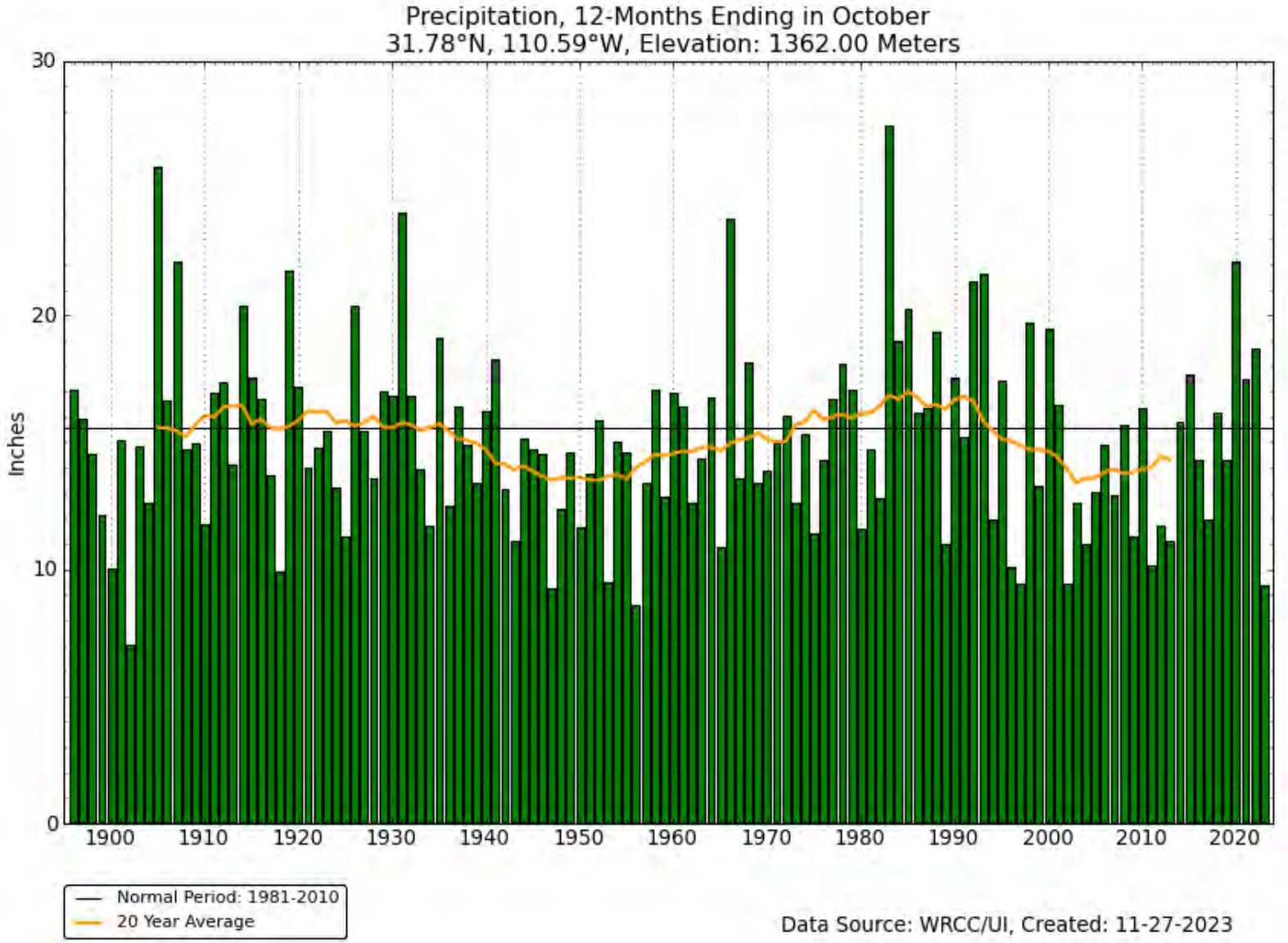
Category	Indicator	No.	Description
Climate	Precipitation	1	Historic data on mean precipitation summer vs. winter
	Temperature	2	Historic data on mean temperature
	Drought	3	Standardized Index for Drought over time

Precipitation

Time Series

Variable Information

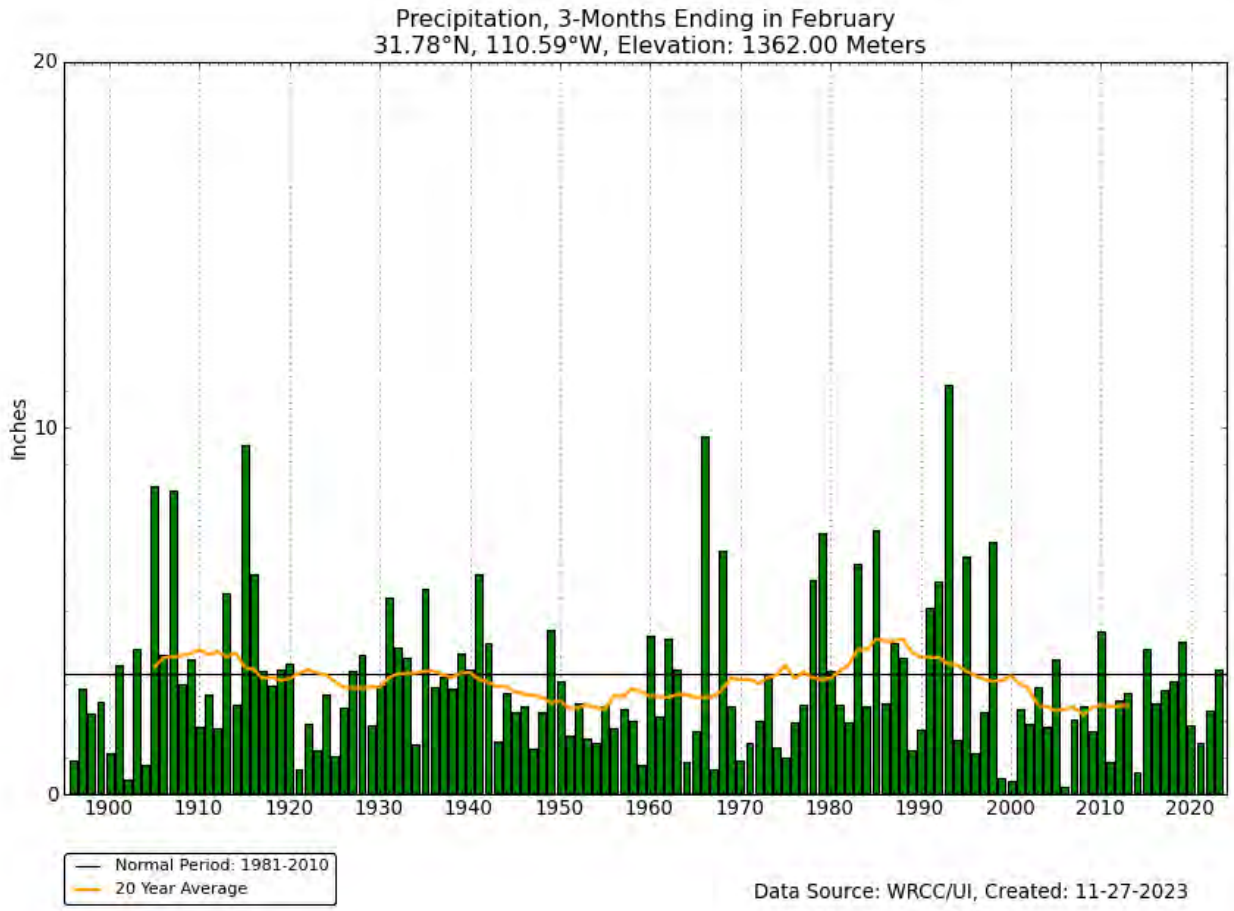
Latitude:	31.78188
Longitude:	-110.58563
Variable:	Precipitation
Start Year:	1895
End Year:	2023
Month:	October
Span:	12-Month
Running Average (Years):	20



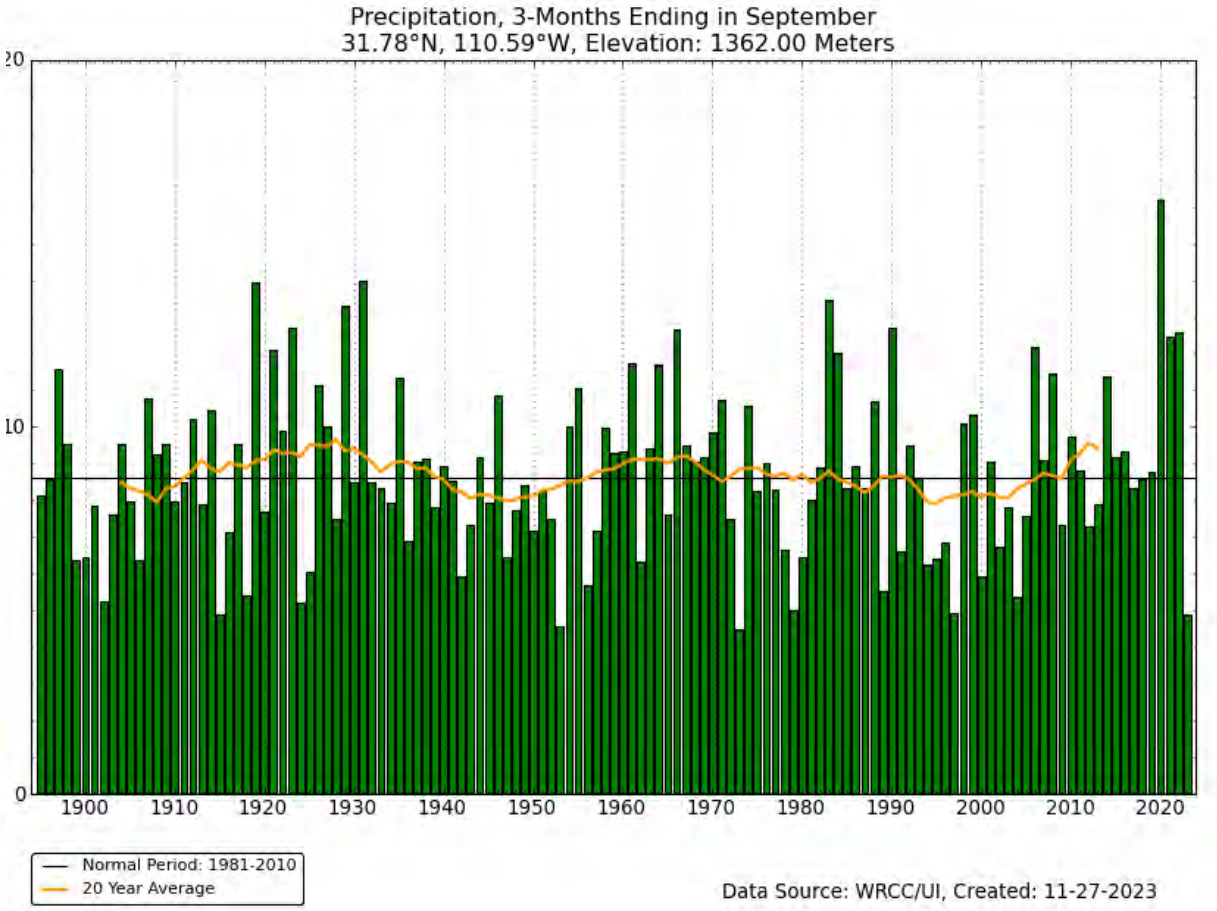
Source: http://www.wrcc.dri.edu/wwdt/
Assistance from: Mike Crimmins

Precipitation – summer vs. winter

Winter (ending in 02/2023)

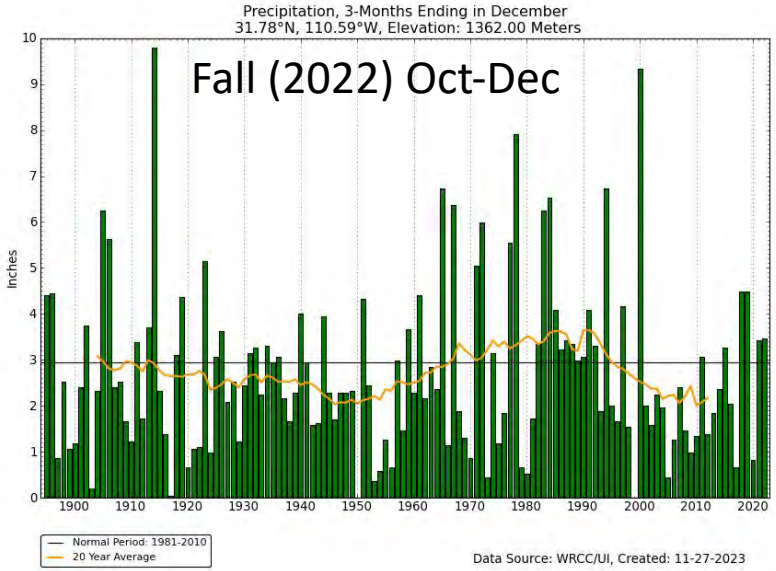


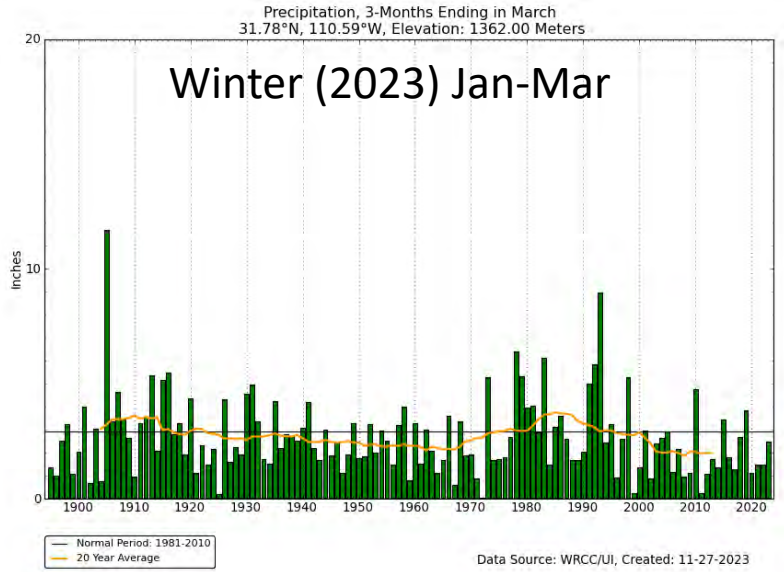
Summer (ending in 09/2023)

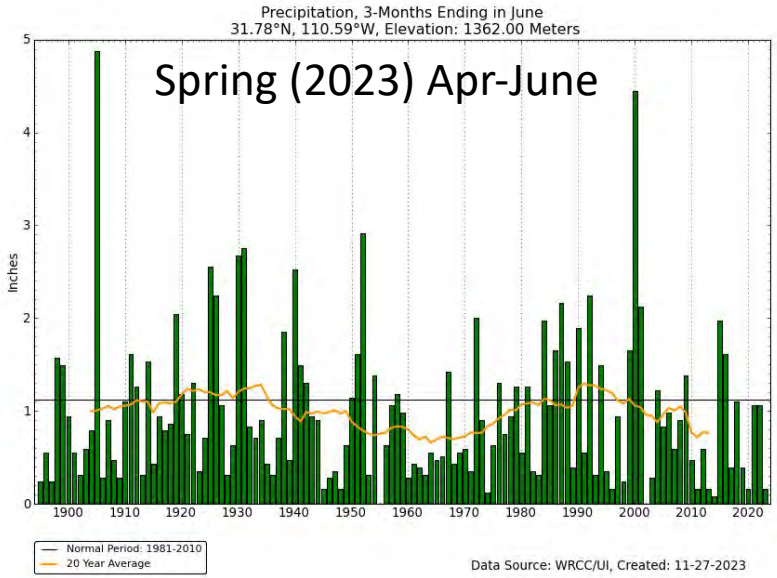


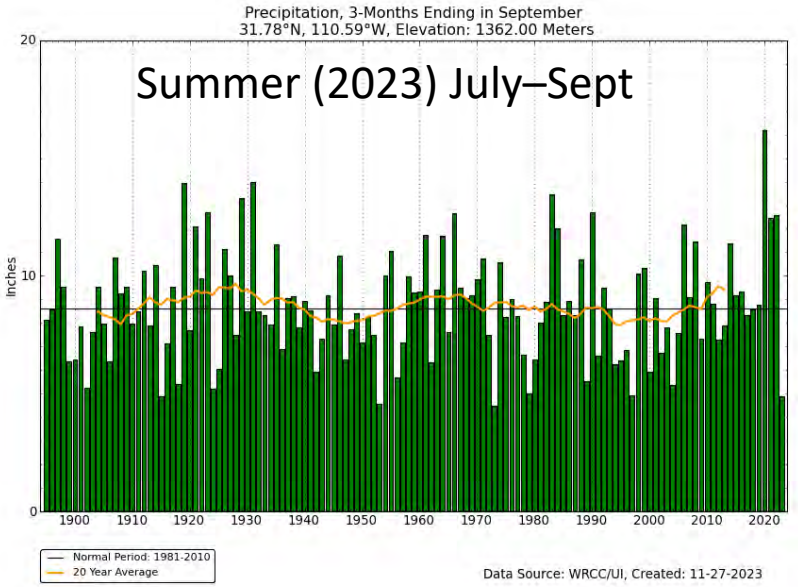
Source: http://www.wrcc.dri.edu/wwdt/
Assistance from: Mike Crimmins

Precipitation – seasonal









Temperature

Time Series

Variable Information

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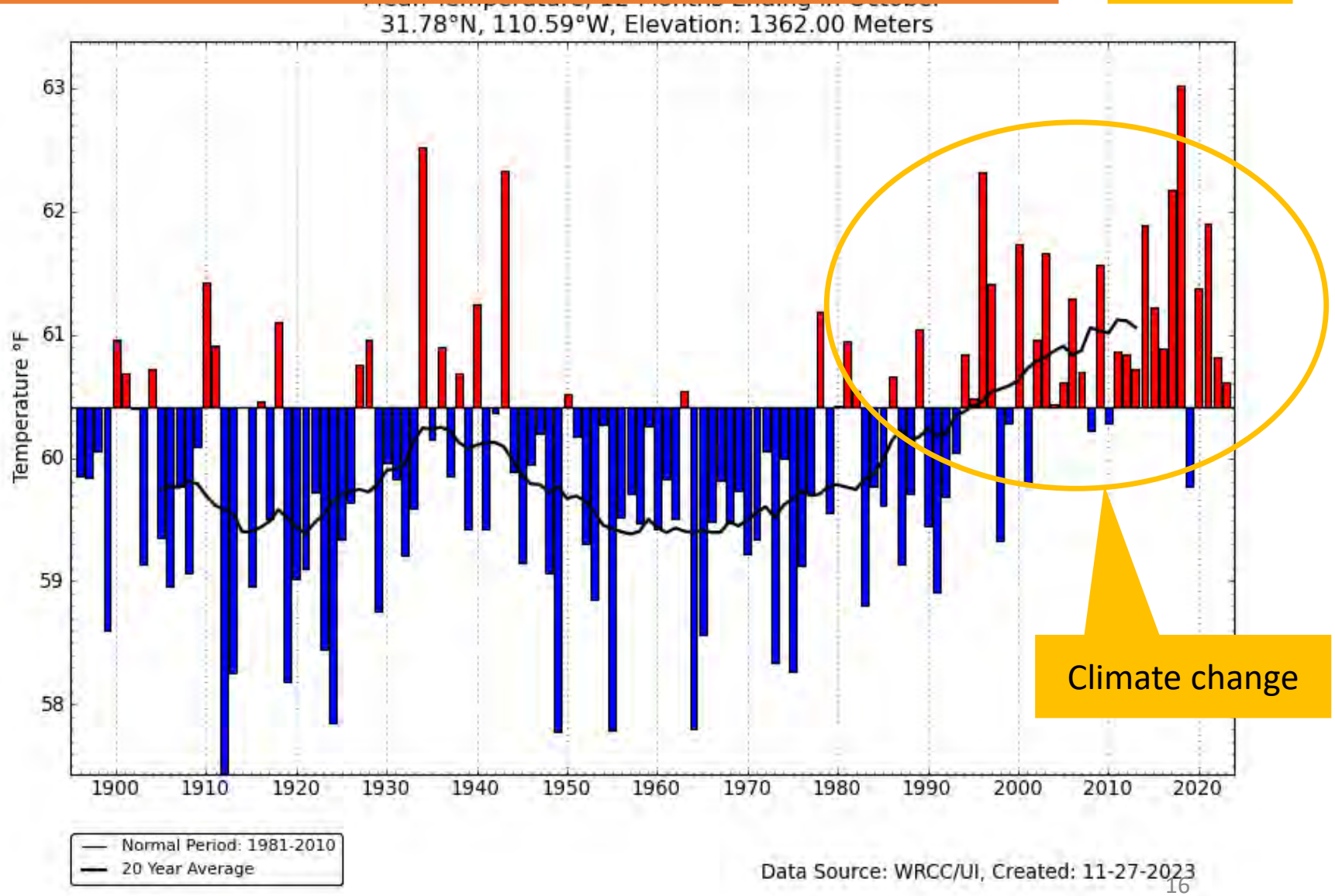
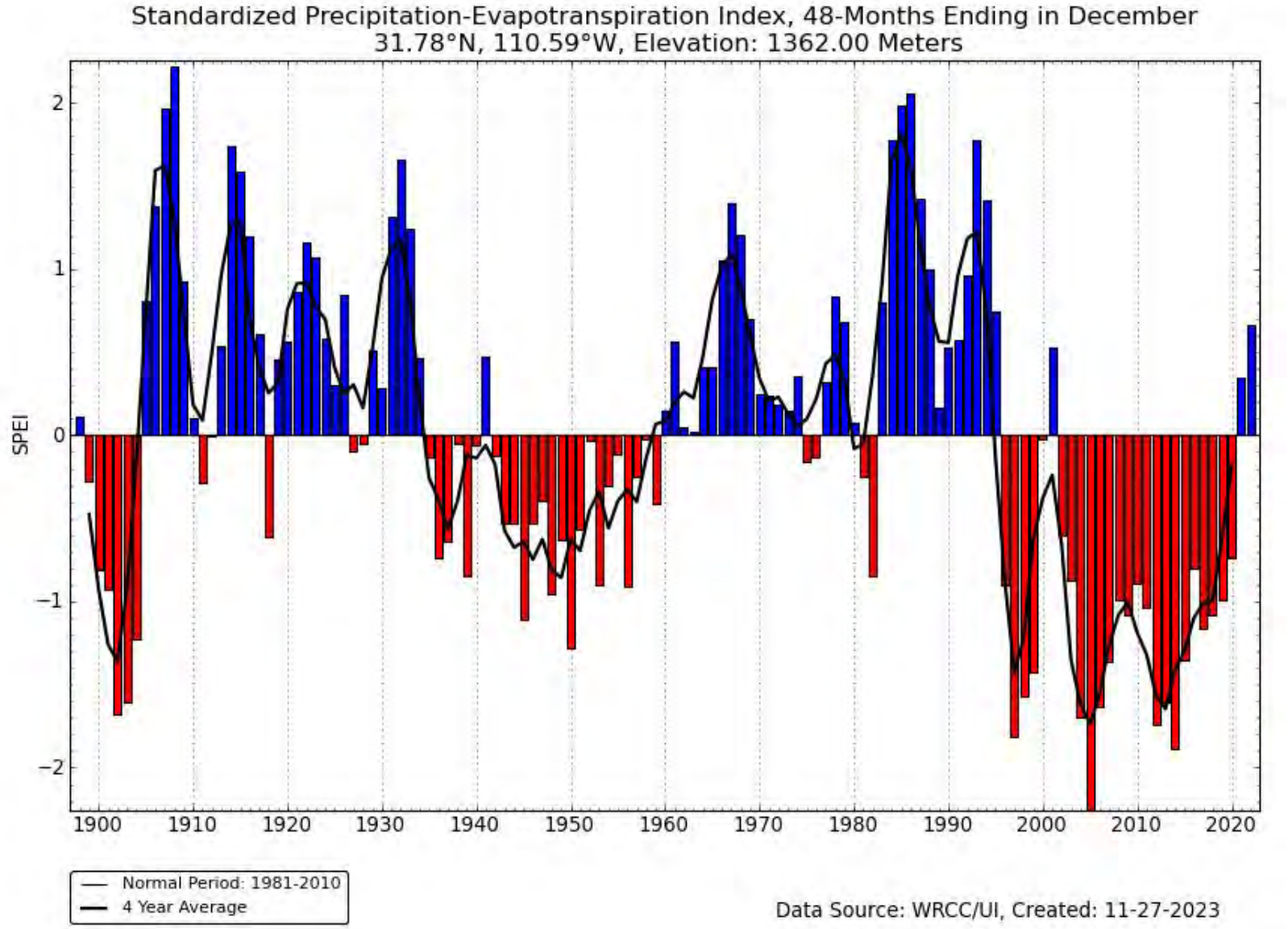


Source: http://www.wrcc.dri.edu/wwdt/
Assistance from: Mike Crimmins

Drought

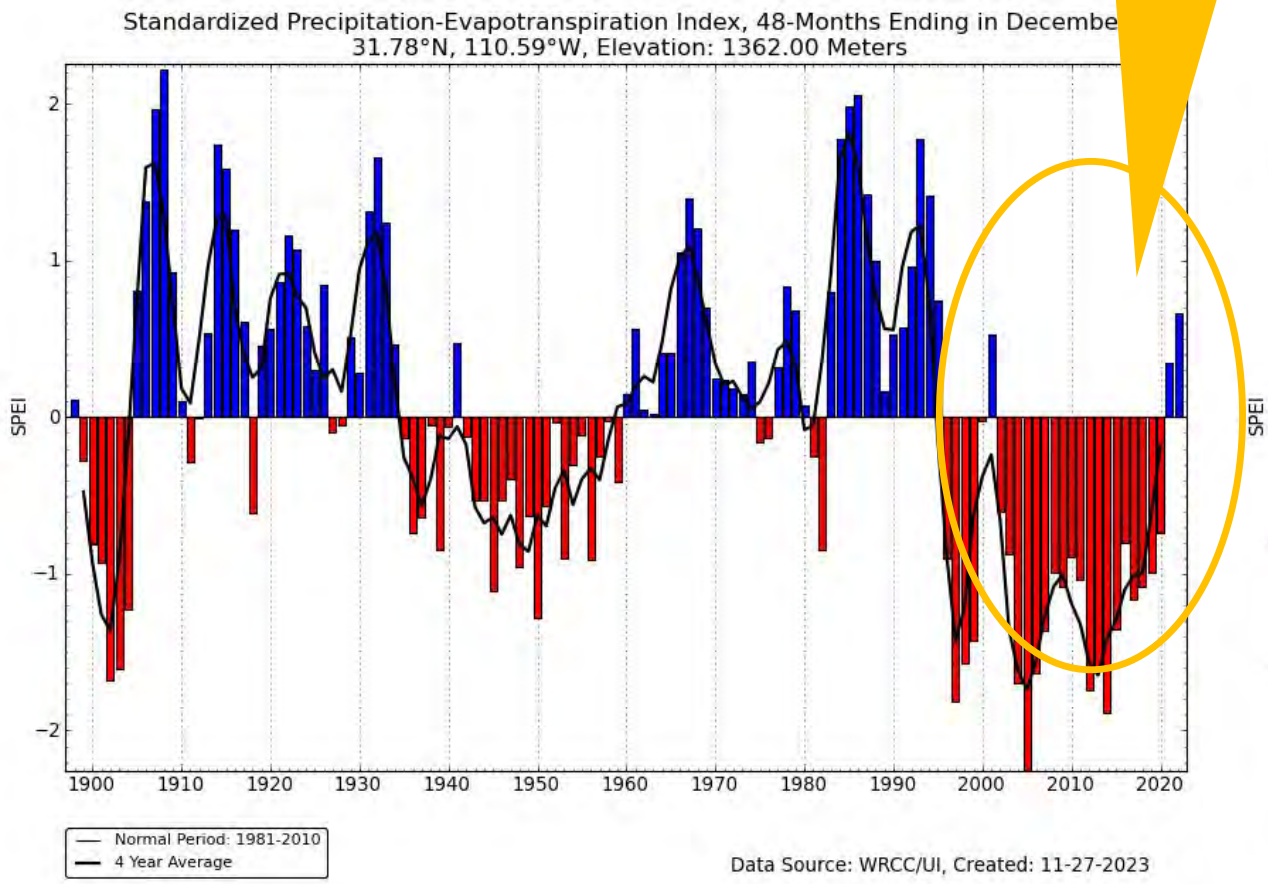
- SPEI – Standardized Precipitation Evapotranspiration Index – an index for drought.
- Standard deviation of observed precipitation and temperature for a given point.

Source: http://www.wrcc.dri.edu/wwdt/
Help from: Mike Crimmins, Haiyan Wei



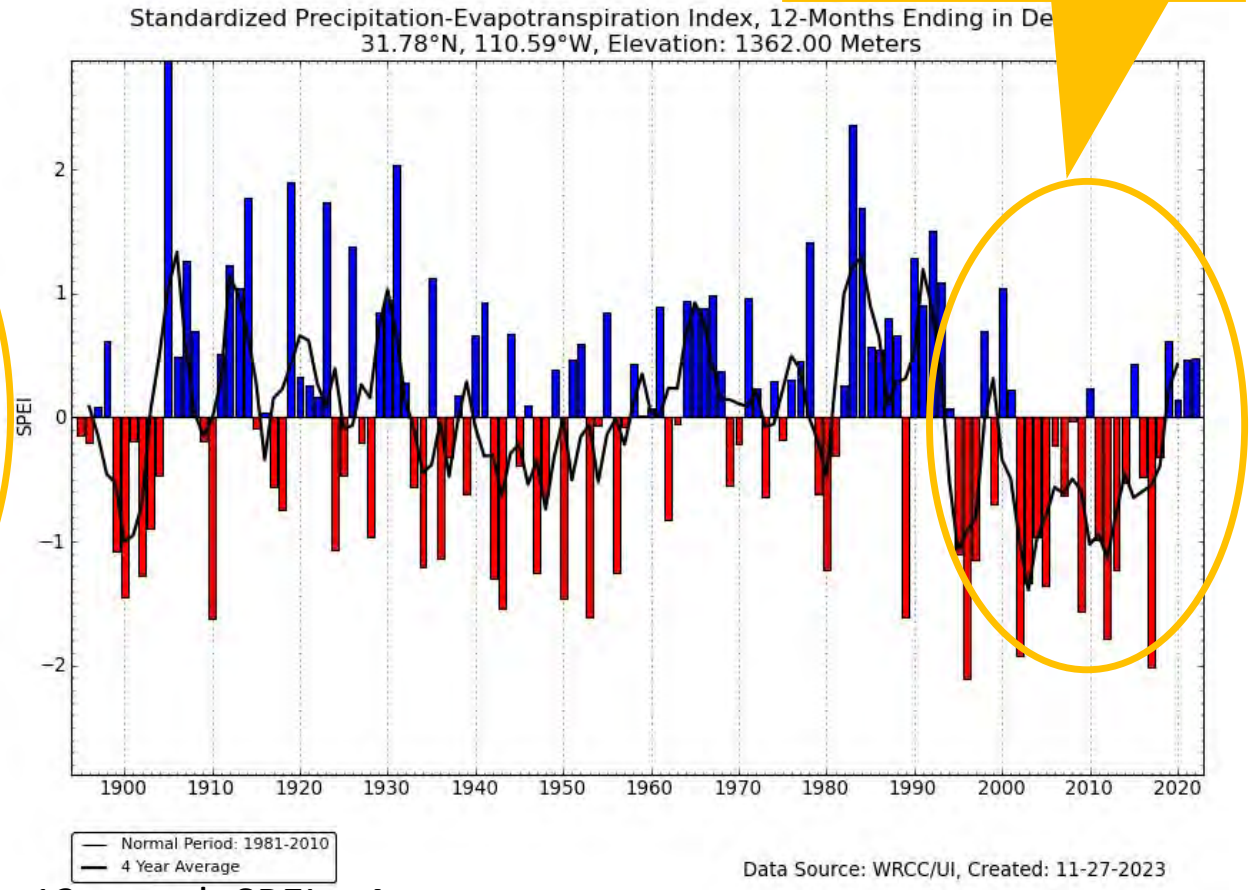
Drought

We are in a drought



48-month SPEI – 4 yr. average

Shorter term swings to less drought



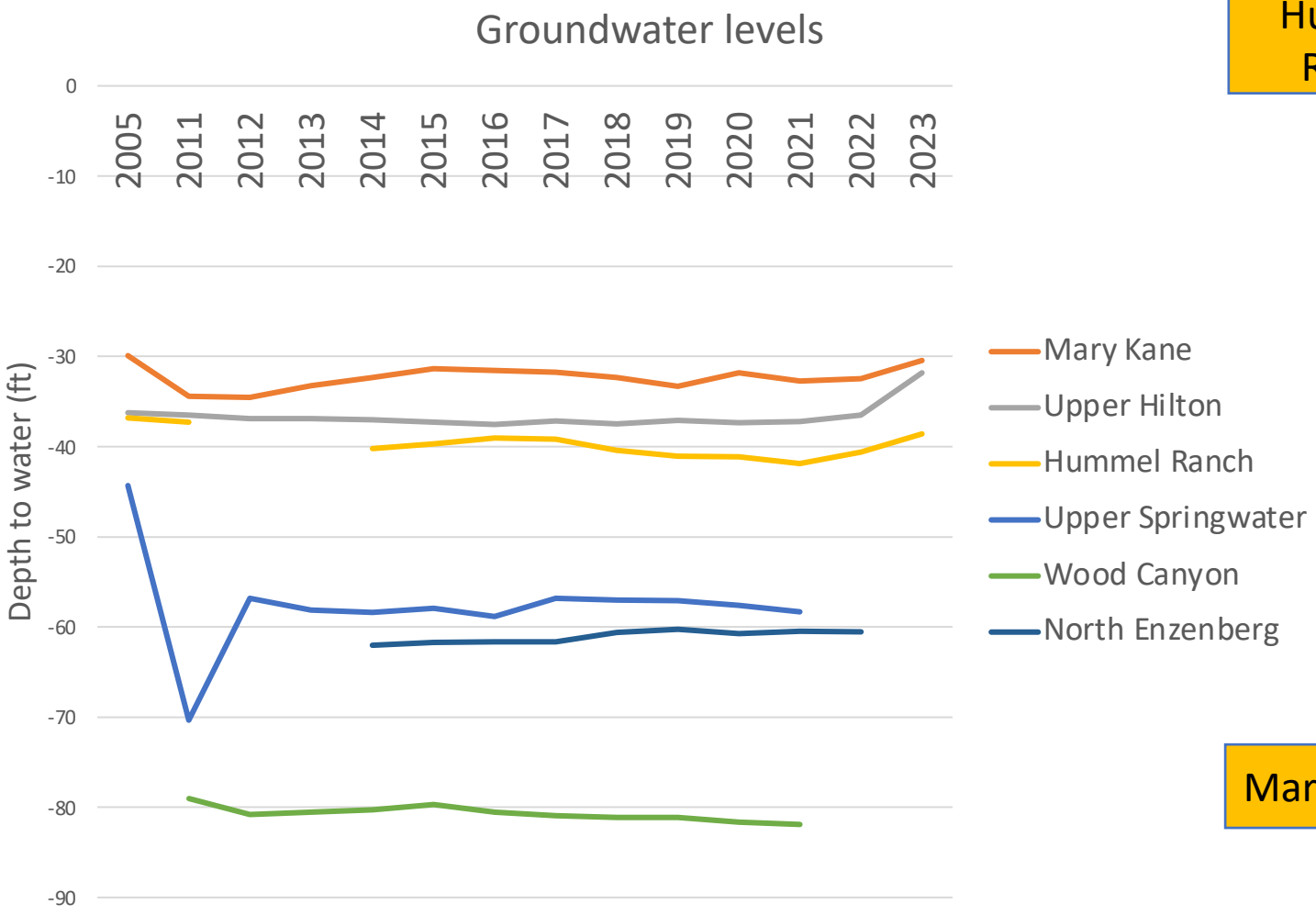
12-month SPEI – 4 yr. average

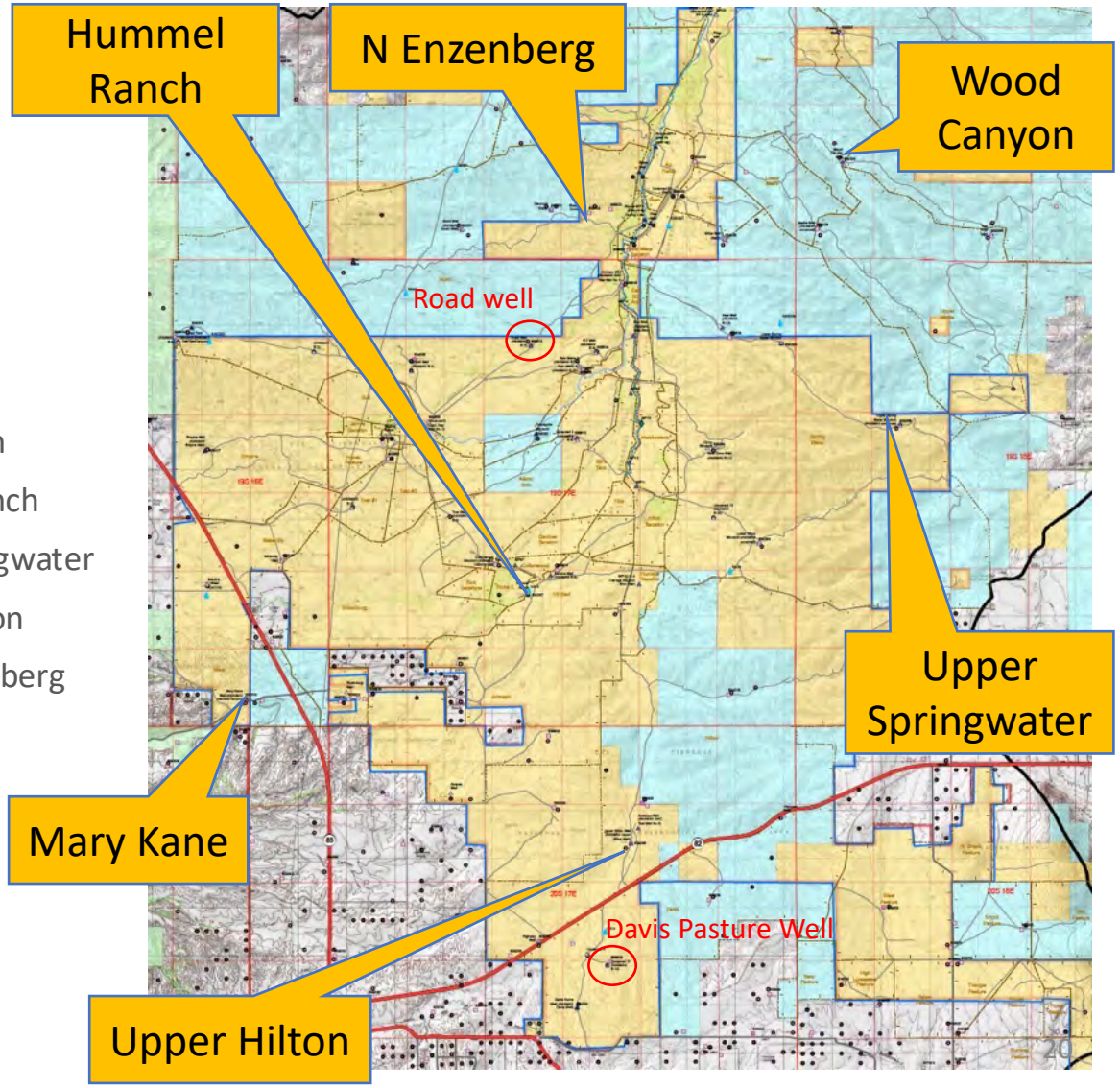
Source: http://www.wrcc.dri.edu/wwdt/ Assistance from: Prof. Mike Crimmins

Water

Indicator	No.	Description
Groundwater levels	4	Change from previous year in Jan. and June (highest/lowest)
	5	Wetlands
Surface water	6	Wet-dry mapping (June – worst case)
	7	Gauges (Cienega Creek and Pantano Dam)
	8	Monthly flows / base flows (average ft3/sec)/total flow
Water quality	9	Conductivity, PH, temperature, DO

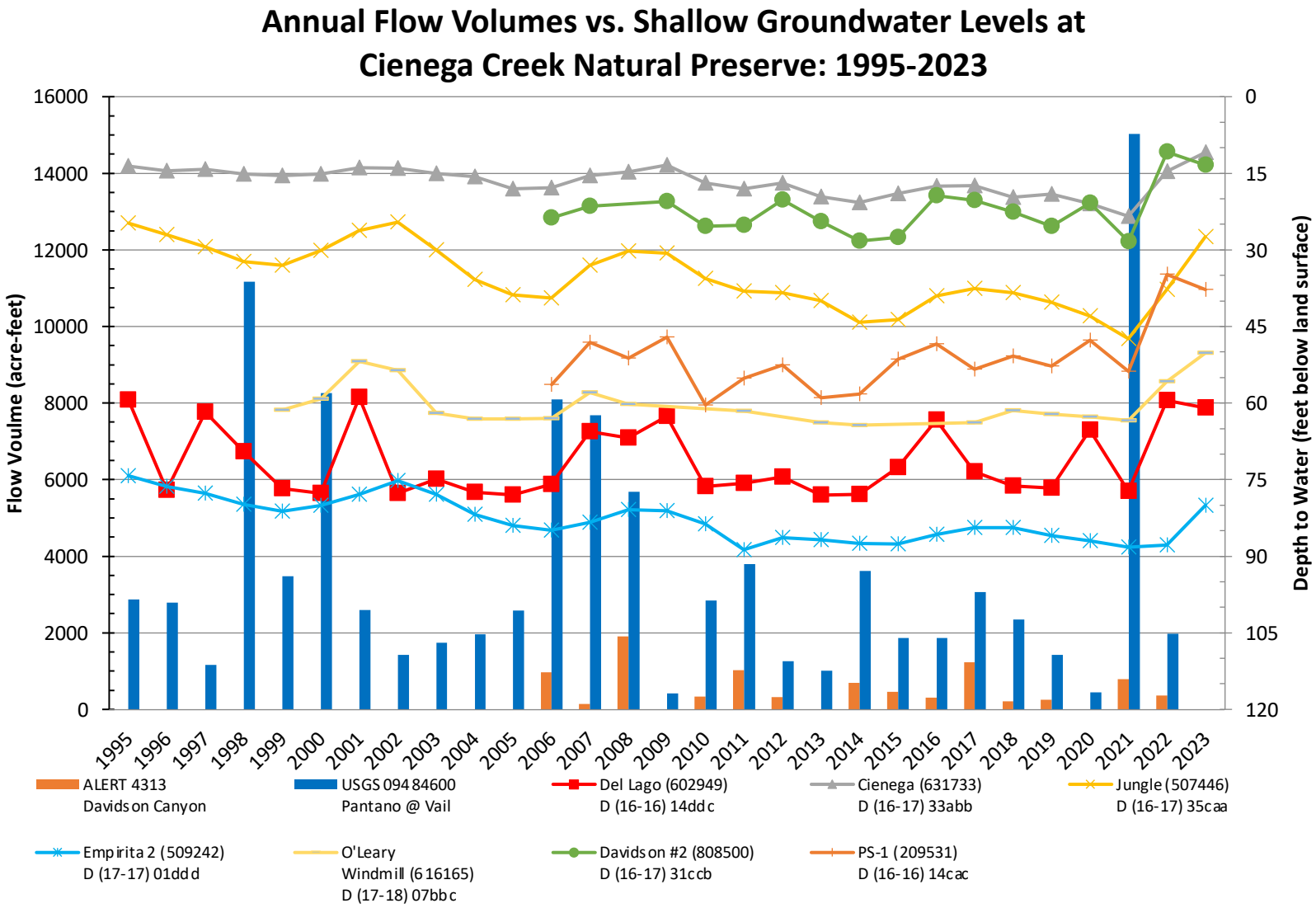
Groundwater levels – BLM (wells)

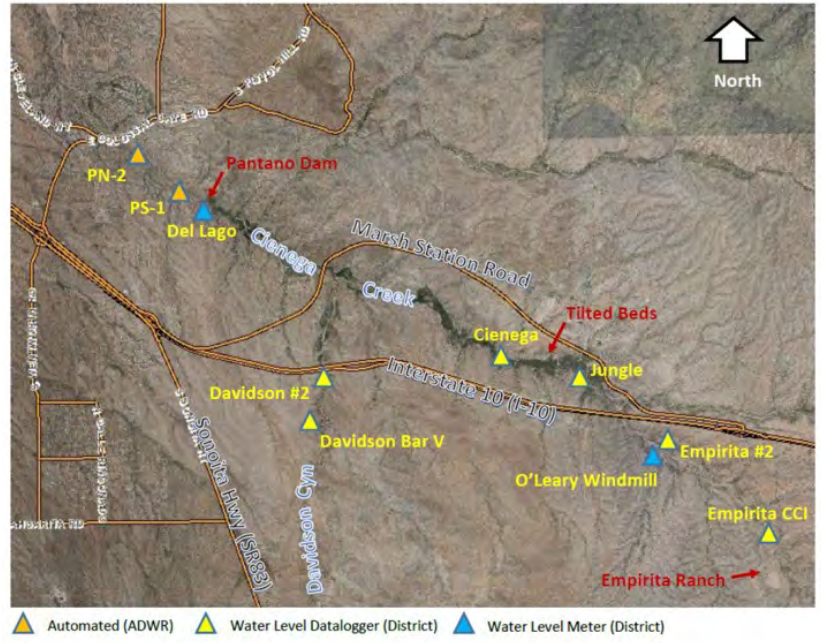




Source: Peter Christensen, BLM

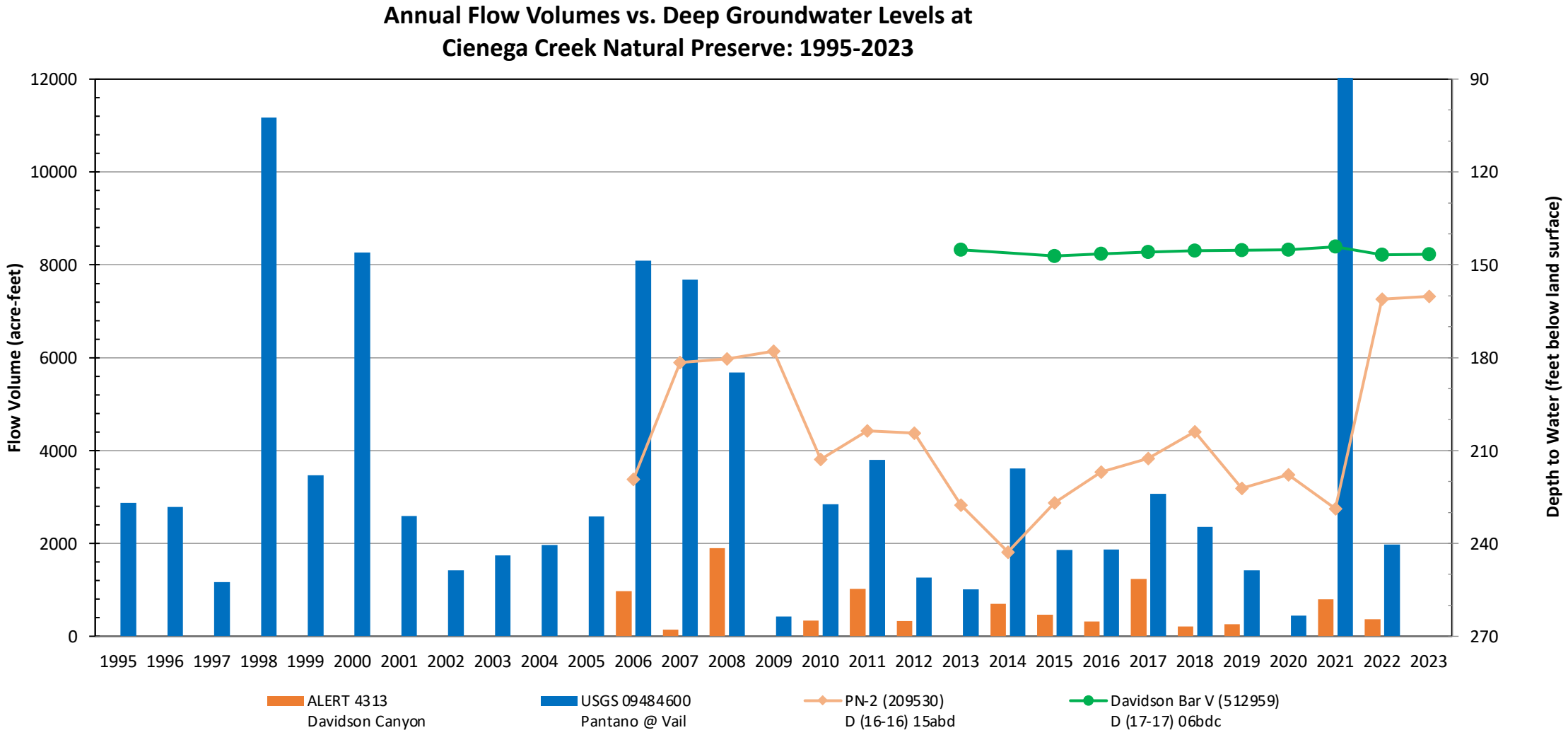
Groundwater levels (shallow wells) – Preserve





Source: David Scalero and Ian Murray, Pima County Regional Flood Control District

Groundwater levels (deep wells) – Preserve



Source: David Scalero and Ian Murray, Pima County Regional Flood Control District

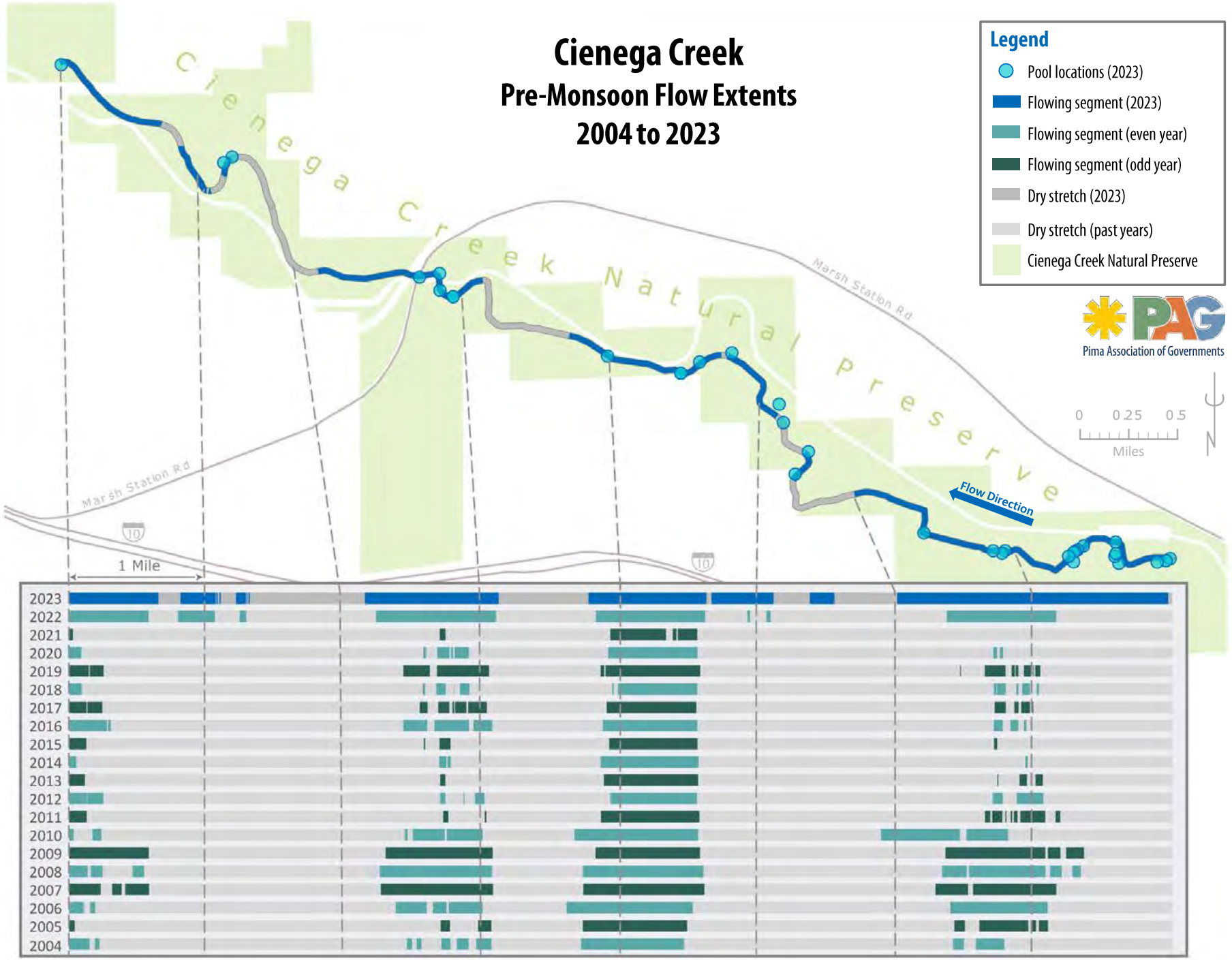
Wet-Dry

“June 2023 was the highest perennial baseflow recorded since PAG re-initiated monitoring to assess the impacts of drought in June 1999.

In June 2023, PAG recorded 5.44 miles of flow in the monitored stretch of Cienega Creek within the Cienega Creek Natural Preserve. This translates to 58% of the 9.3 miles that flowed perennially and throughout the monitoring area in 1985.”

Melanie Alvarez, PAG (2023)

Source: Melanie Alvarez, PAG

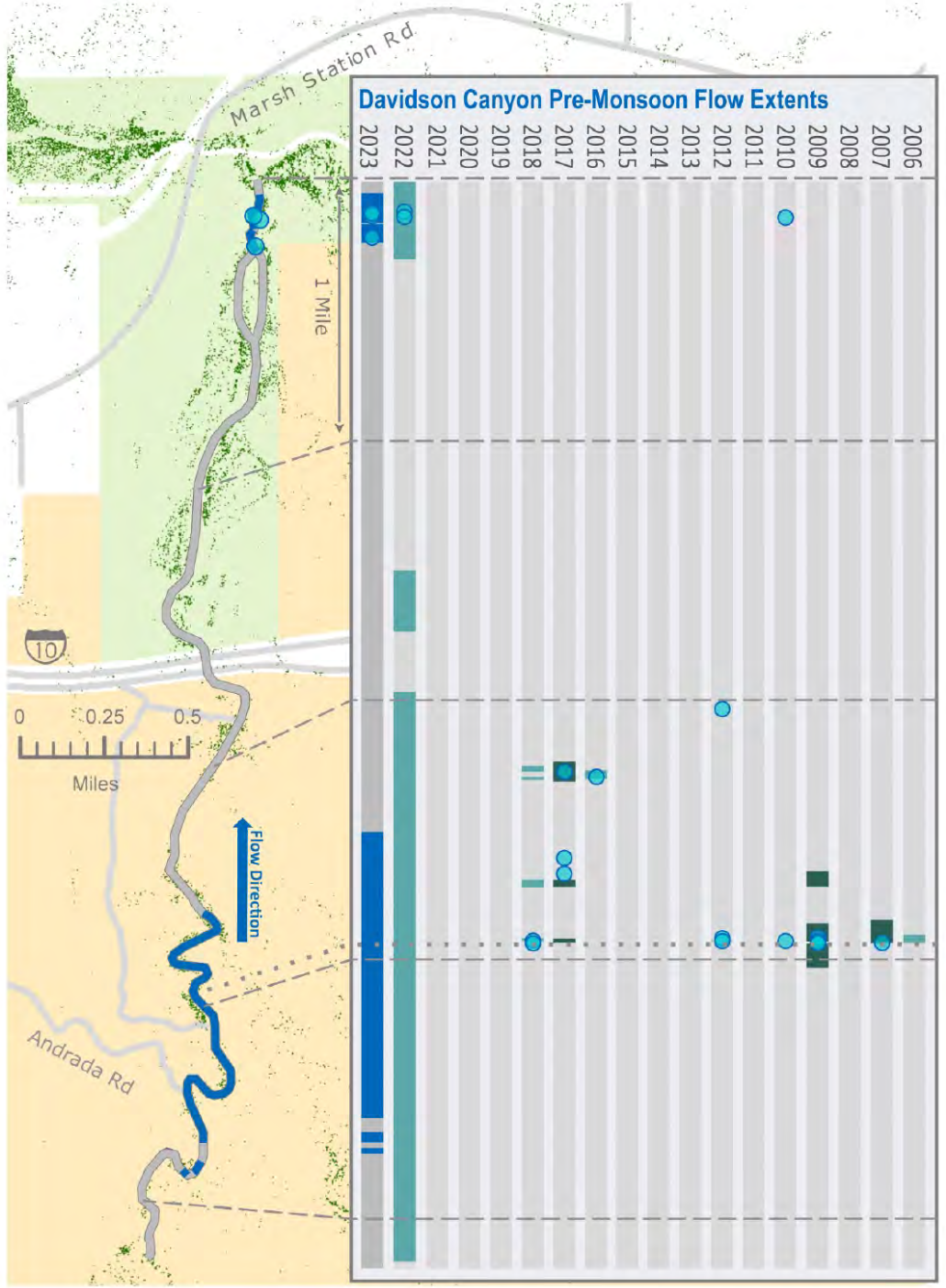


Wet-Dry

"In June 2023, there were 1.35 miles of baseflow in the monitored stretches of Davidson Canyon within the Cienega Creek Natural Preserve and Pima County's Bar V Ranch."

Melanie Alvarez, PAG (2023)

Source: Melanie Alvarez, PAG



Davidson Canyon
Pre-Monsoon Flow Extents
2006 to 2023

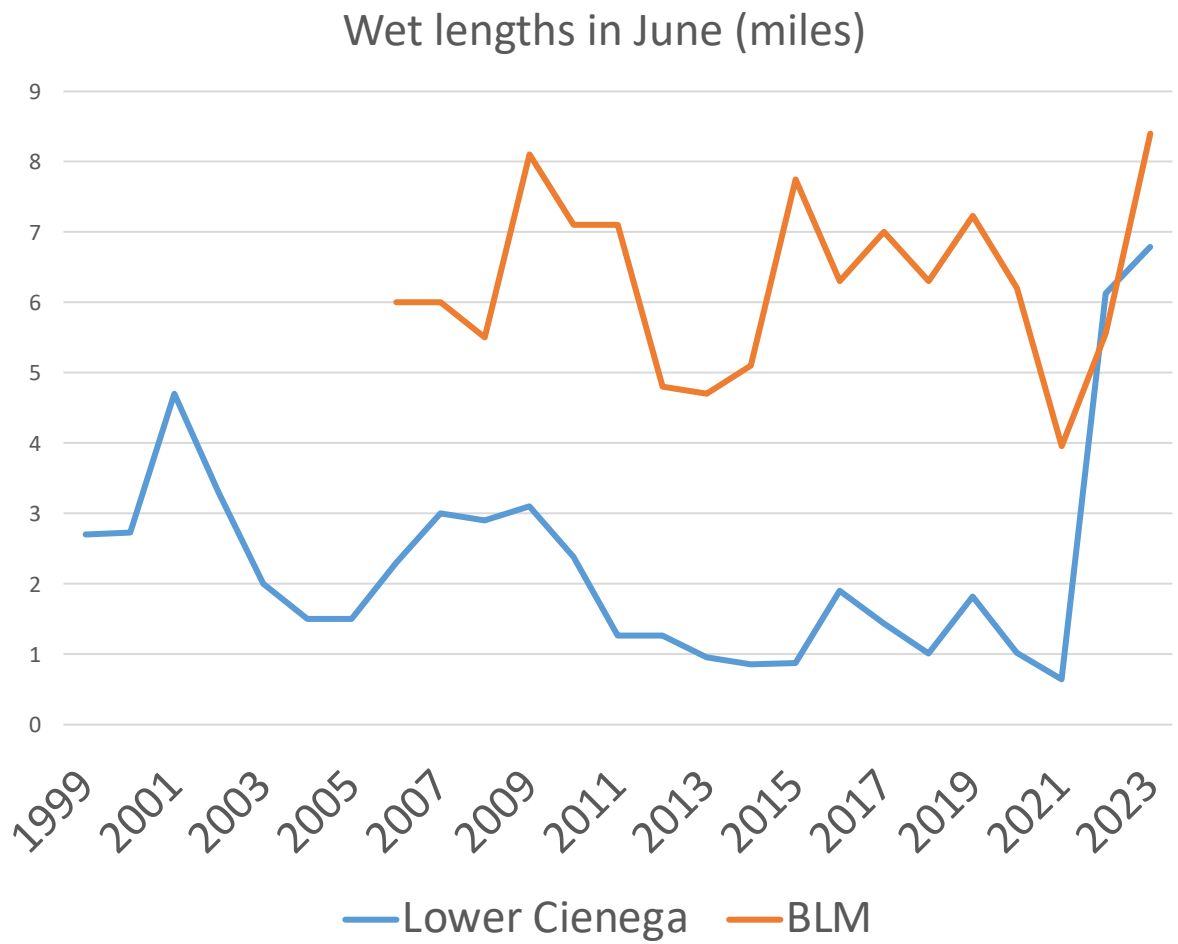
Pre-Monsoon Flow Legend

- Pool locations
- Flowing segment (2023)
- Flowing segment (even year)
- Flowing segment (odd year)
- Dry stretch (2023)
- Dry stretch (past years)
- 6+ Foot Tree Canopy (2015)
- Mile Indicator
- Davidson OAW Upstream Limit
- Cienega Creek Natural Preserve
- Pima County's Bar V Ranch

PAG
Pima Association of Governments

N

Wet-Dry – BLM and Preserve



- *We also observed more June flow in Cienega Creek than we have seen in two decades.*

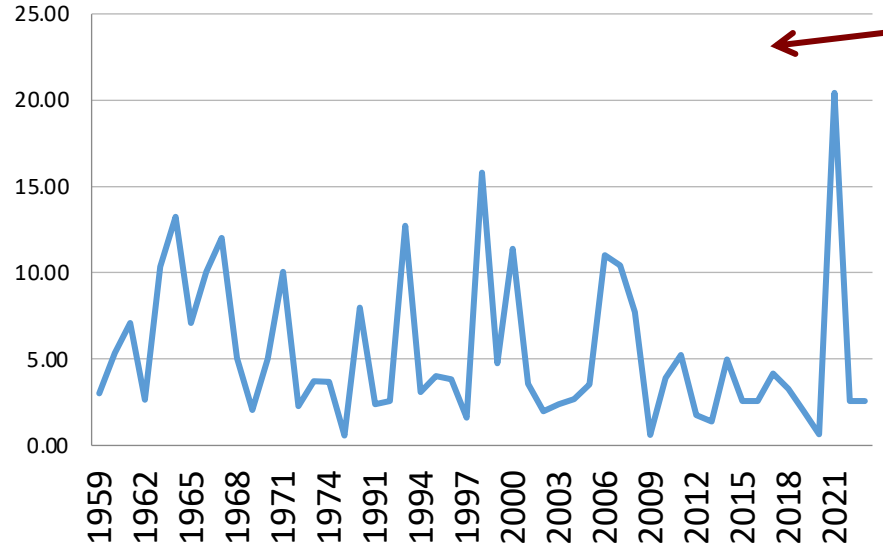
  Melanie Alvarez, PAG (2022)

- *The reaches surveyed are segments of the creeks… which is 8.4 wet miles.*

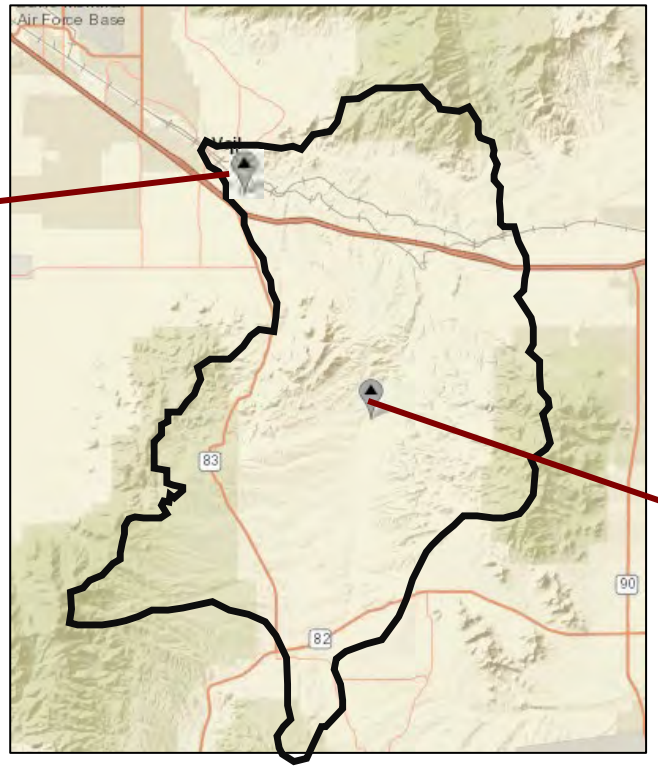
  Tiffany Verlander, BLM (2023)

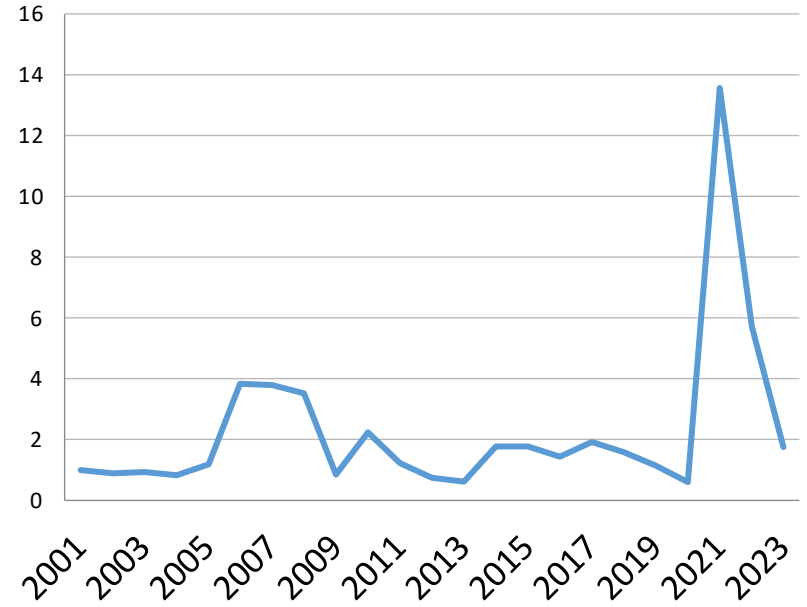
Source: Tiffany Verlander, Peter Christensen, BLM; Melanie Alvarez, PAG

Gauges – Monthly mean discharge



Pantano Wash
Gauge # 09484600



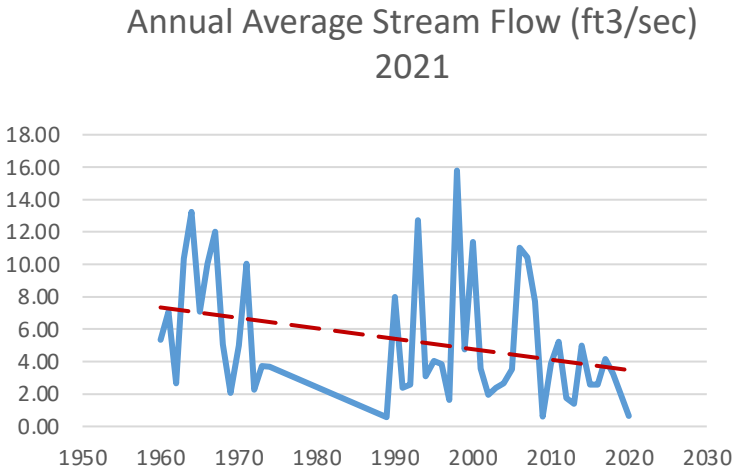


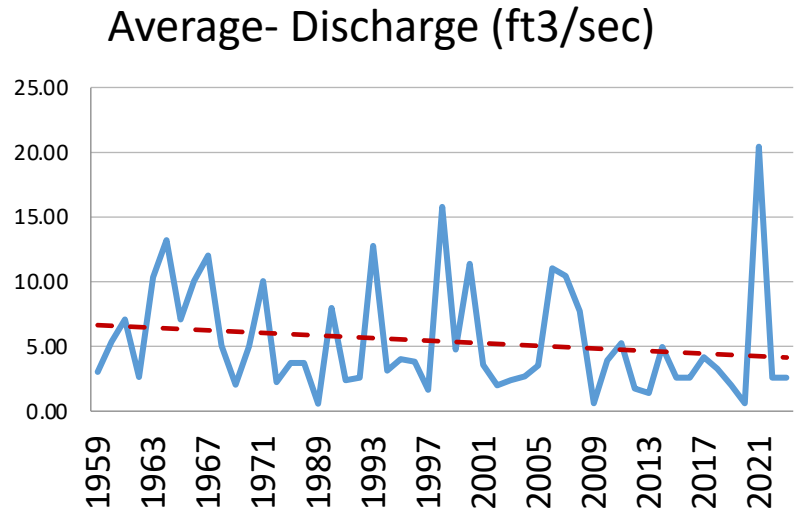
Cienega Creek
Gauge # 09484550

Source: waterdata.usgs.gov

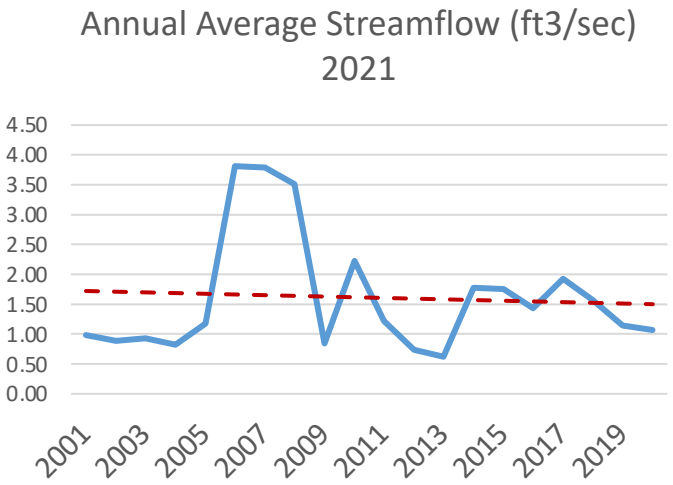
Gauges (2021 and 2023)

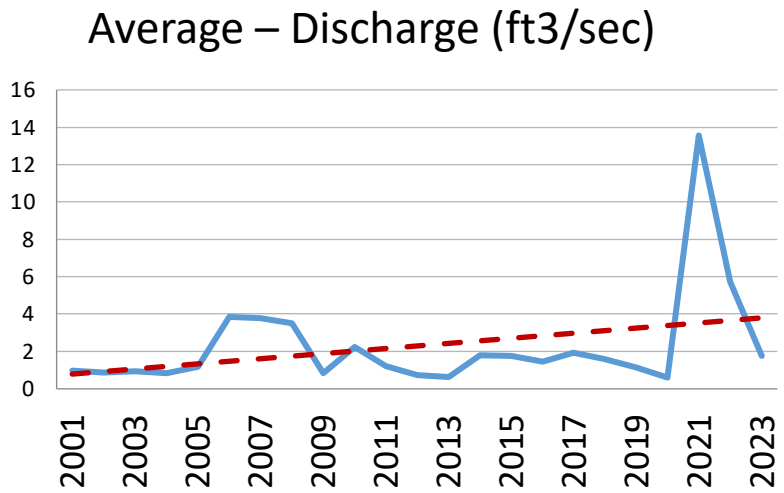
Pantano Wash - Gauge # 09484600





Cienega Creek - Gauge # 09484550

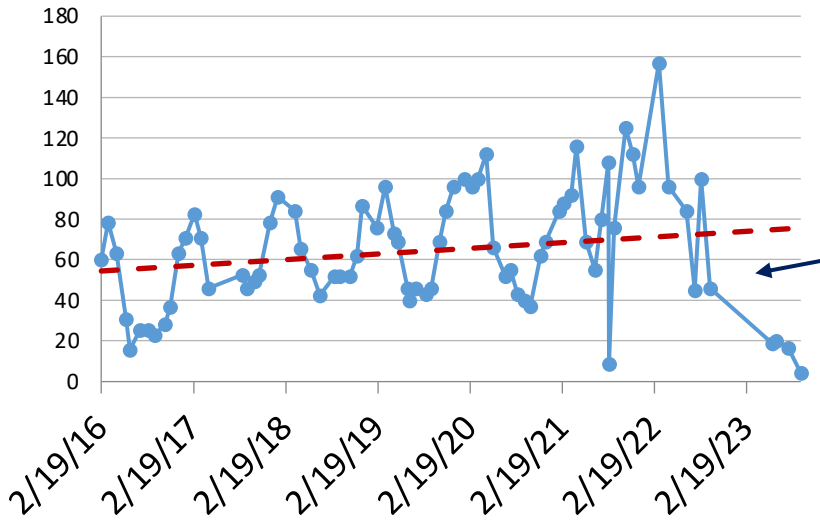


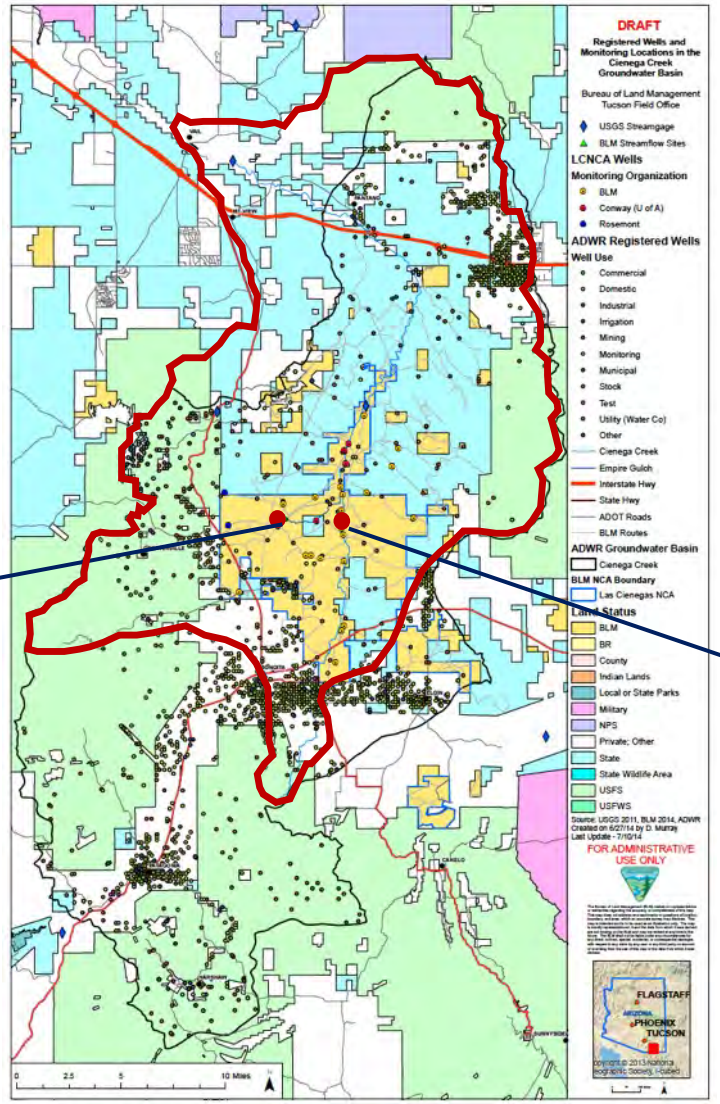


Source: waterdata.usgs.gov

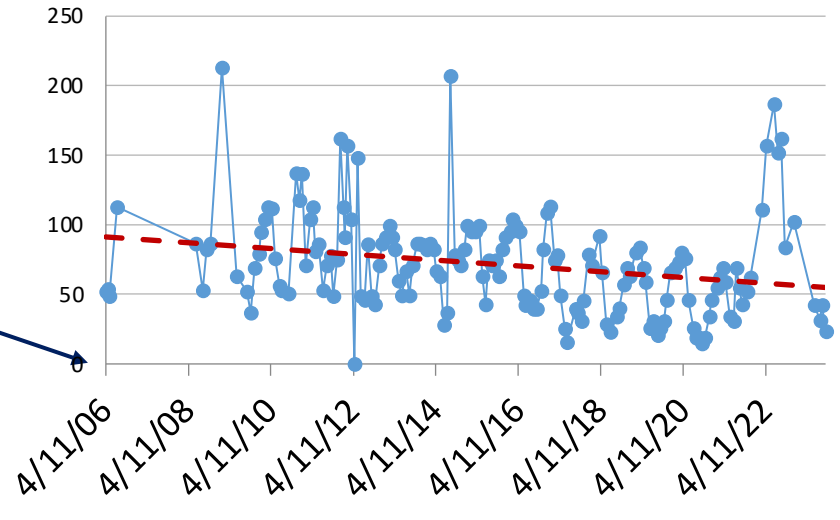
Stream Flows - BLM

Empire Gulch (new)
Flow (gpm)





Upper Cienega Creek
Flow (gpm)



Source: Peter Christensen, BLM

Stream Flows - Preserve

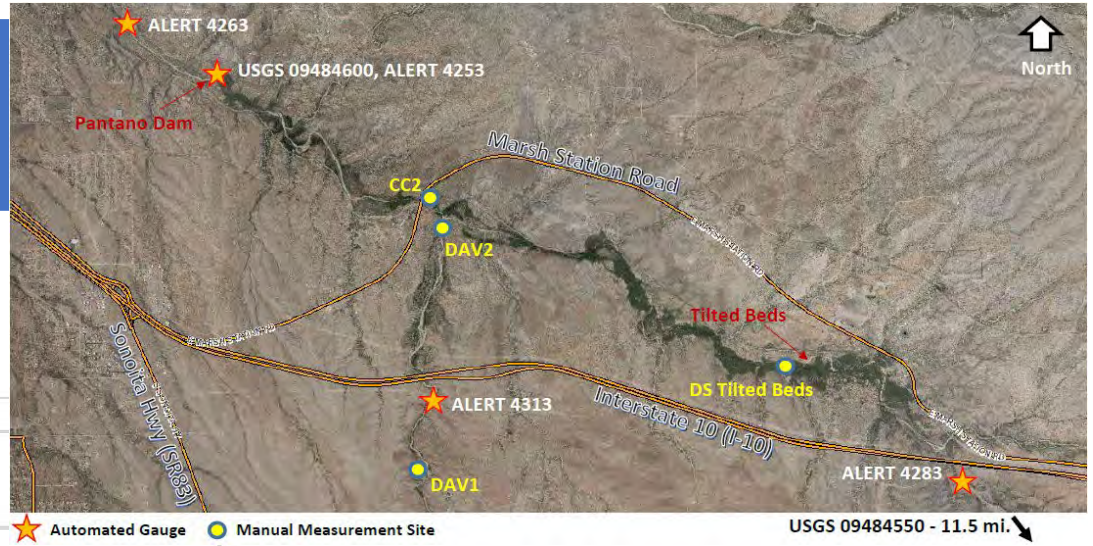
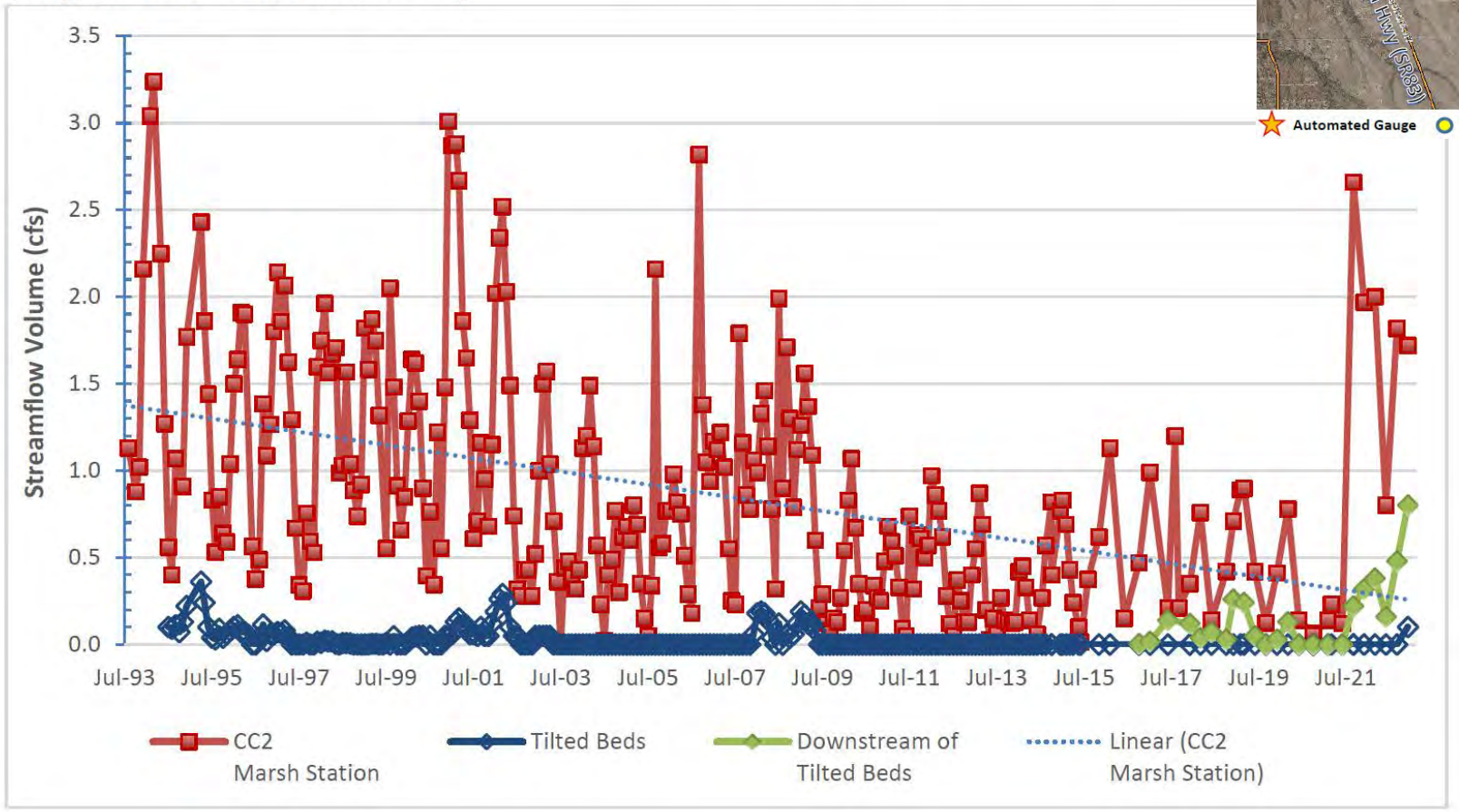
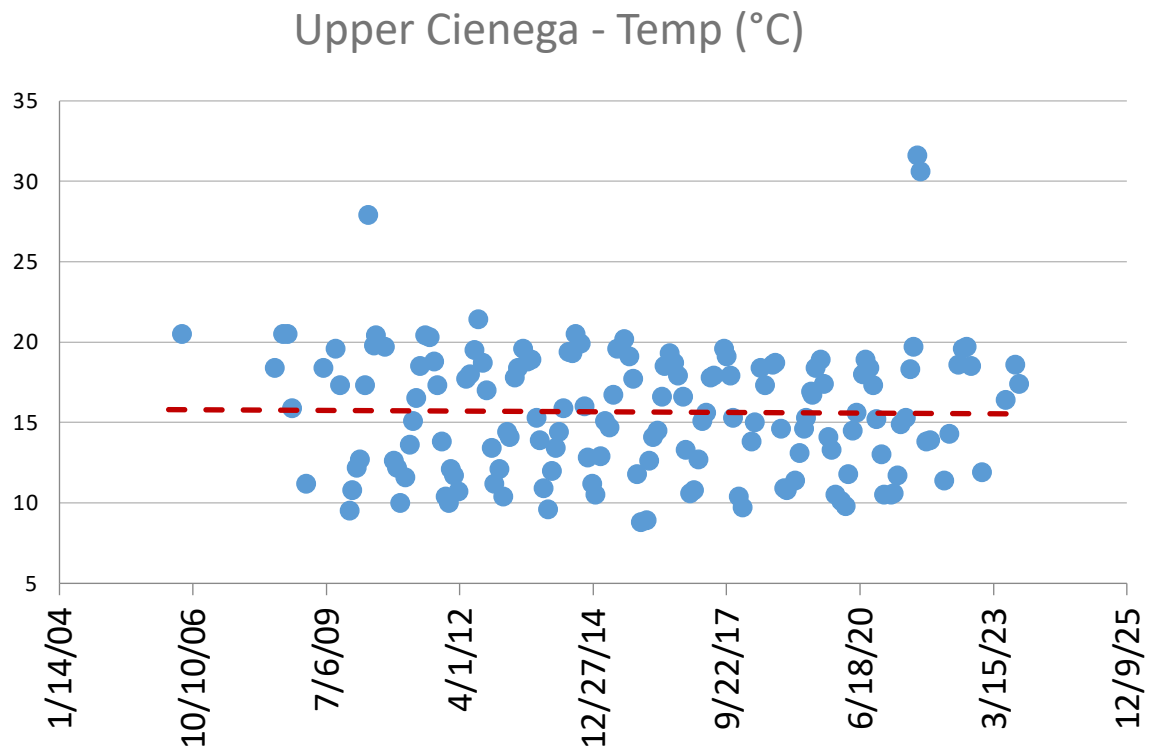


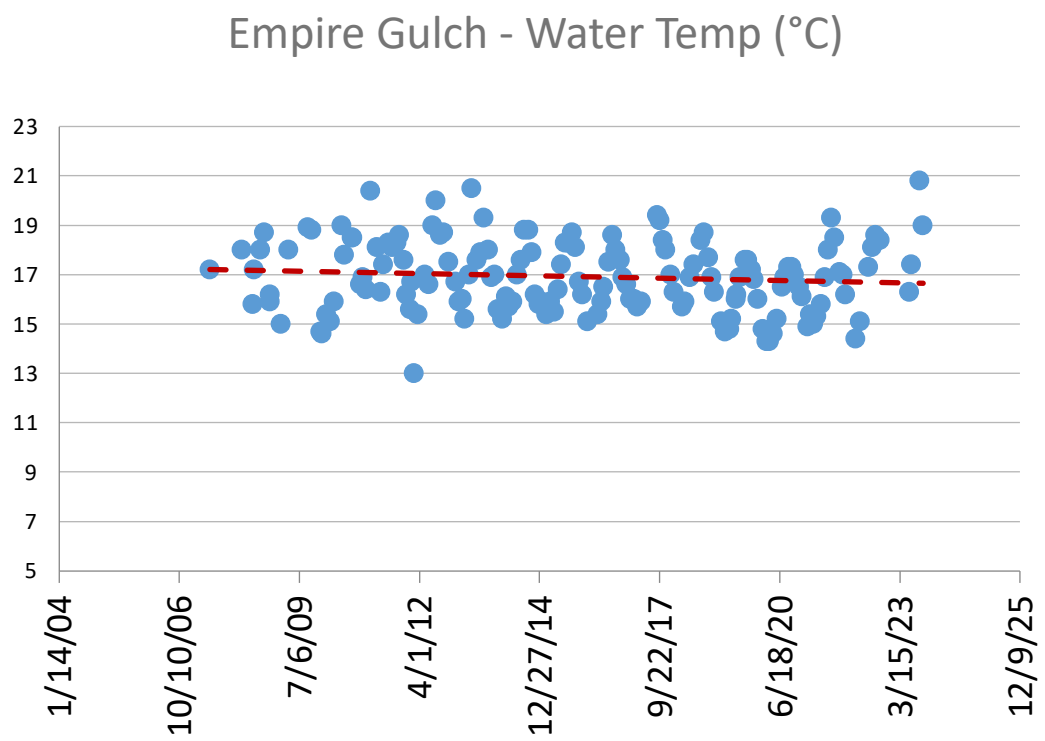
Figure 2-2. Monthly Streamflow Volume at Tilted Beds and Marsh Station Sites (August 1993 – December 2022)



Source: David Scalero and Ian Murray, Pima County, Pima County Regional Flood Control District

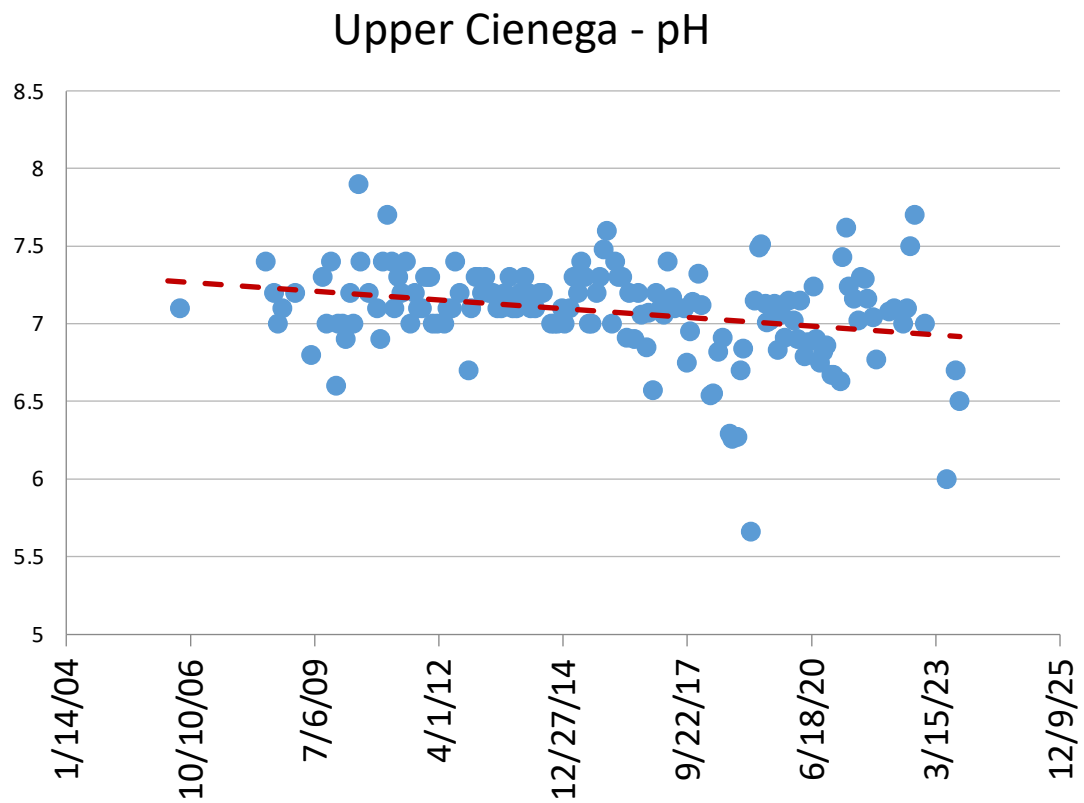
Water quality – Temperature, LCNCA

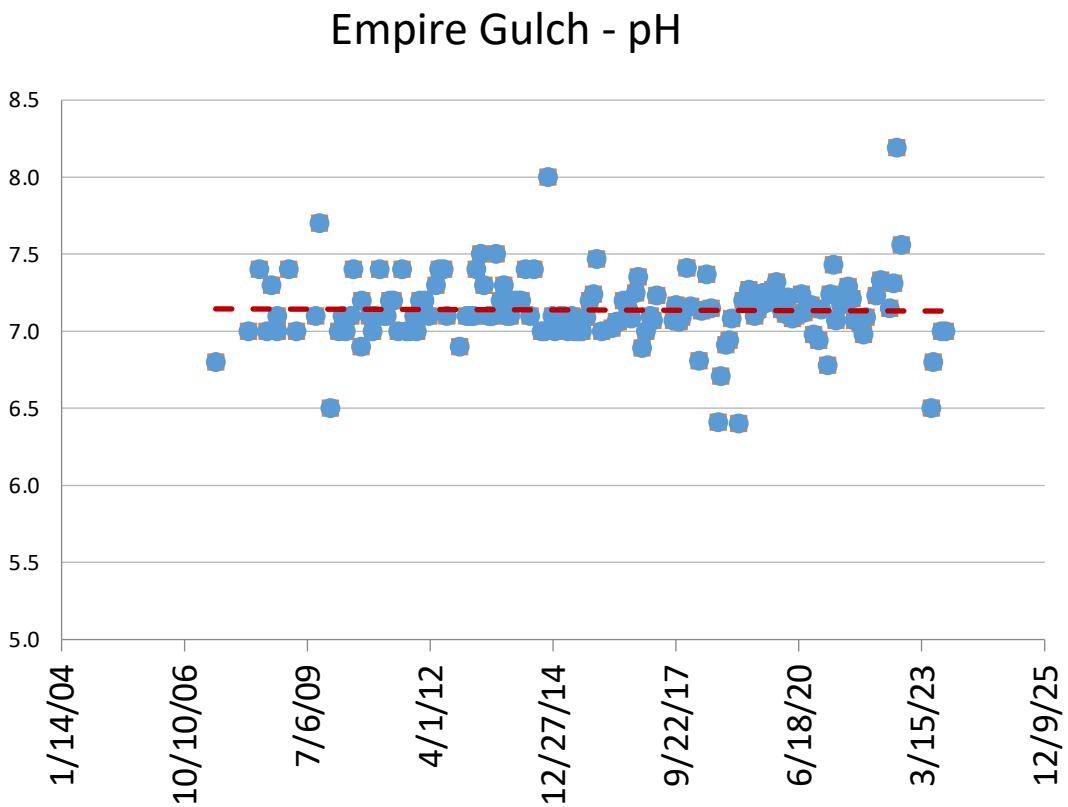




Source: Peter Christensen, BLM

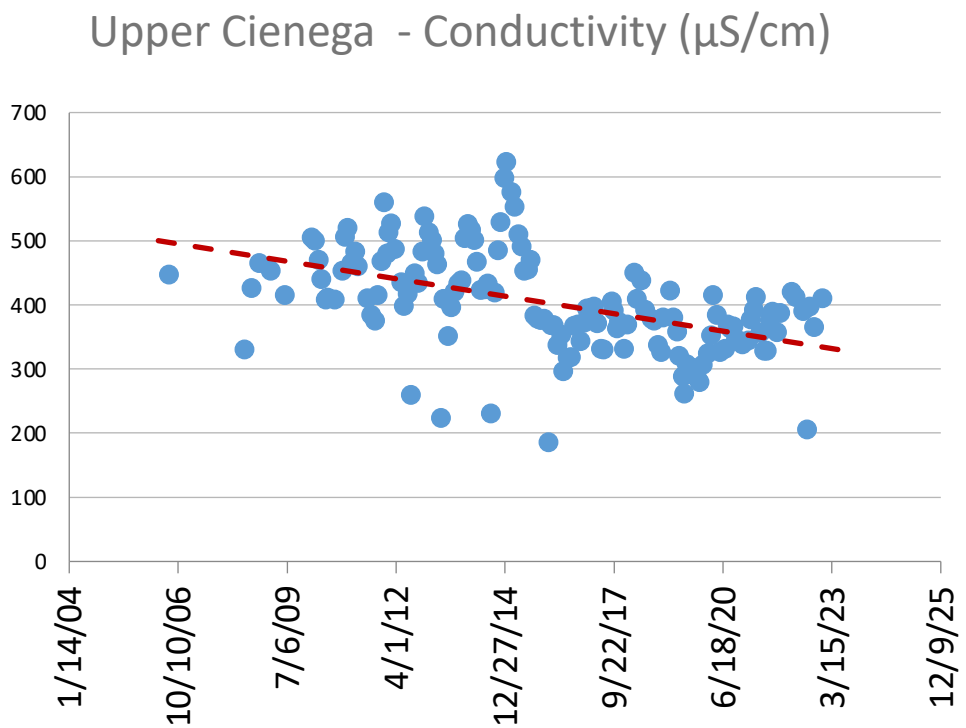
Water quality – pH, LCNCA

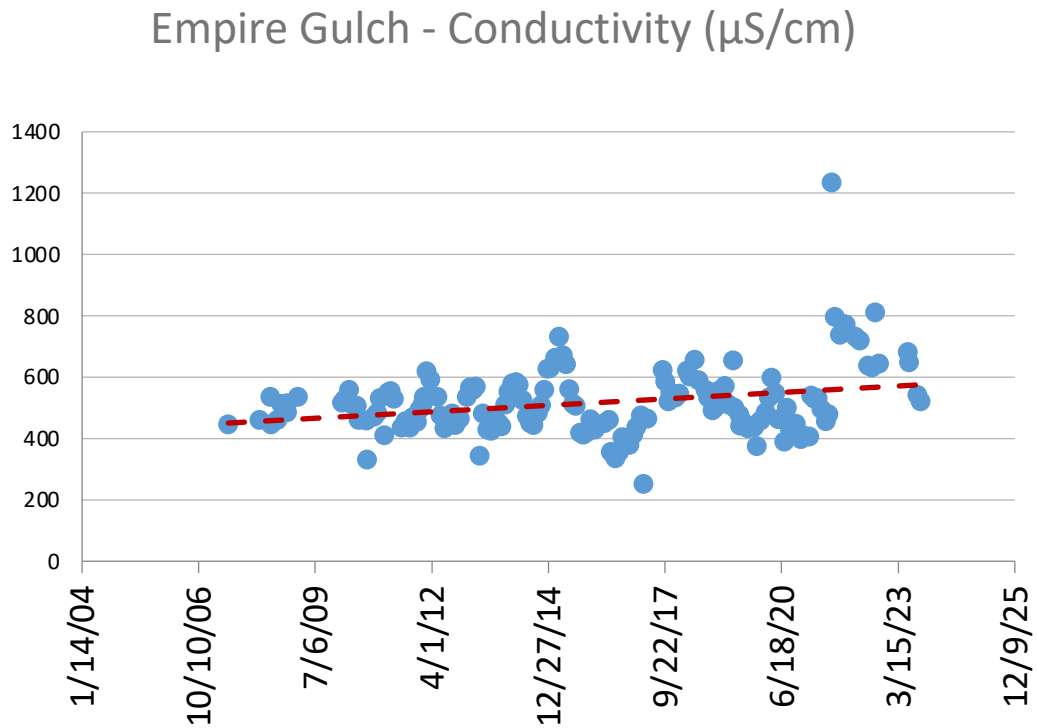




Source: Peter Christensen, BLM

Water quality – Conductivity, LCNCA

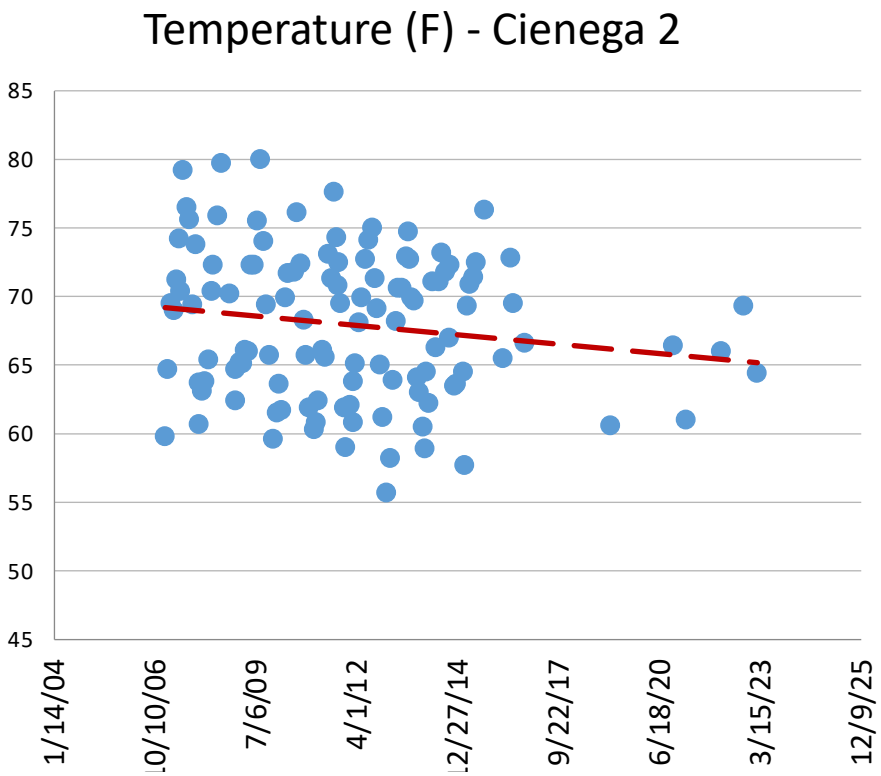


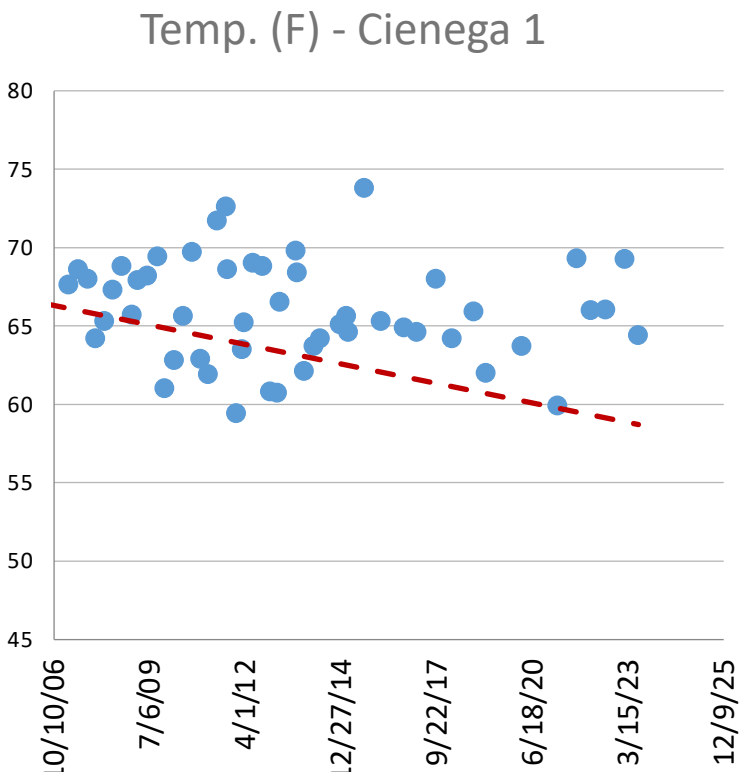


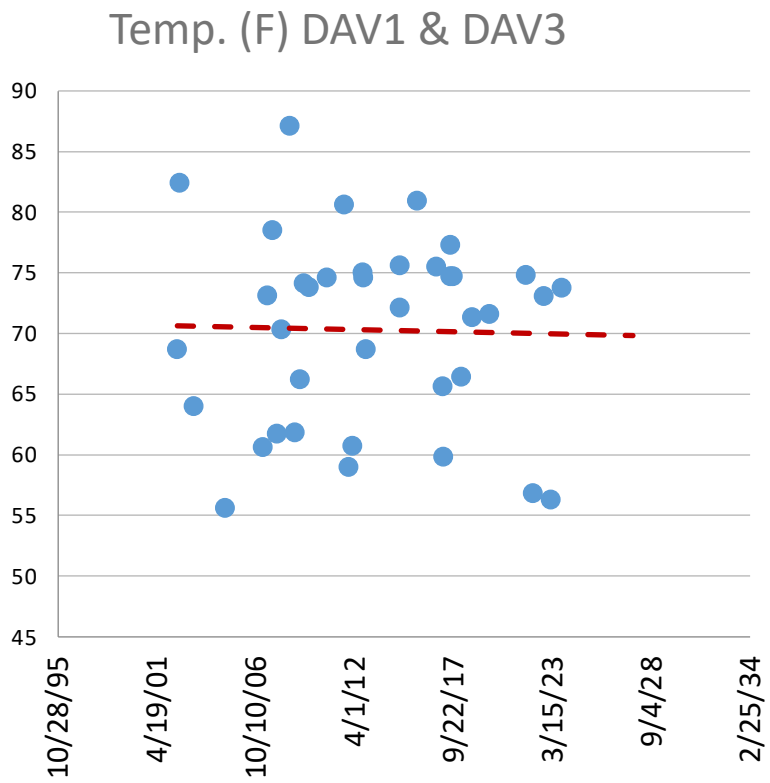
Source: Peter Christensen, BLM

Water quality – Temperature - Preserve

Temperature – (F)

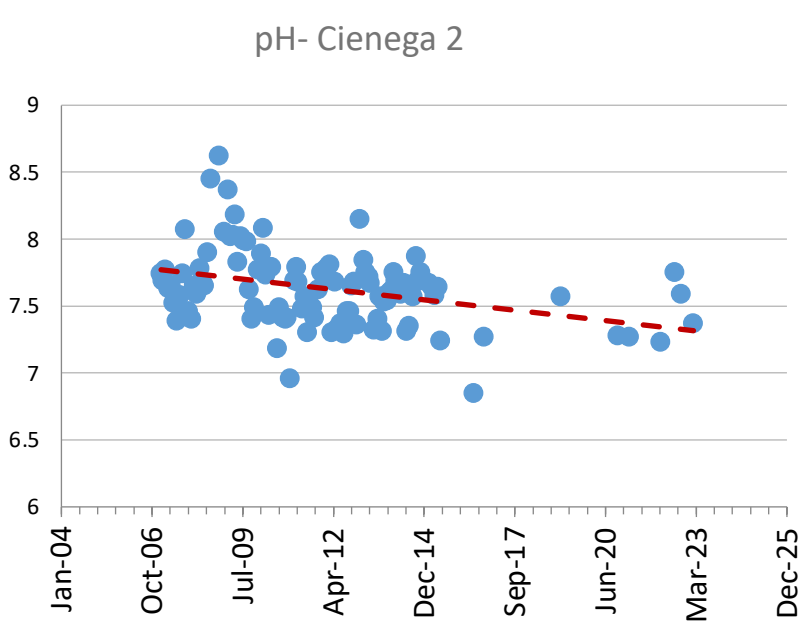


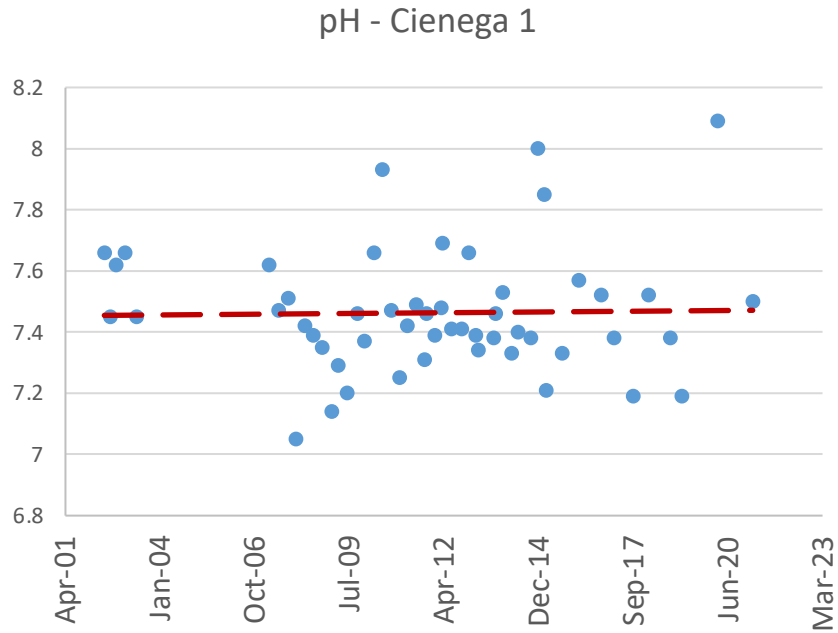


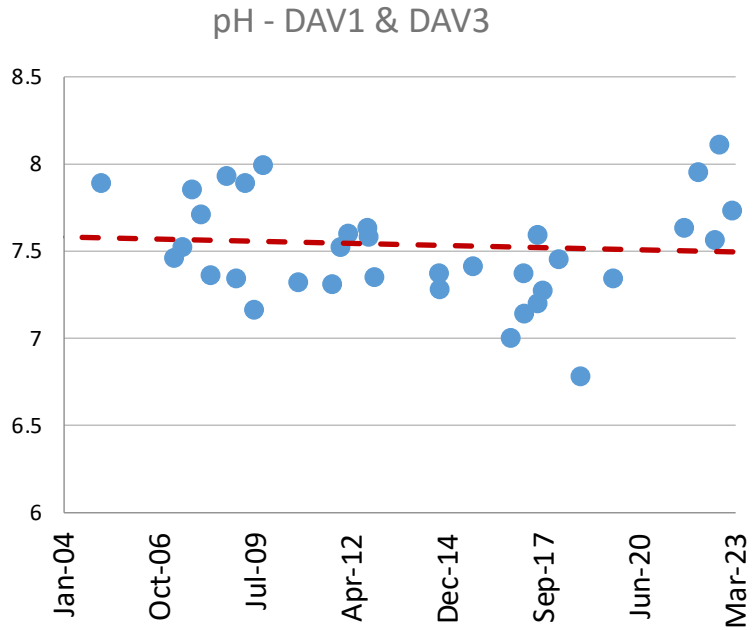


Source: David Scalero and Ian Murray, Pima County, Pima County Regional Flood Control District

Water quality – pH Preserve

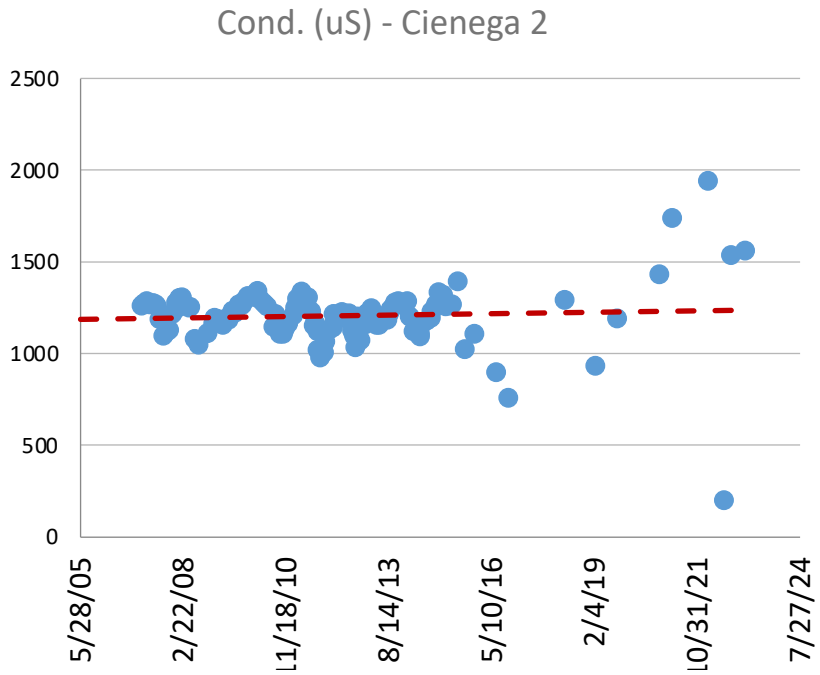


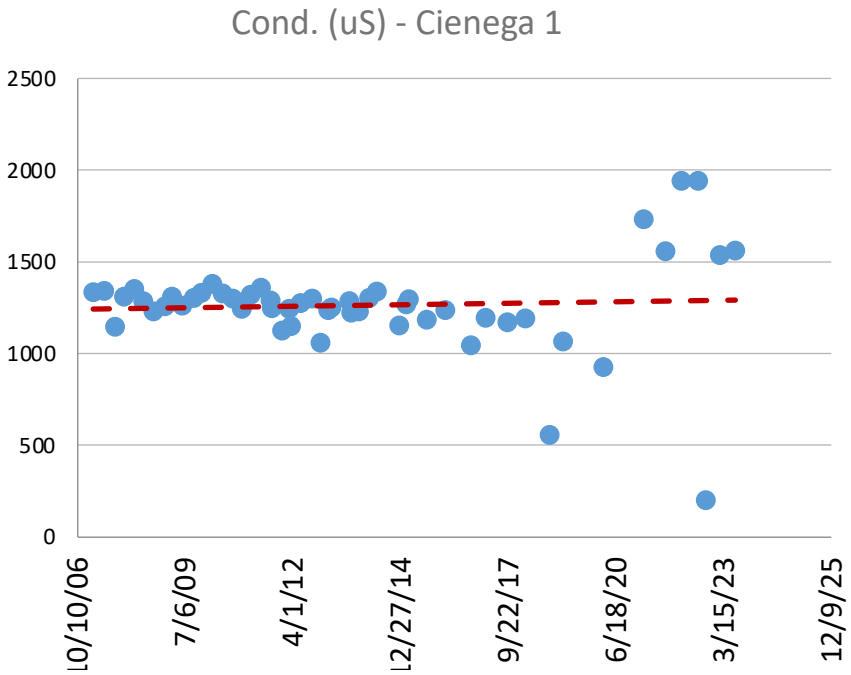


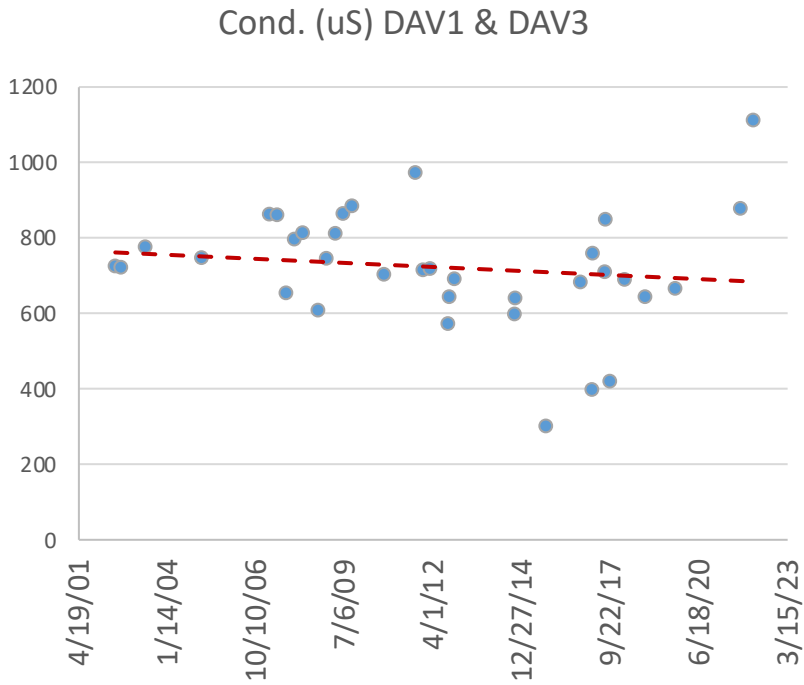


Source: David Scalero and Ian Murray, Pima County, Pima County Regional Flood Control District

Water quality – Conductivity - Preserve





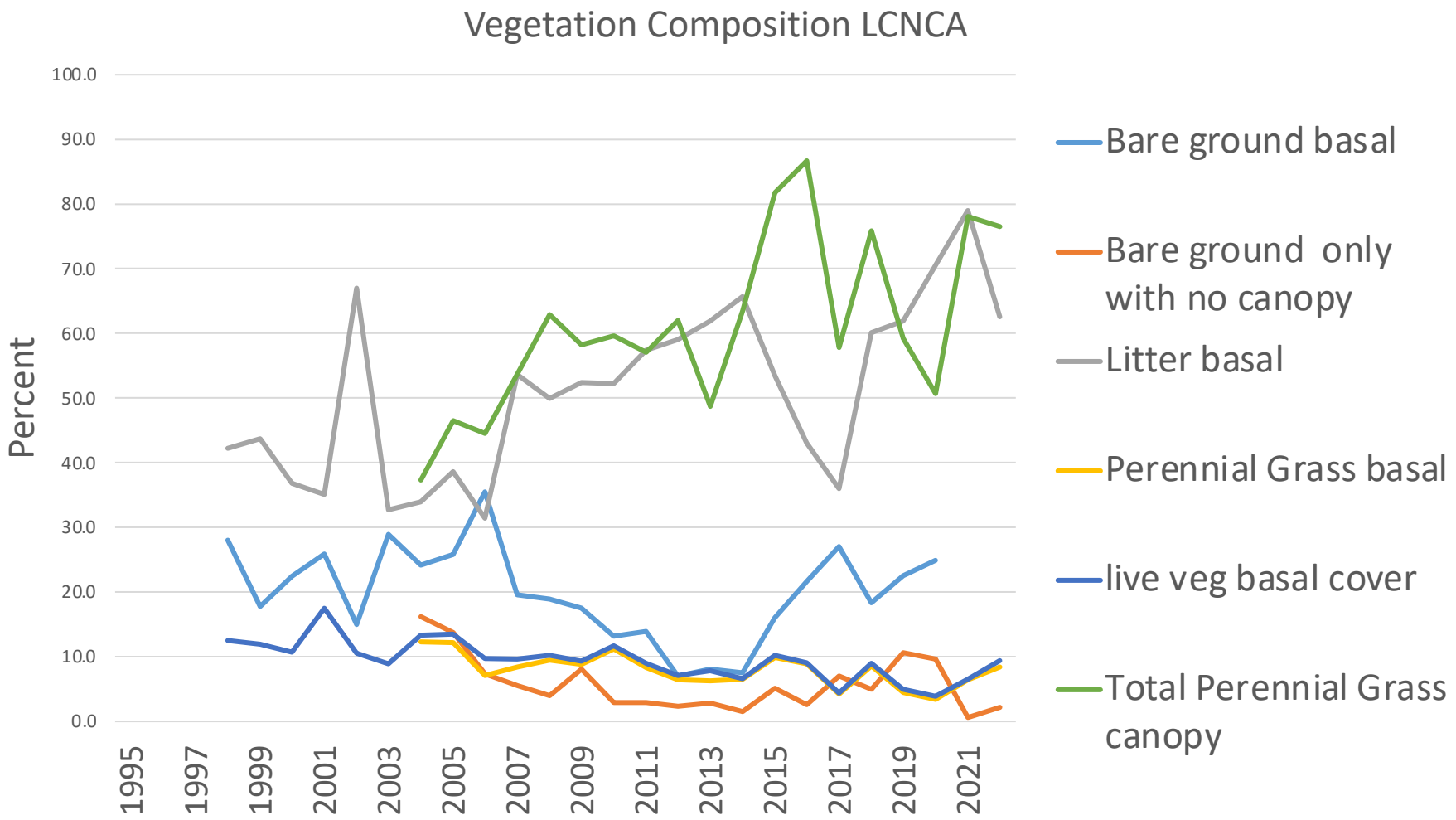


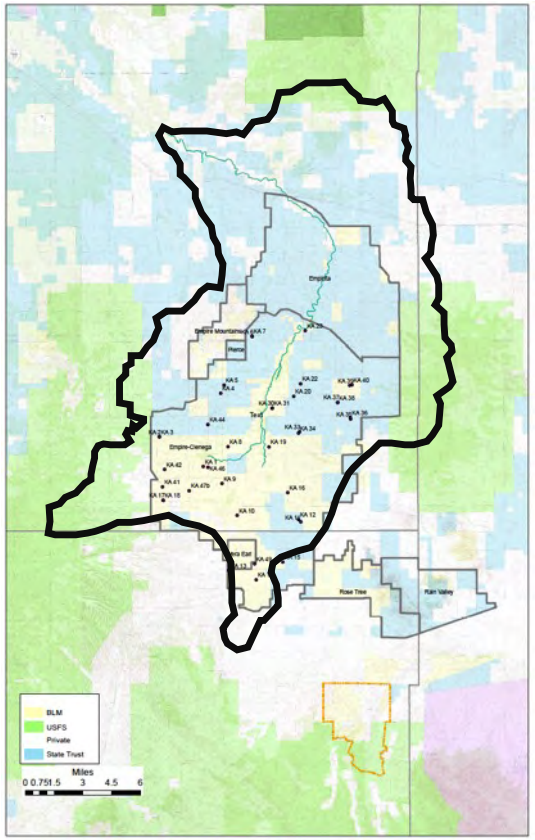
Source: David Scalero and Ian Murray, Pima County, Pima County Regional Flood Control District

Ecological

Indicator	No.	Description
Veg. vol./comp./cover	9	Land cover
Wildlife	10	Pronghorn
	11	Fish
	12	Frogs
Fire	13	Coverage, severity
Birds	14	Riparian and grassland
NDVI	15	Riparian and watershed

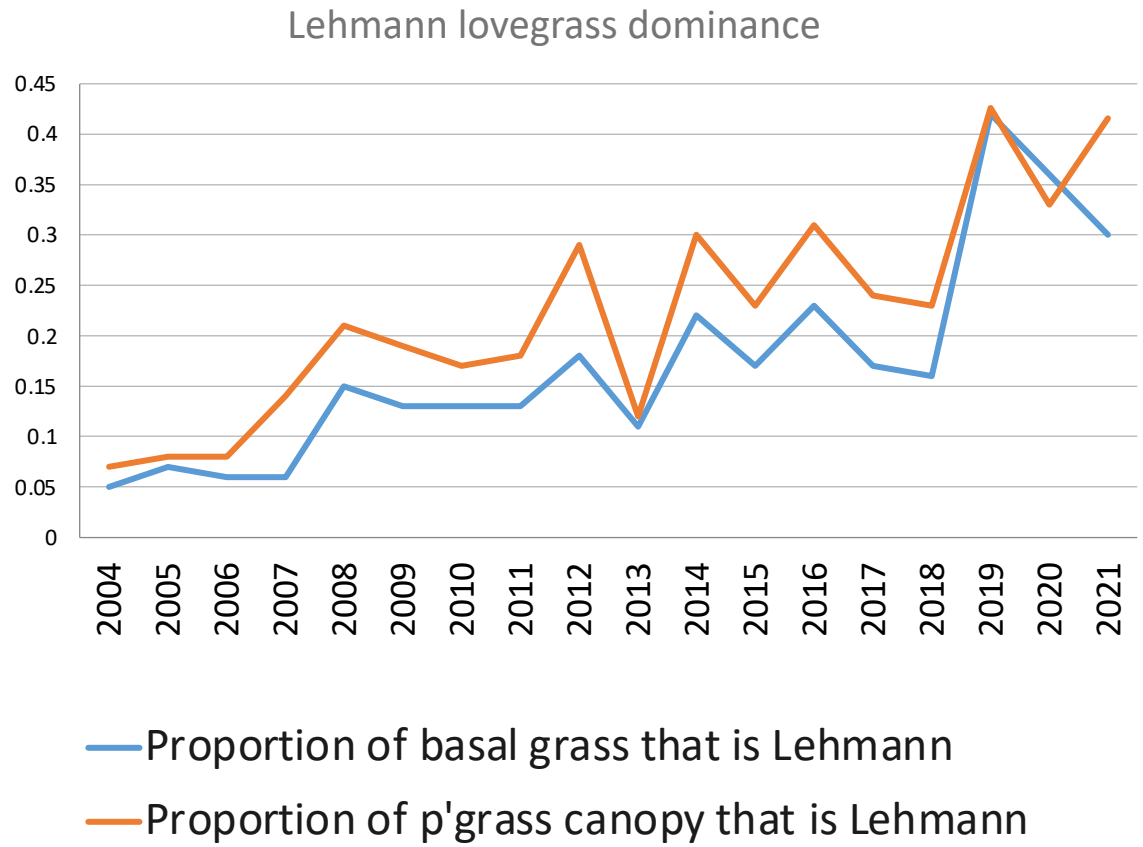
Vegetation composition (BLM)

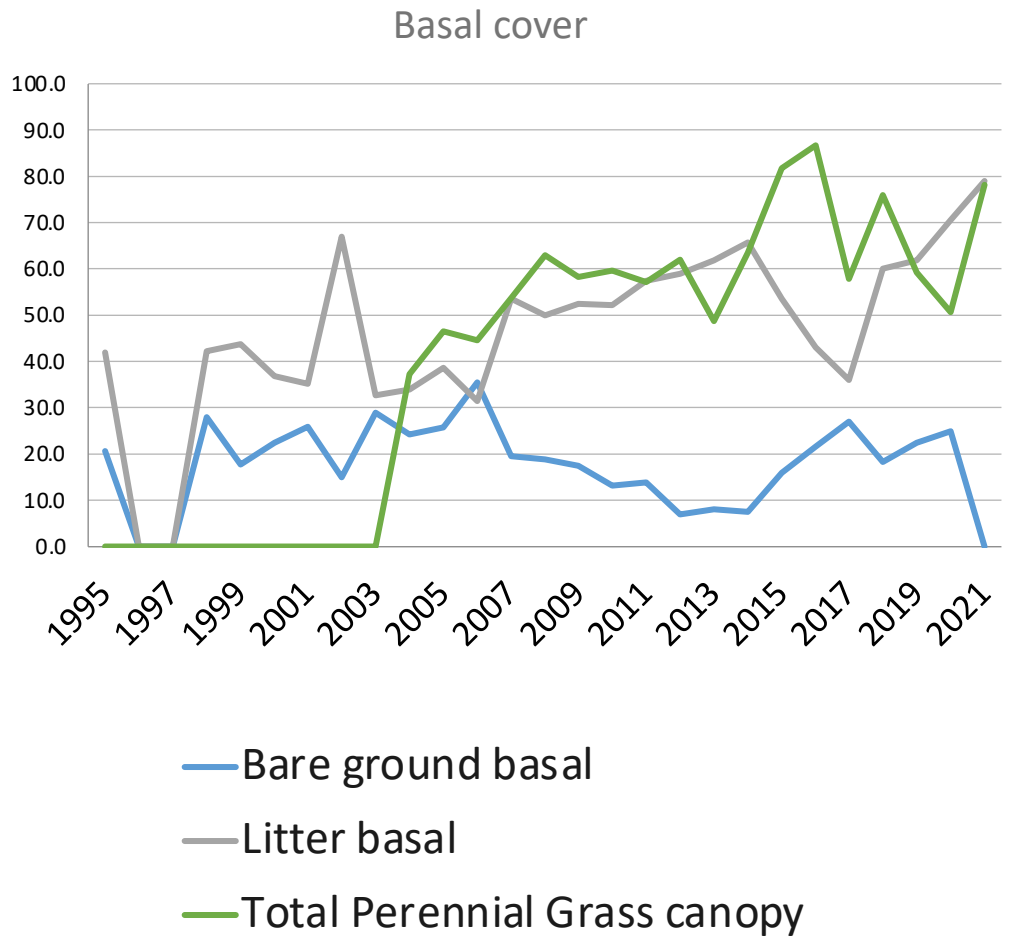




Source: Theresa Condo, BLM (for 2019); Emilio Corella, BLM (2020)

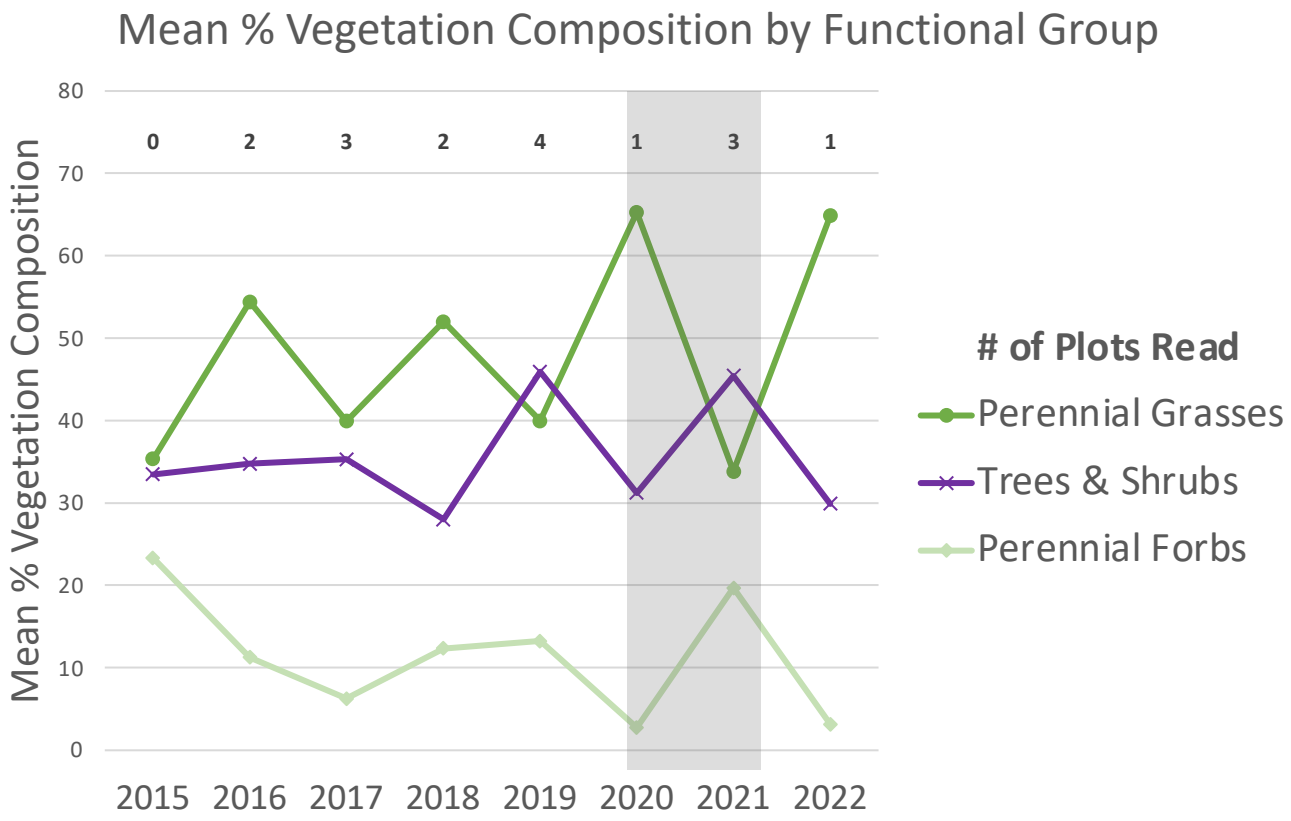
Vegetation composition – Basal cover (BLM)

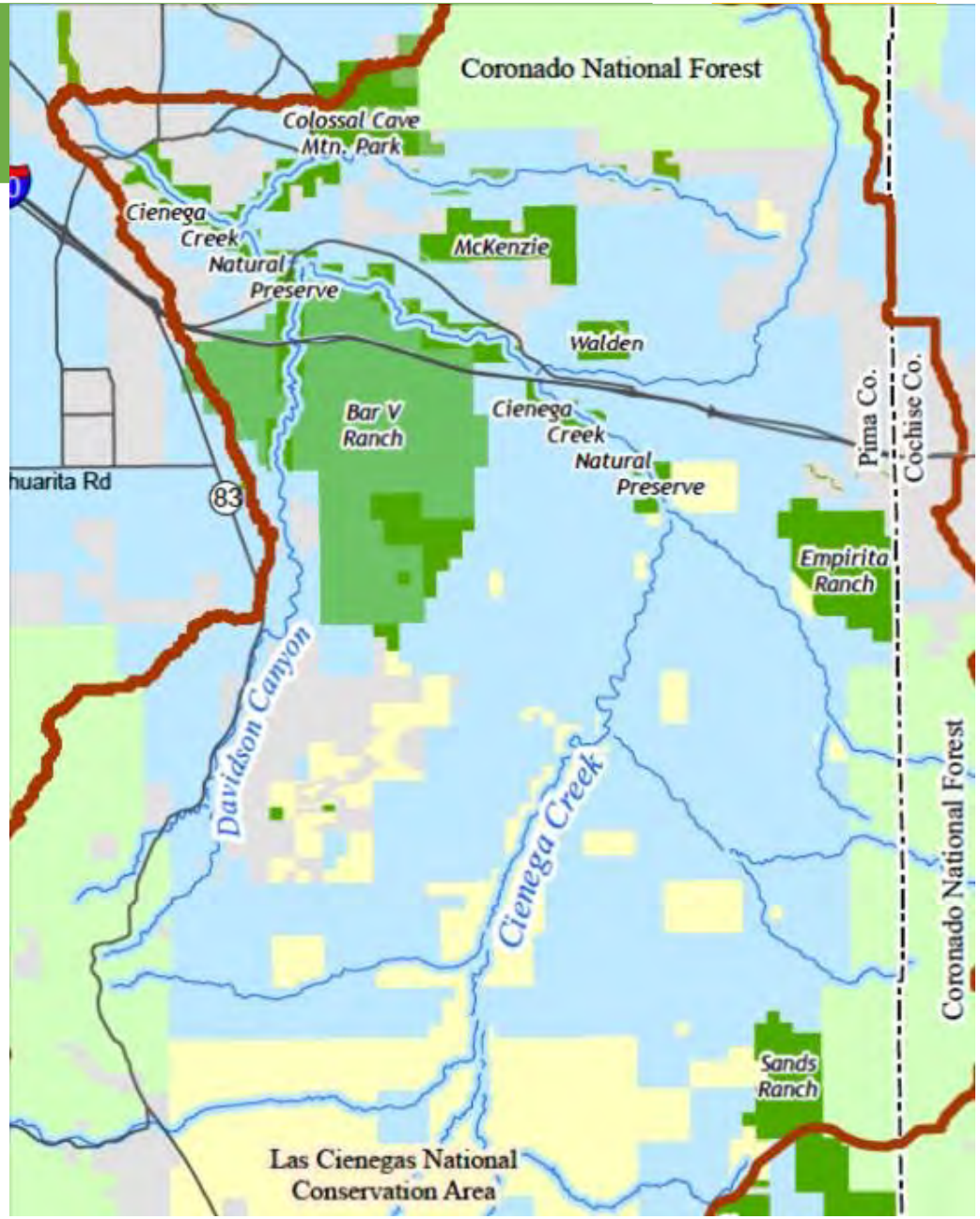




Source: Theresa Condo, BLM; Aaron Peretz, BLM

Vegetation composition – Pima County

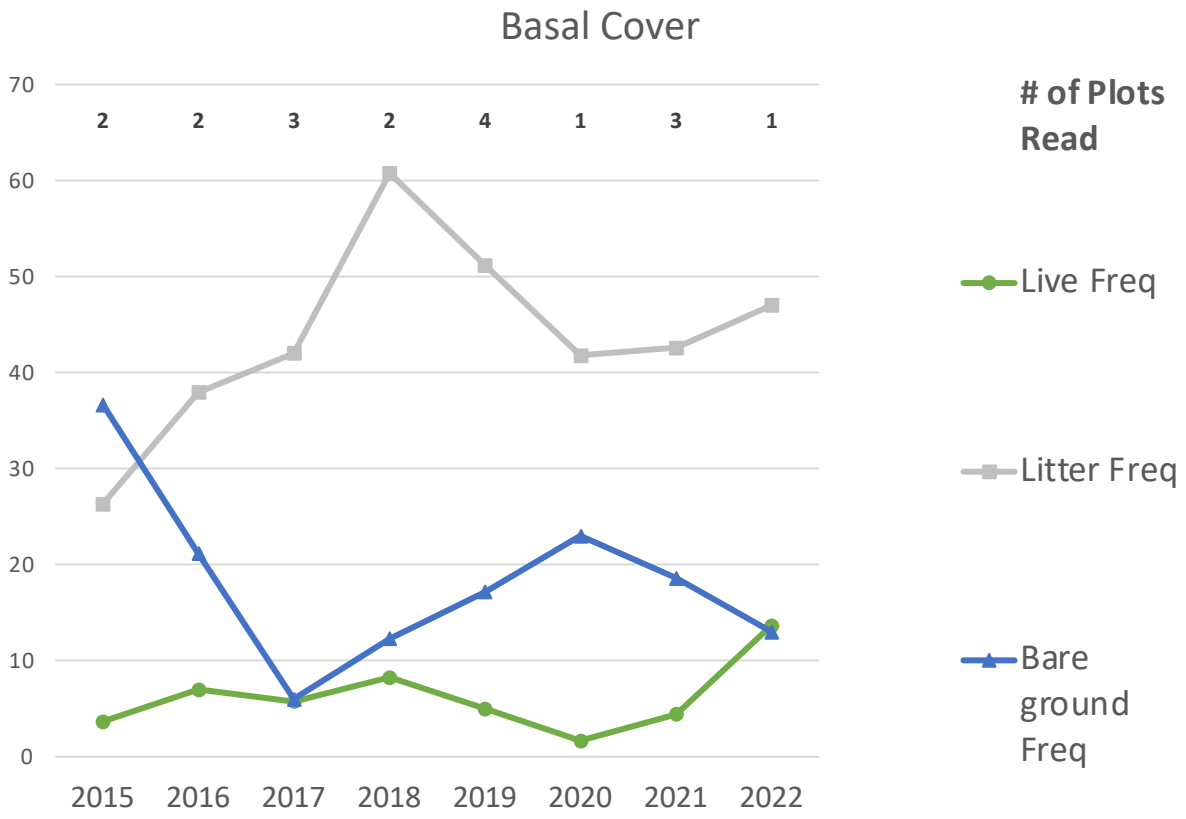


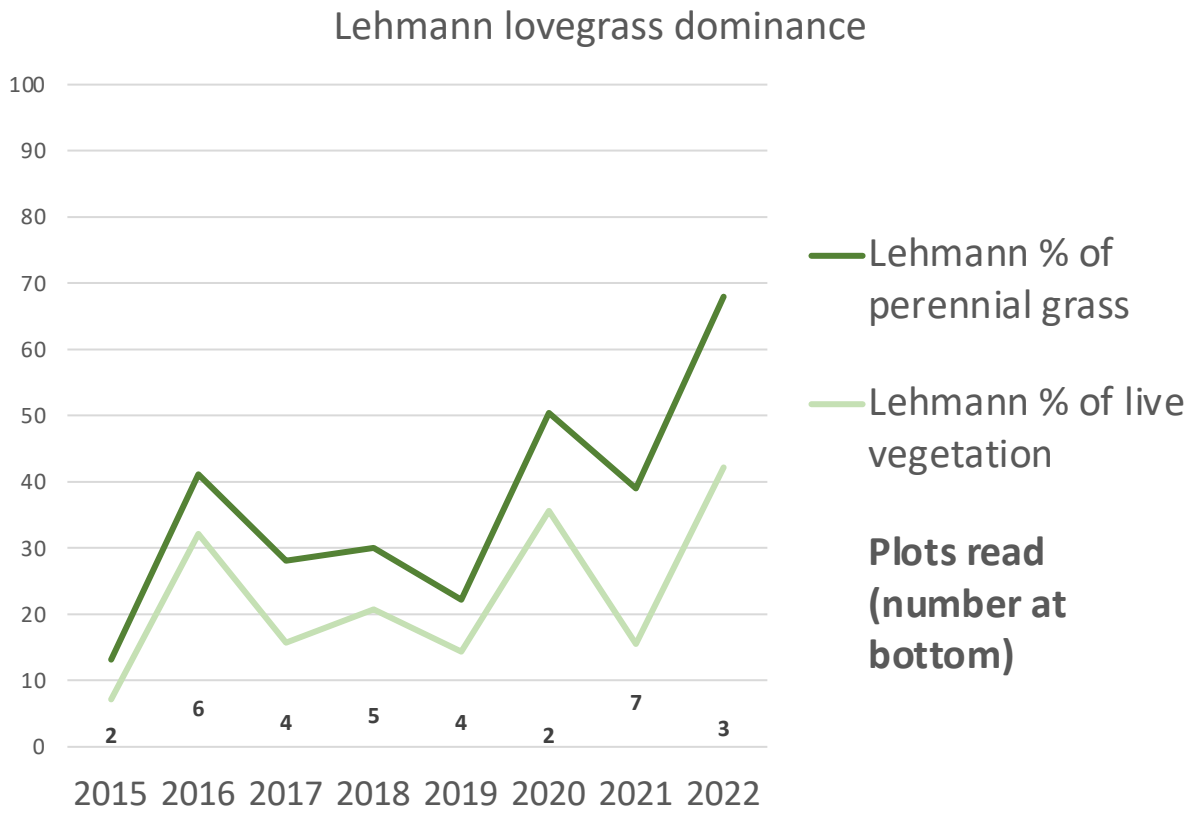


"Number of plots read is at the top - gray columns are added manually and indicate only a few plots read that year, so data is probably less reliable."

Sami Hammer and Ian Murray, Pima County

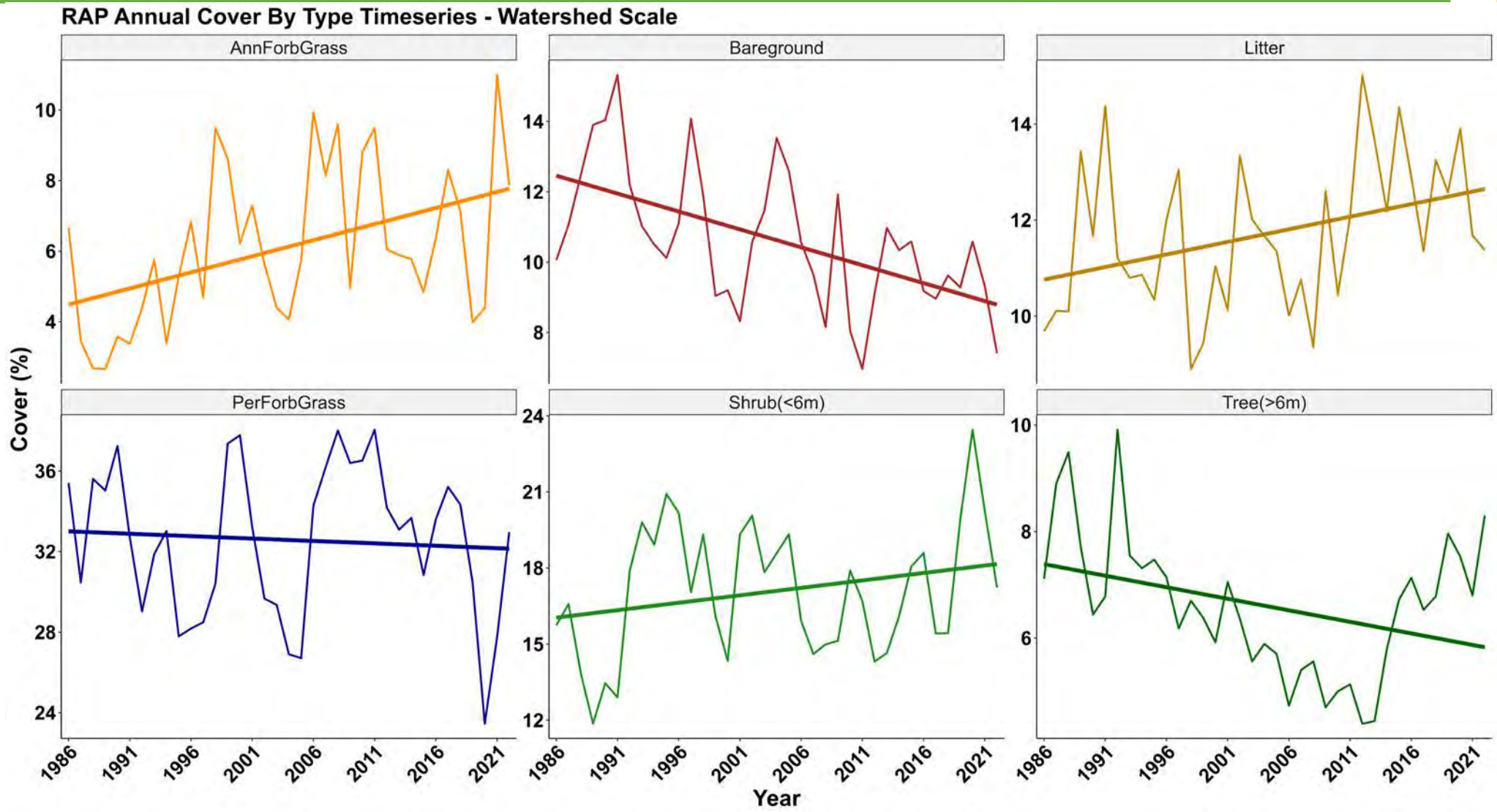
Vegetation composition – Pima County





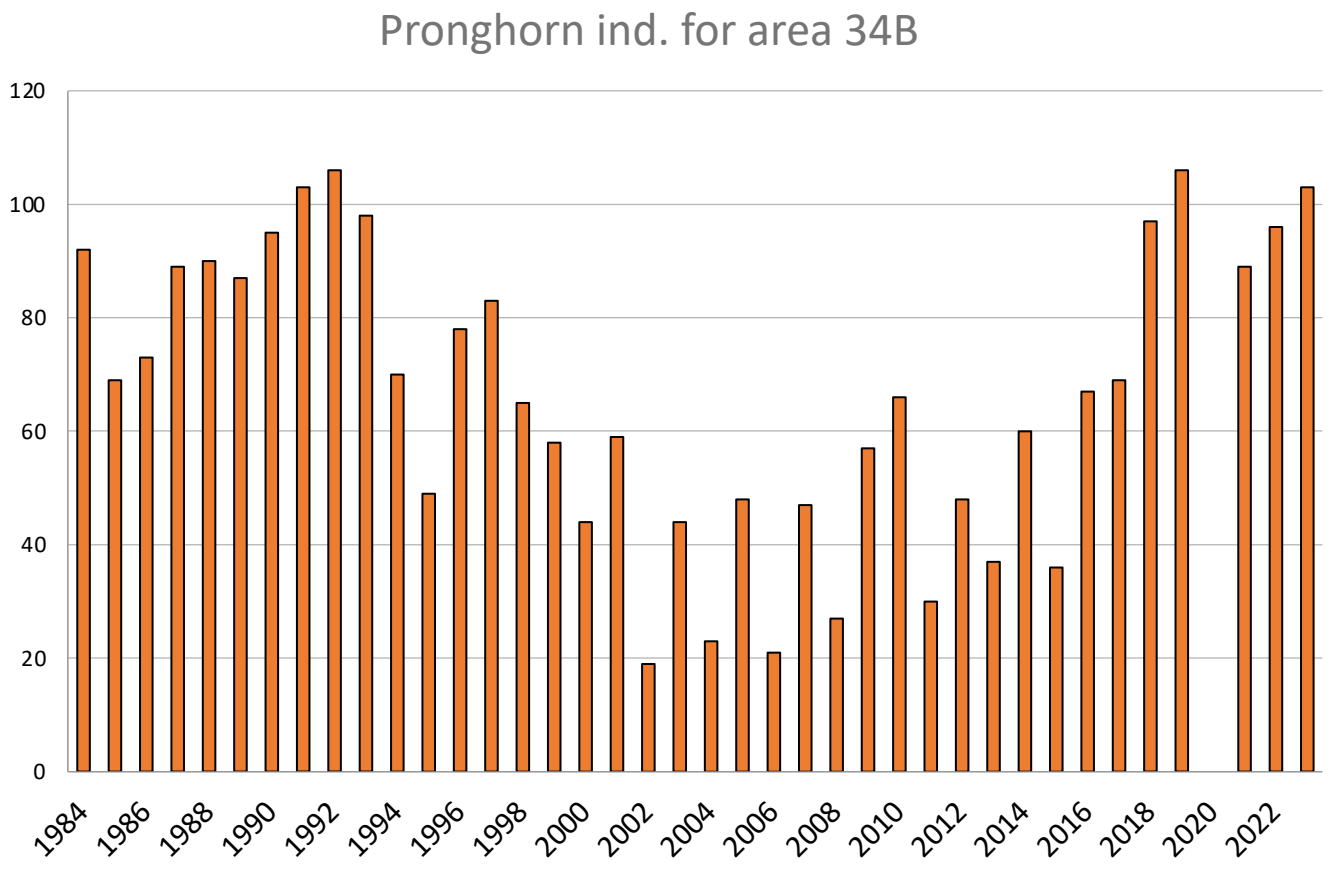
Source: Sami Hammer and Ian Murray, Pima County

Veg Composition - Rangeland Analysis Platform (30m)



Source: Austin Rutherford, UArizona

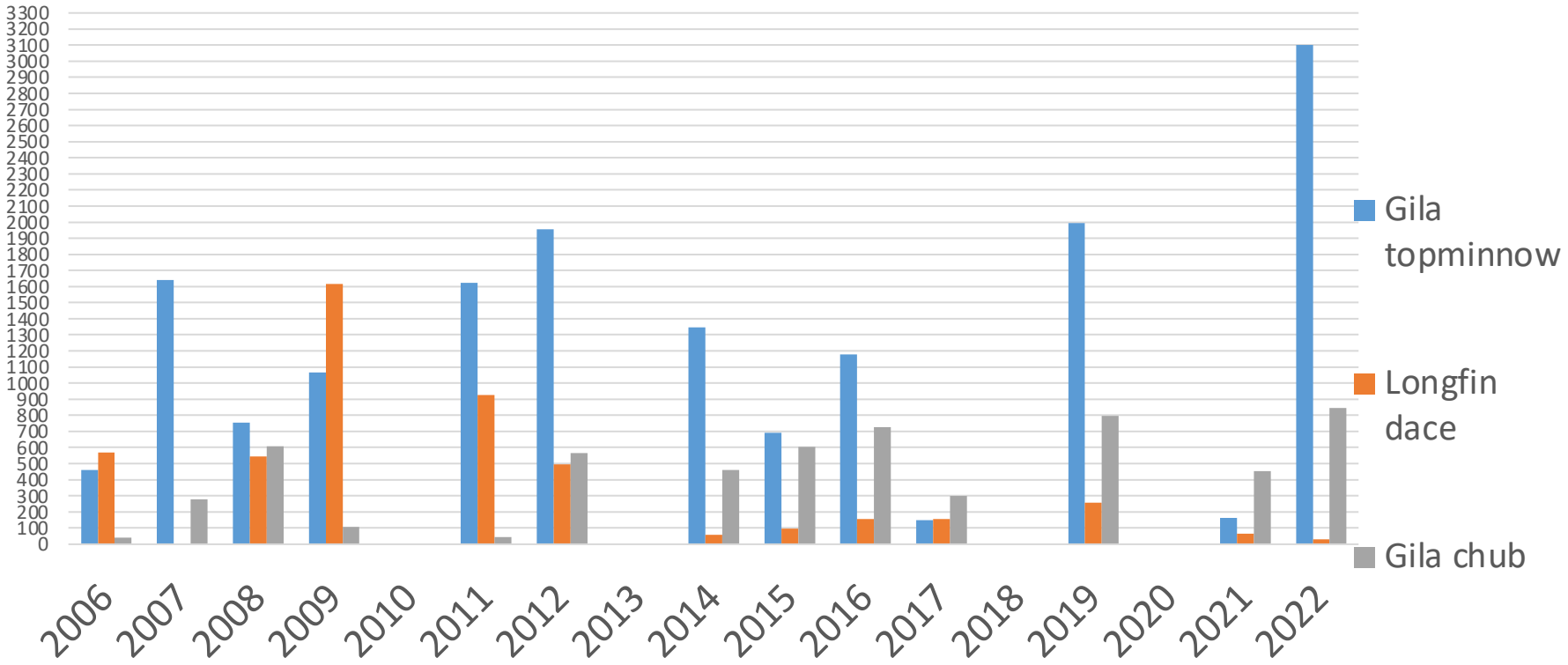
Pronghorn



Pronghorn (*Antilocapra americana*) is a mammal indigenous to North America. Although not an antelope, it is known colloquially as the American antelope

Source: Rana Tucker, Arizona Game and Fish Department

Fish



Gila Topminnow (*Poeciliopsis occidentalis*) was listed as endangered species under the ESA in 1967.

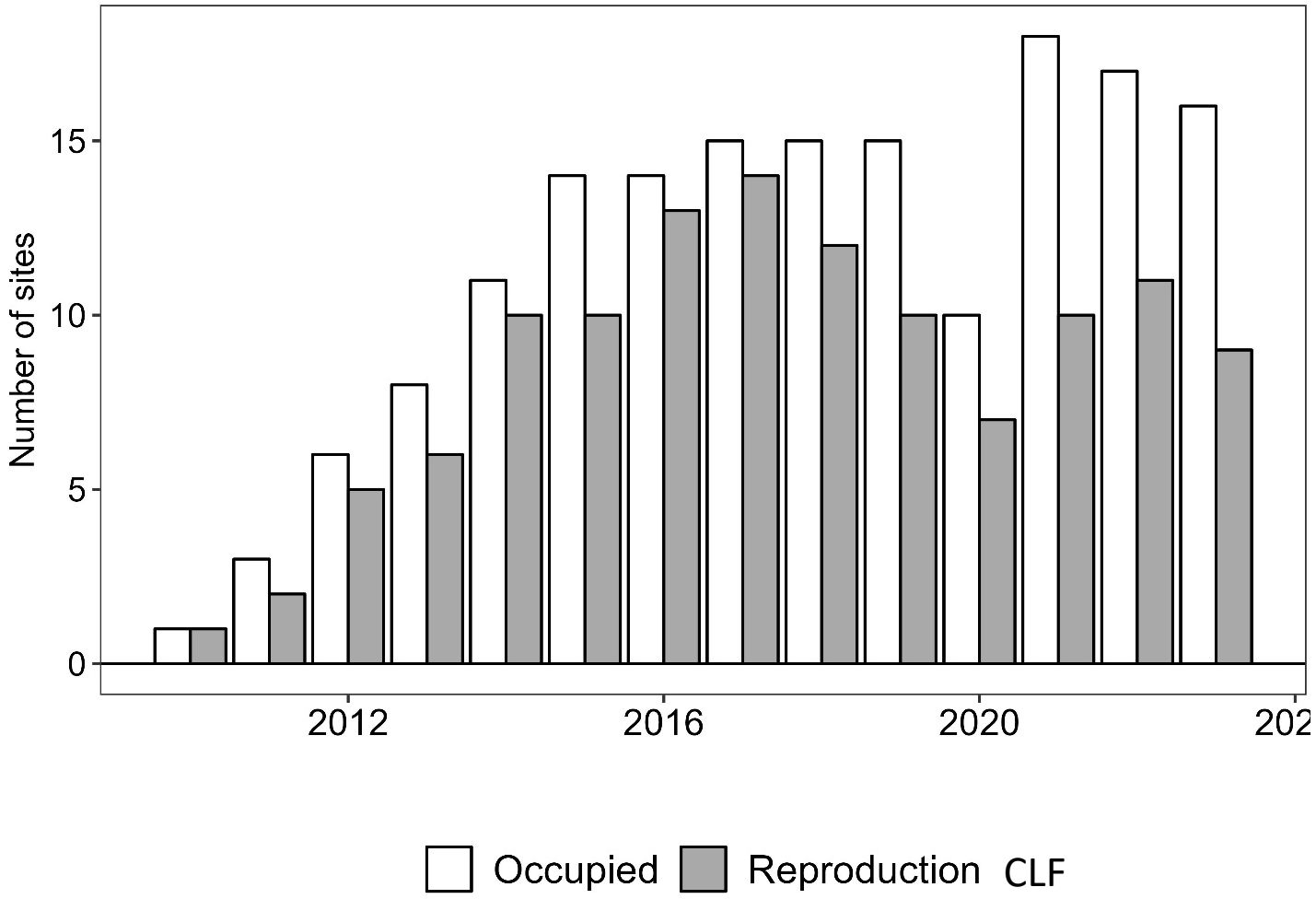
Gila chub (*Gila intermedia*) was listed as endangered species under the ESA in 1998.

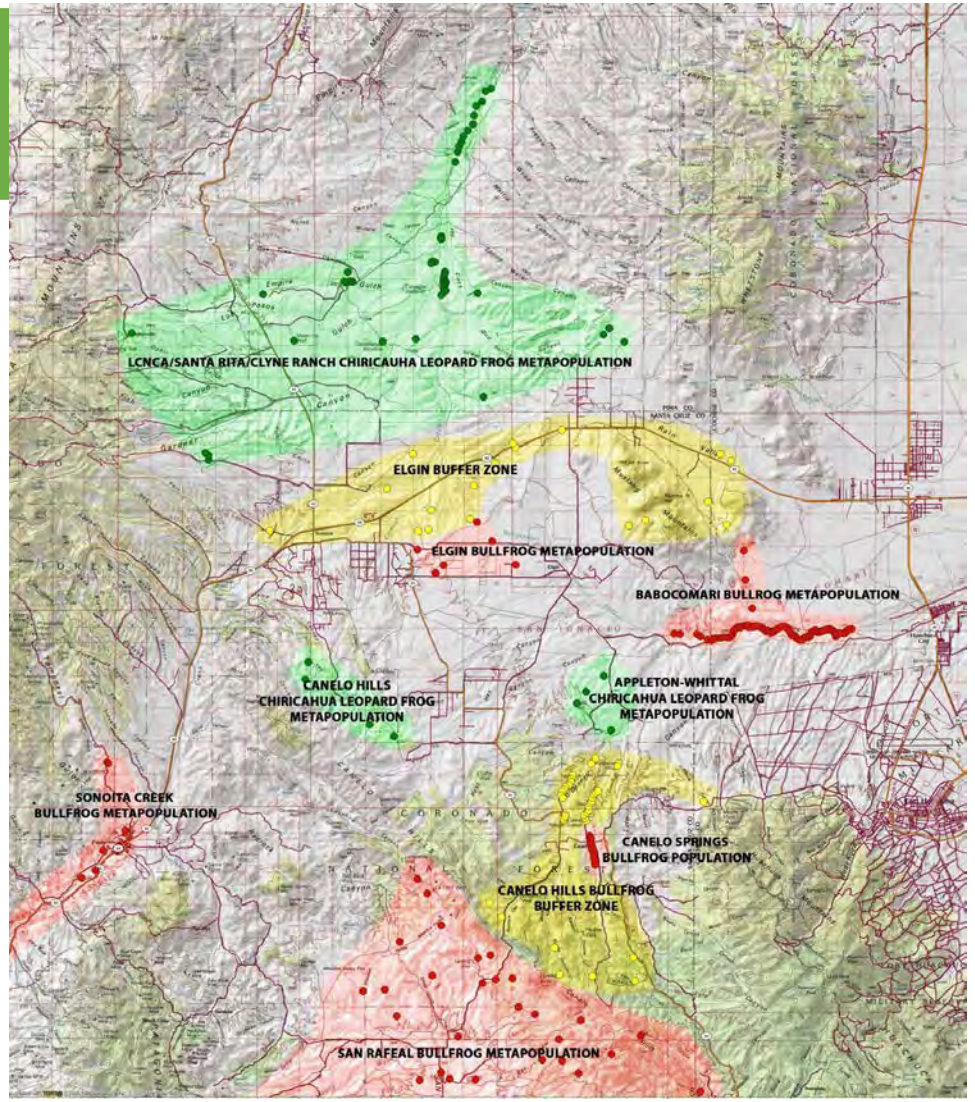
"Native fish populations in Cienega Creek appear stable."

"Be careful in how you use the data. By reporting number of fish captured and not reporting effort there is no comparable measurement between years. Also, please note that this data set uses methods that specifically target Gila Chub. This means that we use a sampling technique that selects for this species so other species of fish may not be accurately represented."

Christina Perez, BLM

Frogs – Chiricahua (CLF) vs. Bullfrog (BF)





Green dots & areas = CLF rep. sites & distribution

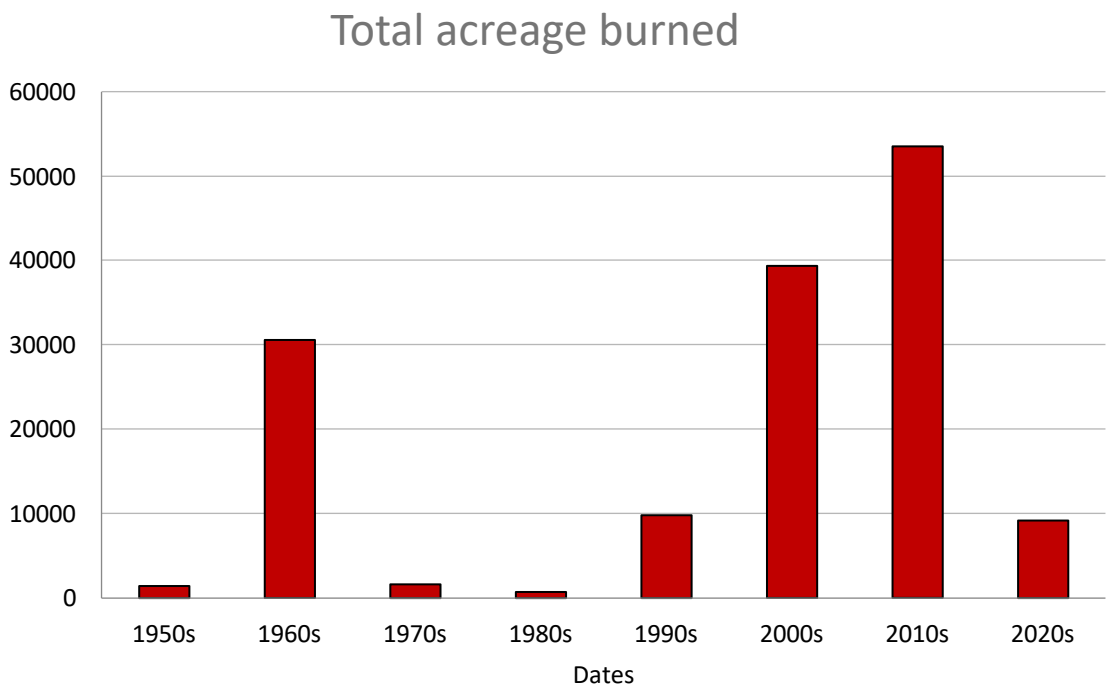
Yellow areas = buffer zones (BF removed)

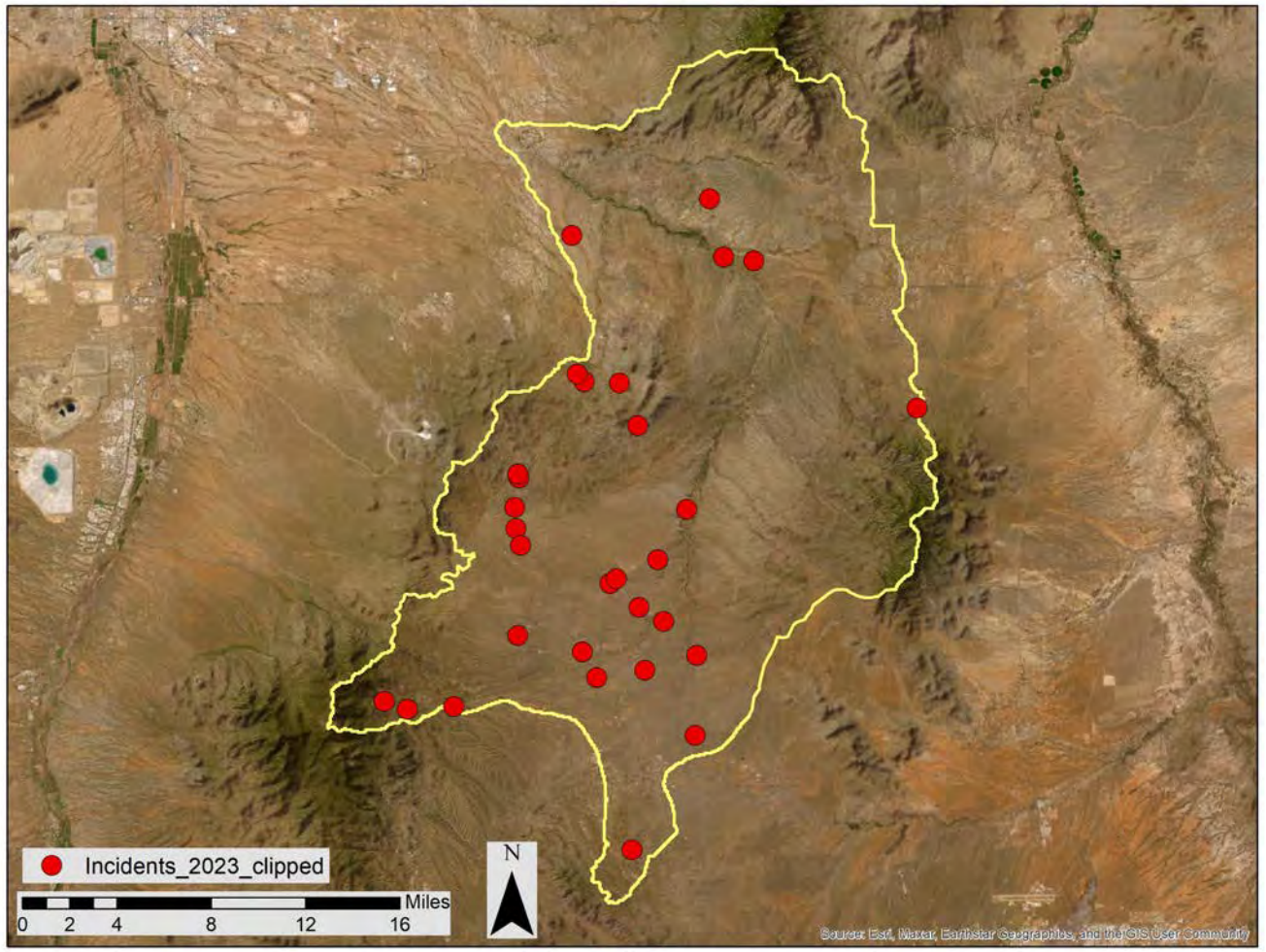
Red dots & areas = BF rep sites & distribution

Source: Javan Bauder, CWP-Frog Project

Wildfires

30 fires occurred in 2023 burning a total of 9,190 acres (2 cases show 0 acres burned). 9 fires were naturally caused, 15 were human caused, the rest undetermined.



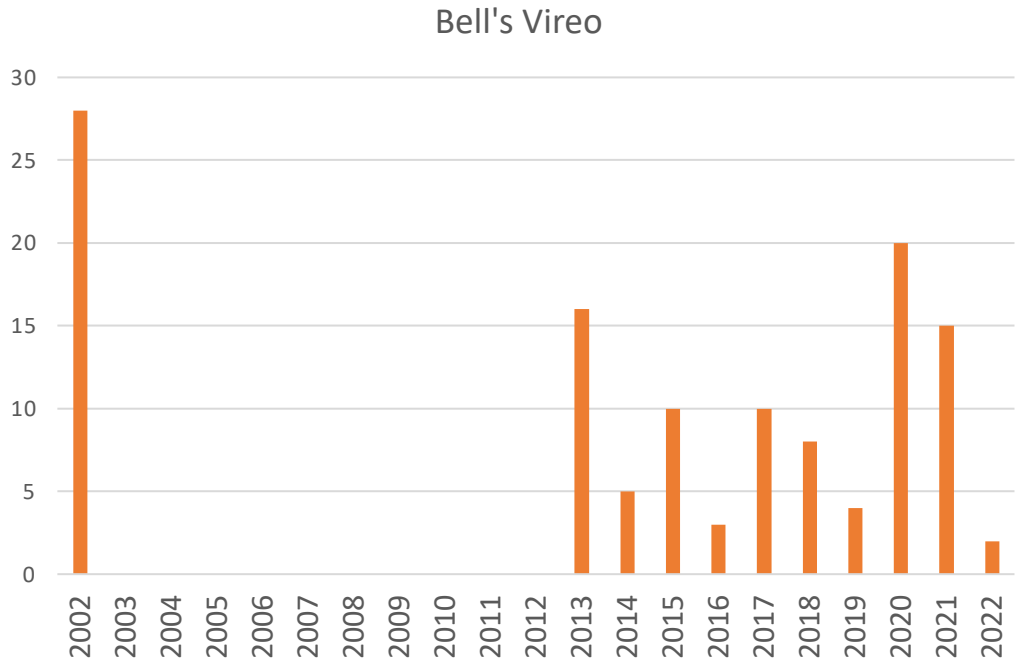


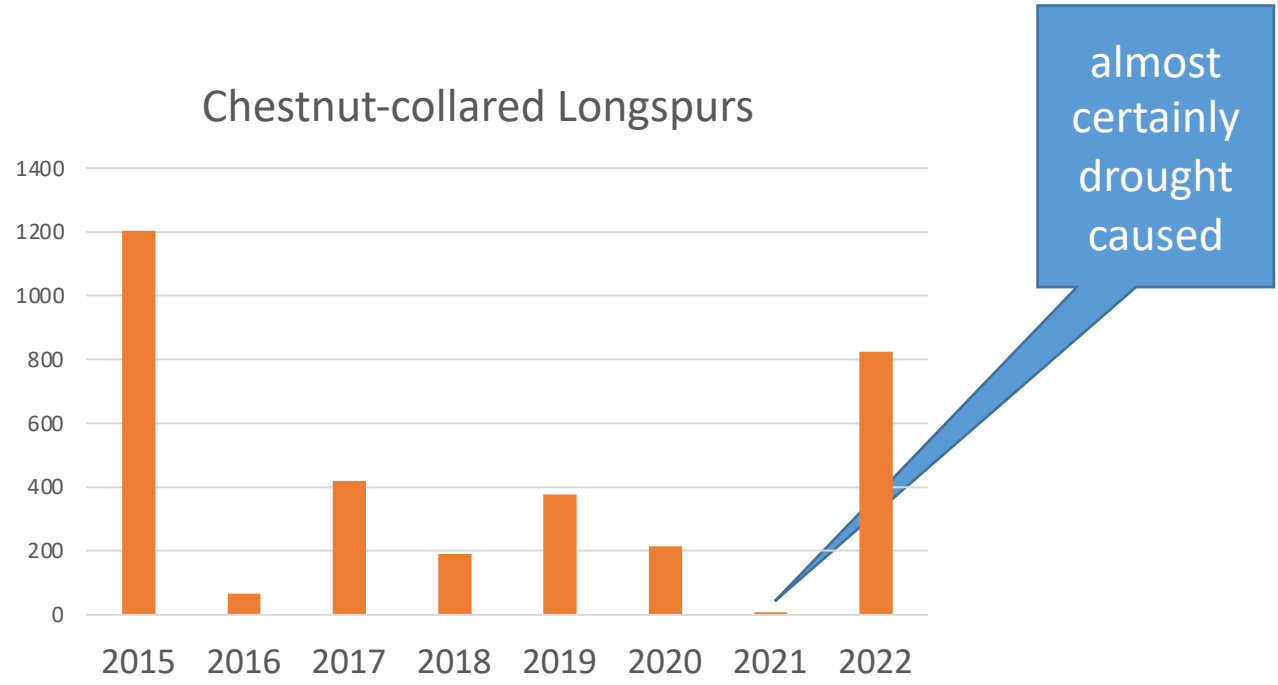
Site: National Interagency Fire Center
Source: Tiffany Verlander, BLM

Birds

Bell's Vireo is a riparian migratory species, so the count is done during the autumn. It is also seen in mesquite bosques.

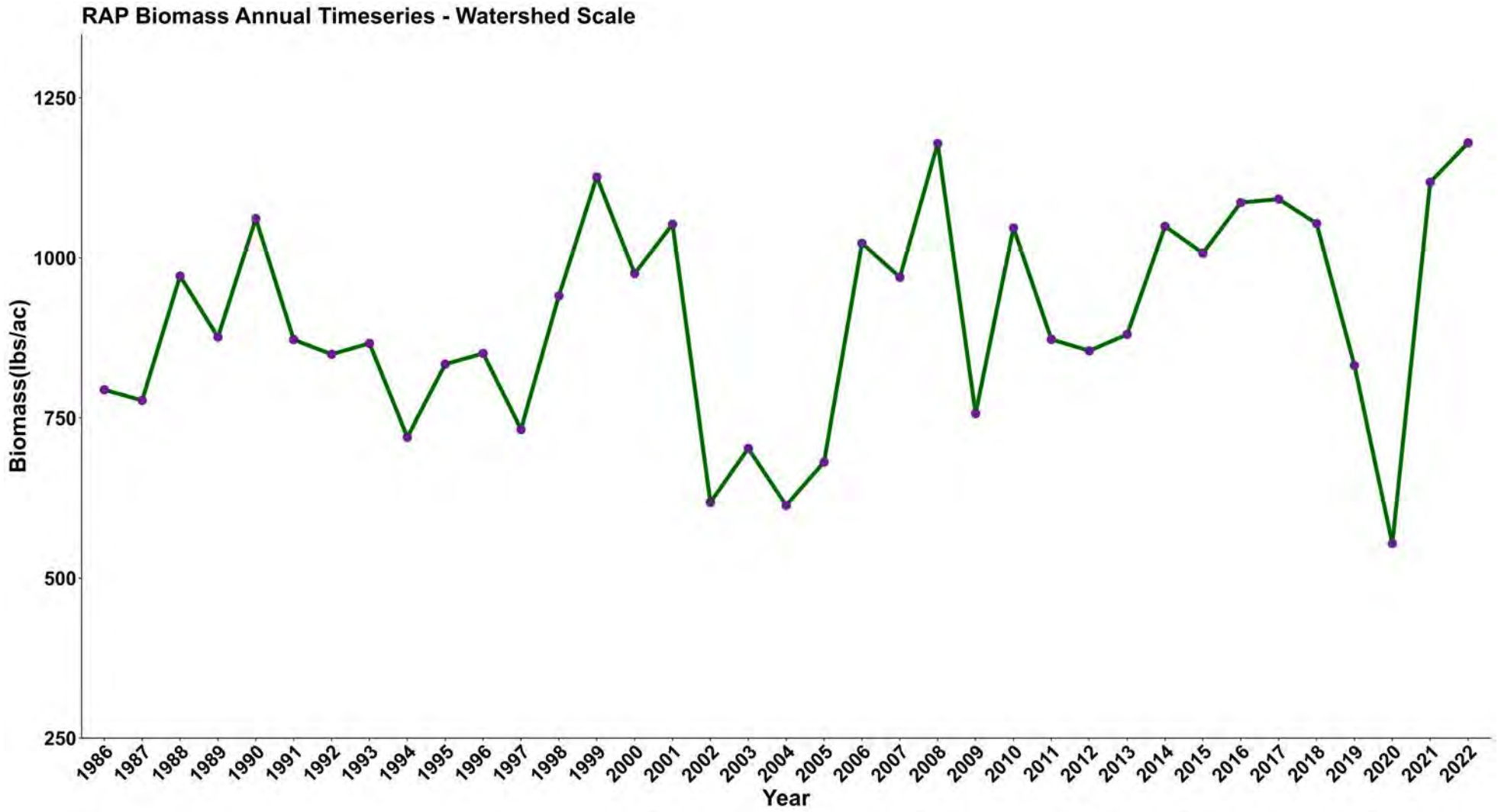
Chestnut-collared Longspurs is detected in the grasslands and is one of most rapidly declining bird species in North America. Data is collected in the winter.





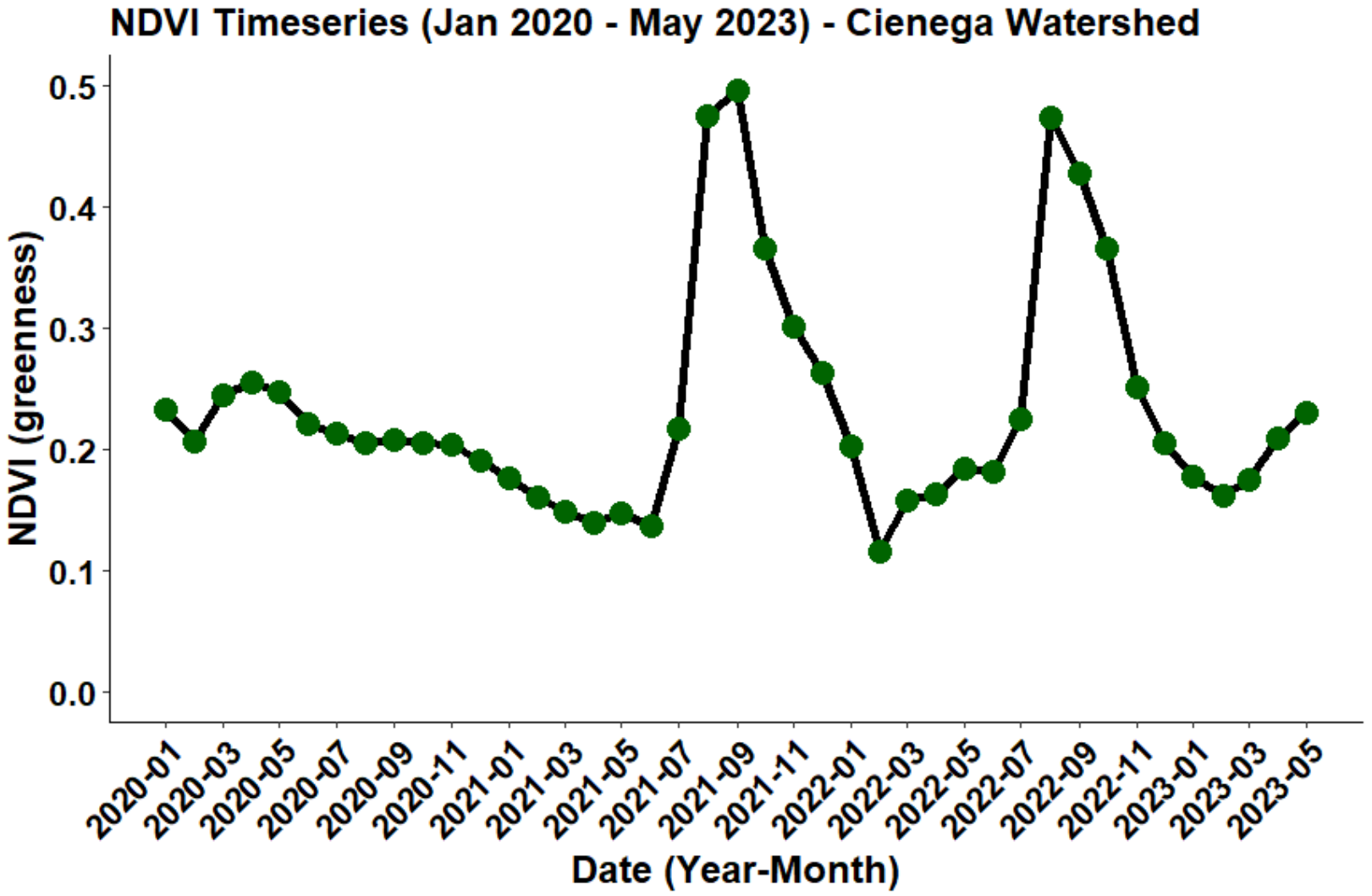
Source: Jennie MacFarland, Audubon Society

Watershed Biomass - Rangeland Analysis Platform (30m)



Source: Austin Rutherford. USDA – Agricultural Research Service

Watershed - NDVI

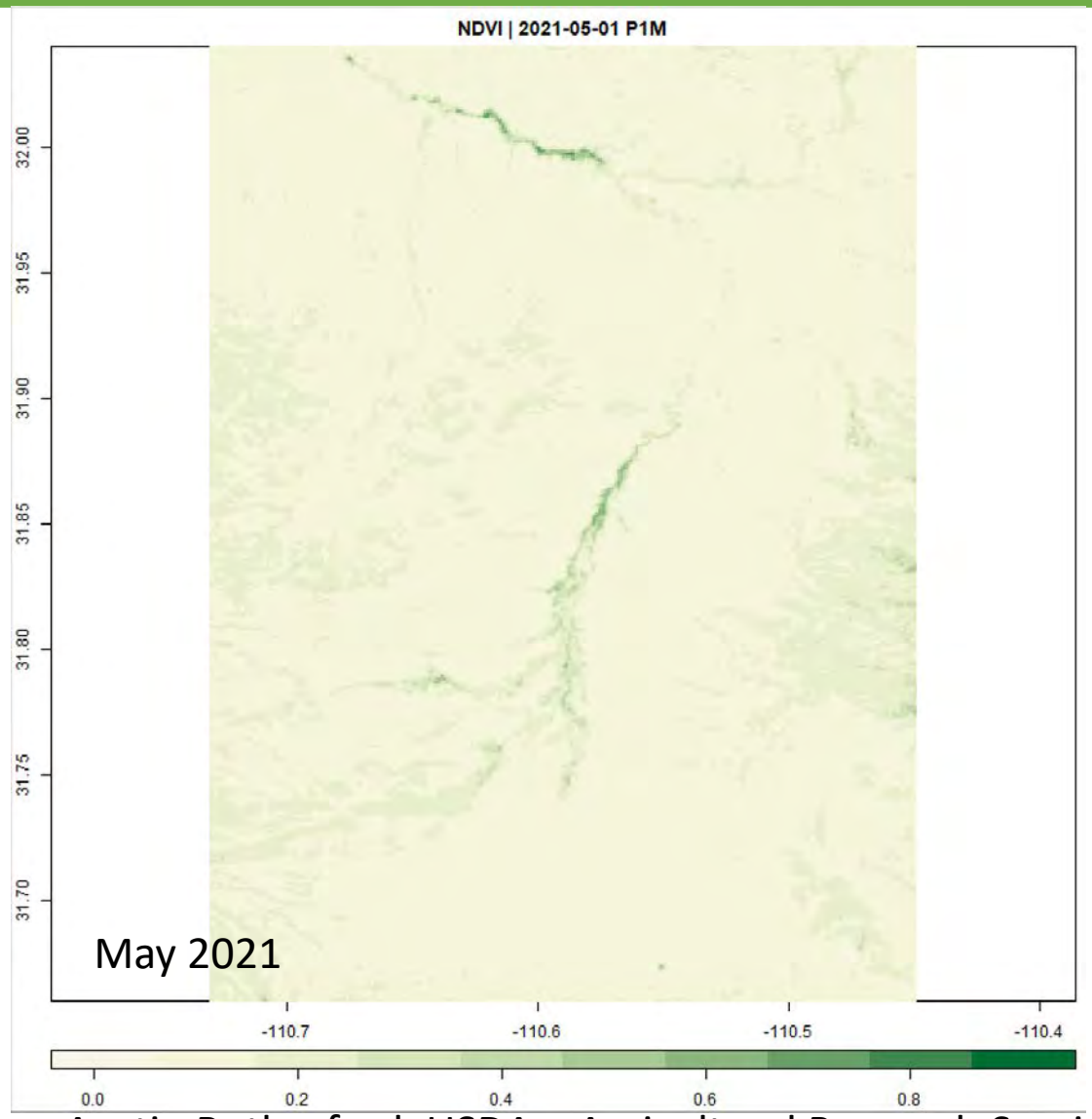


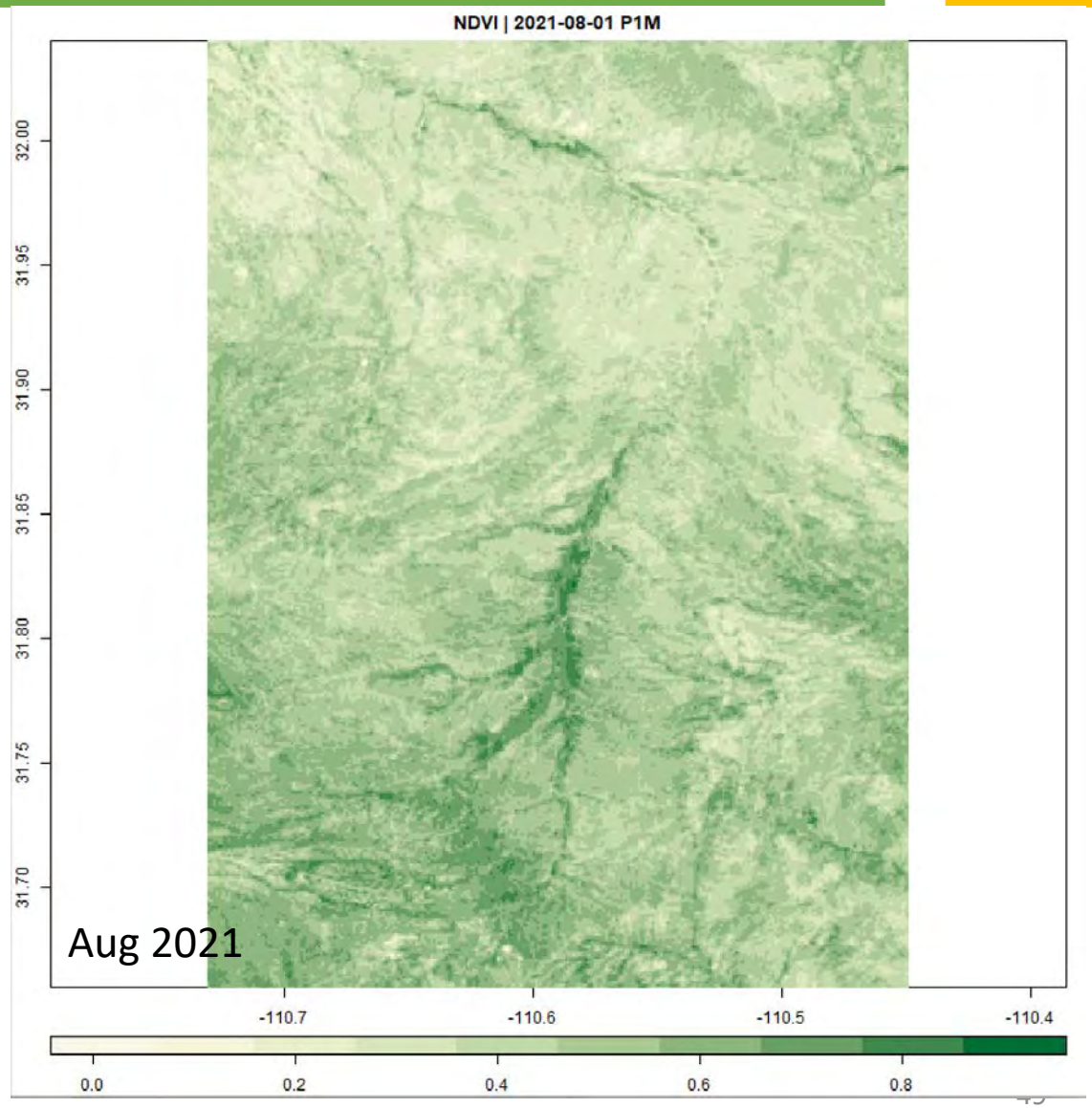
"...NDVI values (show) the dry 2020, wet 2021/22, and then the lackluster 2023 until May."

Austin Rutherford

Source: Austin Rutherford, USDA – Agricultural Research Service

Watershed Biomass - Rangeland Analysis Platform (30m)



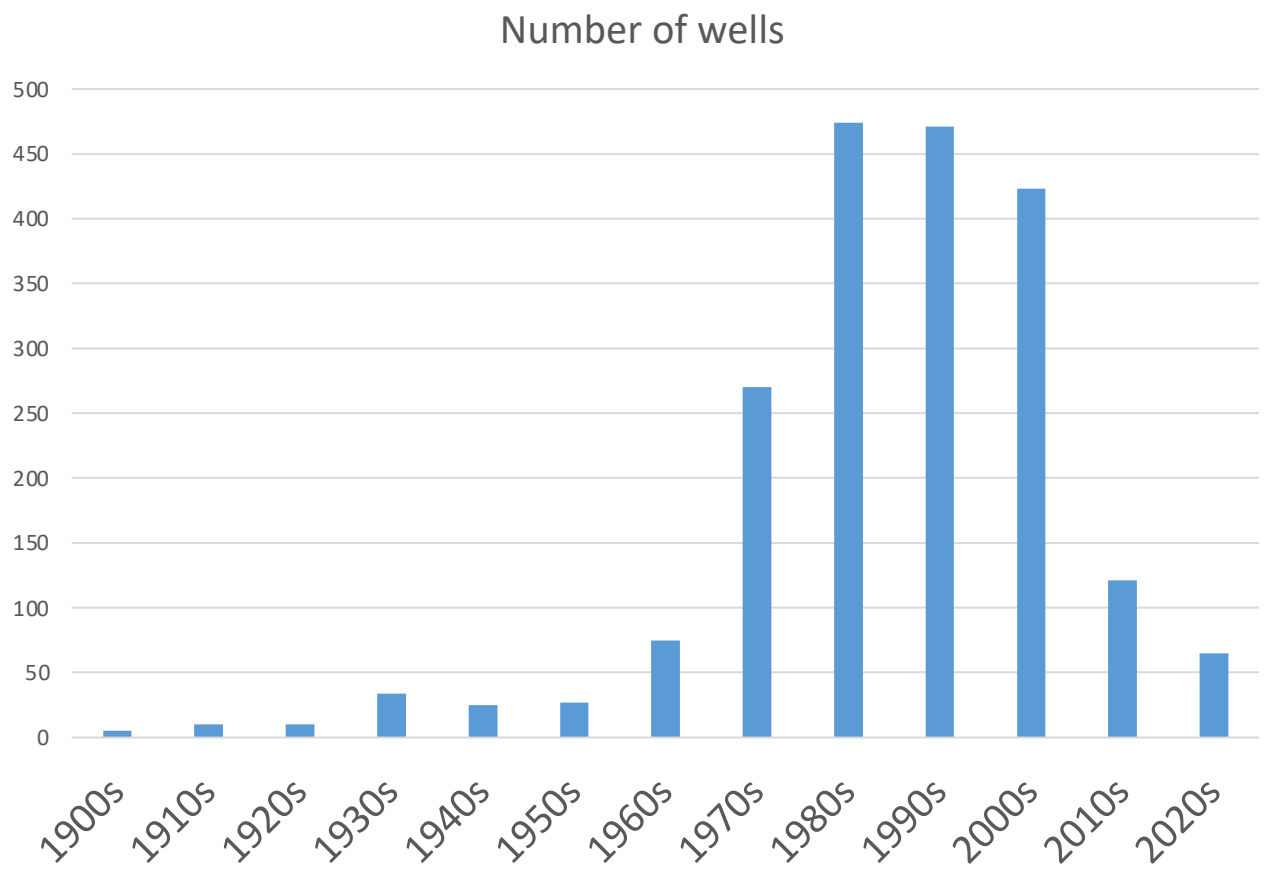


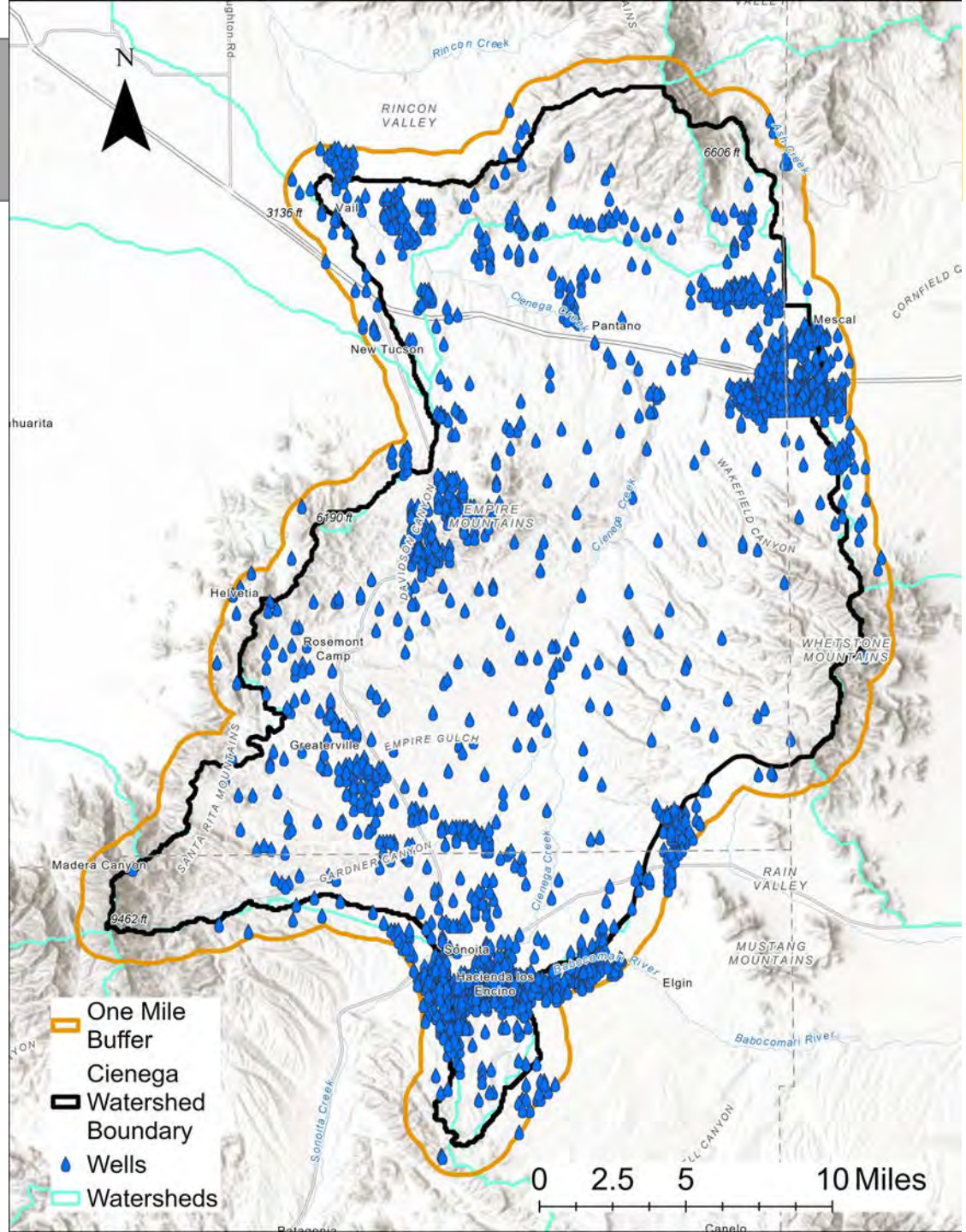
Source: Austin Rutherford. USDA – Agricultural Research Service

Socio-cultural

Indicator	No.	Description
~~**Economic vitality**~~	~~15~~	~~Median household income, median home values, unemployment, residents below poverty level~~
~~**Land-use land-cover change**~~	~~16~~	~~Land use and land cover change~~
Number of wells	17	Number of wells installed within the watershed and buffer area of 10 mi
Archaeological site conditions	18	Trend in site conditions, both human and natural-caused damage.
Number of recreational permits	19	Number of recreational permits over time
Stewardship engagement programs	20	Number of opportunities for active engagement

Wells

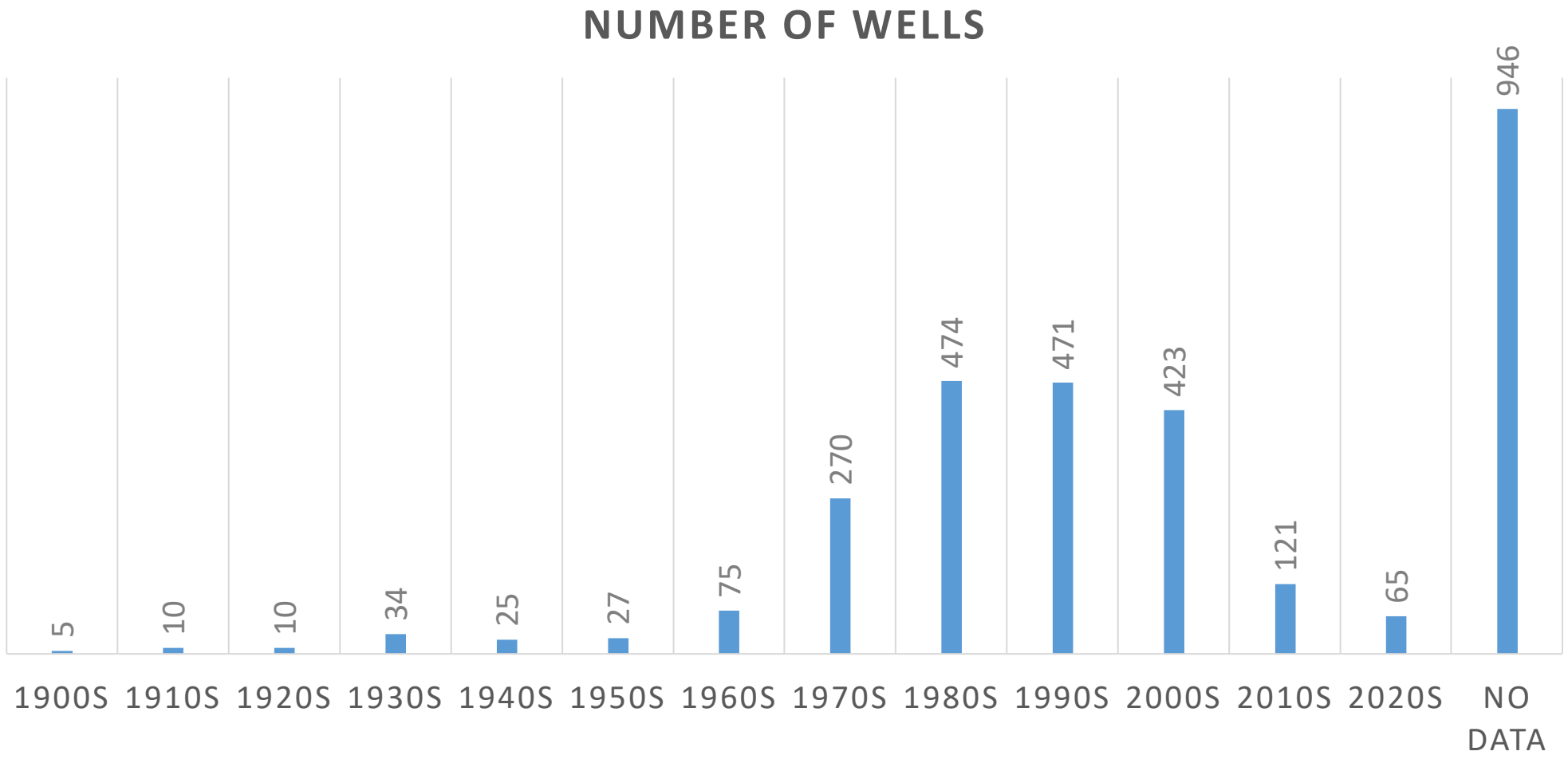




Data source: Arizona Department of Water Resources: http://www.new.azwater.gov/gis/

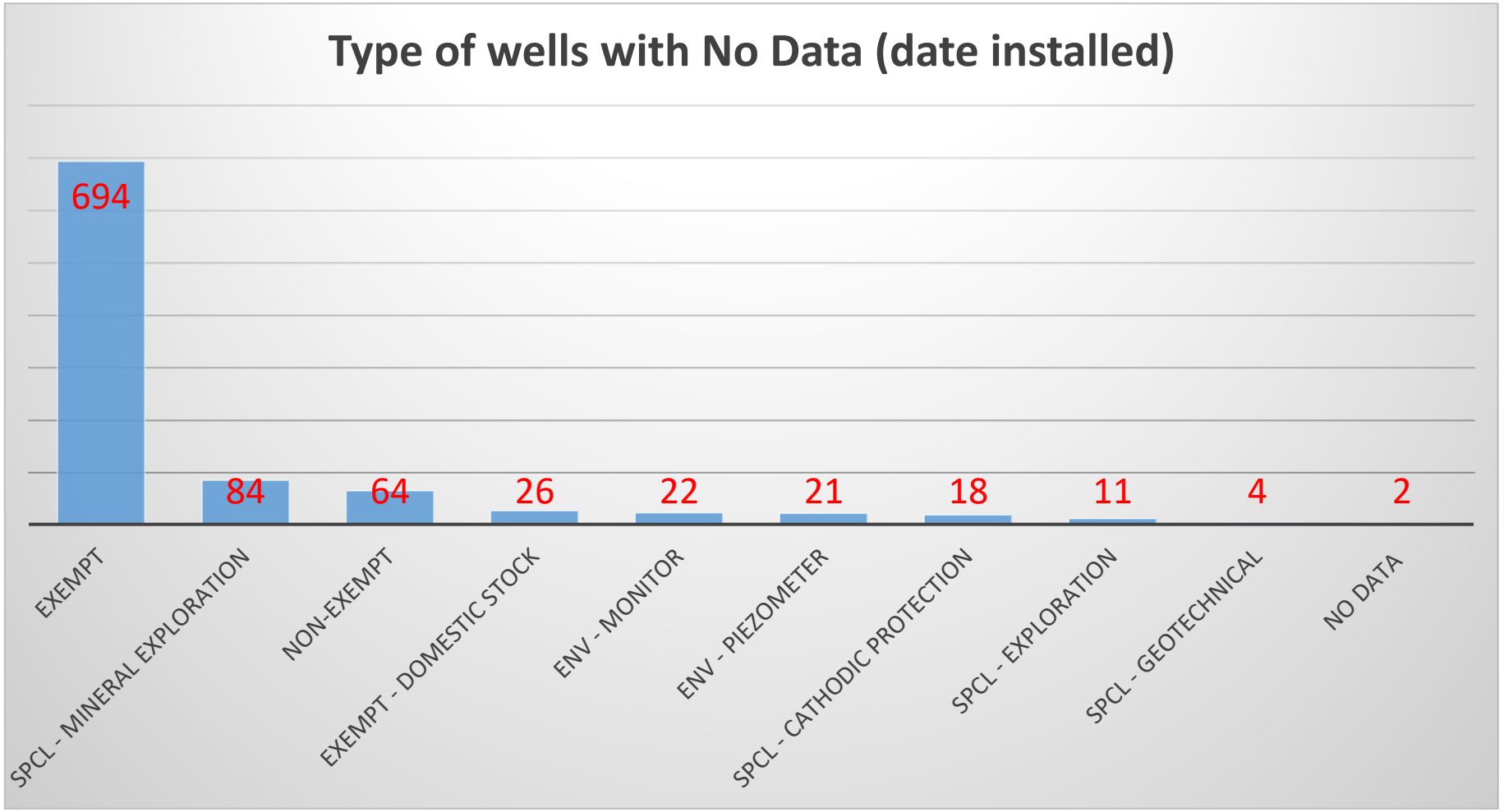
Source: Kyle Hartfield, ARSC. Advice from Julia Fonseca. PC

Wells



Source: Arizona Department of Water Resources: http://www.new.azwater.gov/gis/
Advise: Kyle Hartfield, ARSC, Advice from Julia Fonseca. PC

Wells



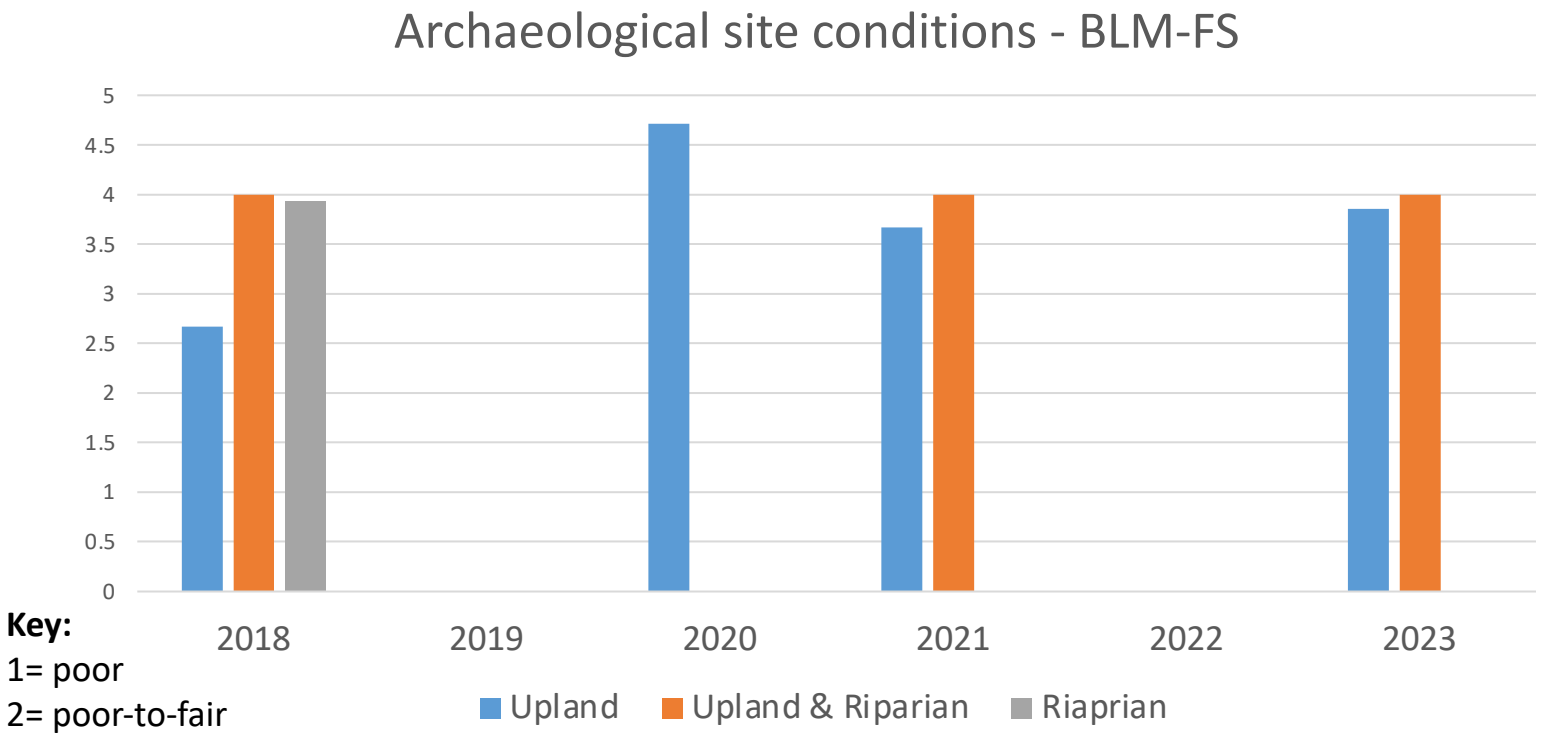
Exempt wells pump less than 35 gallons per minute.

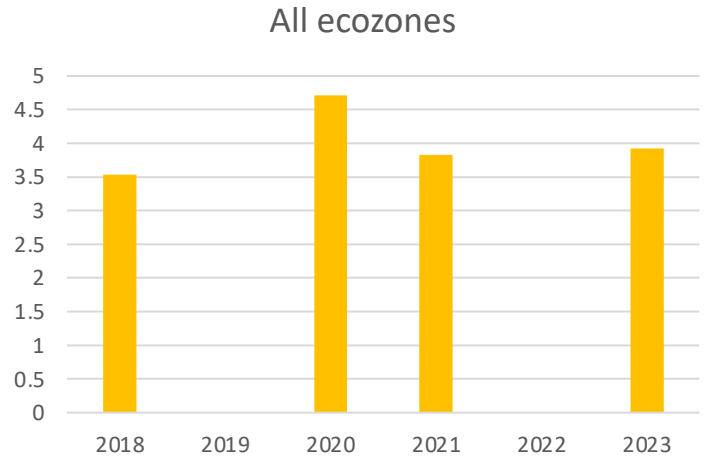
Nobody really knows how much they are pumping.

Exempt/non-exempt wells are outside the AMA and they don't have to report.

Source: Arizona Department of Water Resources: http://www.new.azwater.gov/gis/
Advise: Kyle Hartfield, ARSC, Advice from Julia Fonseca. PC

Archaeological Site Conditions – BLM



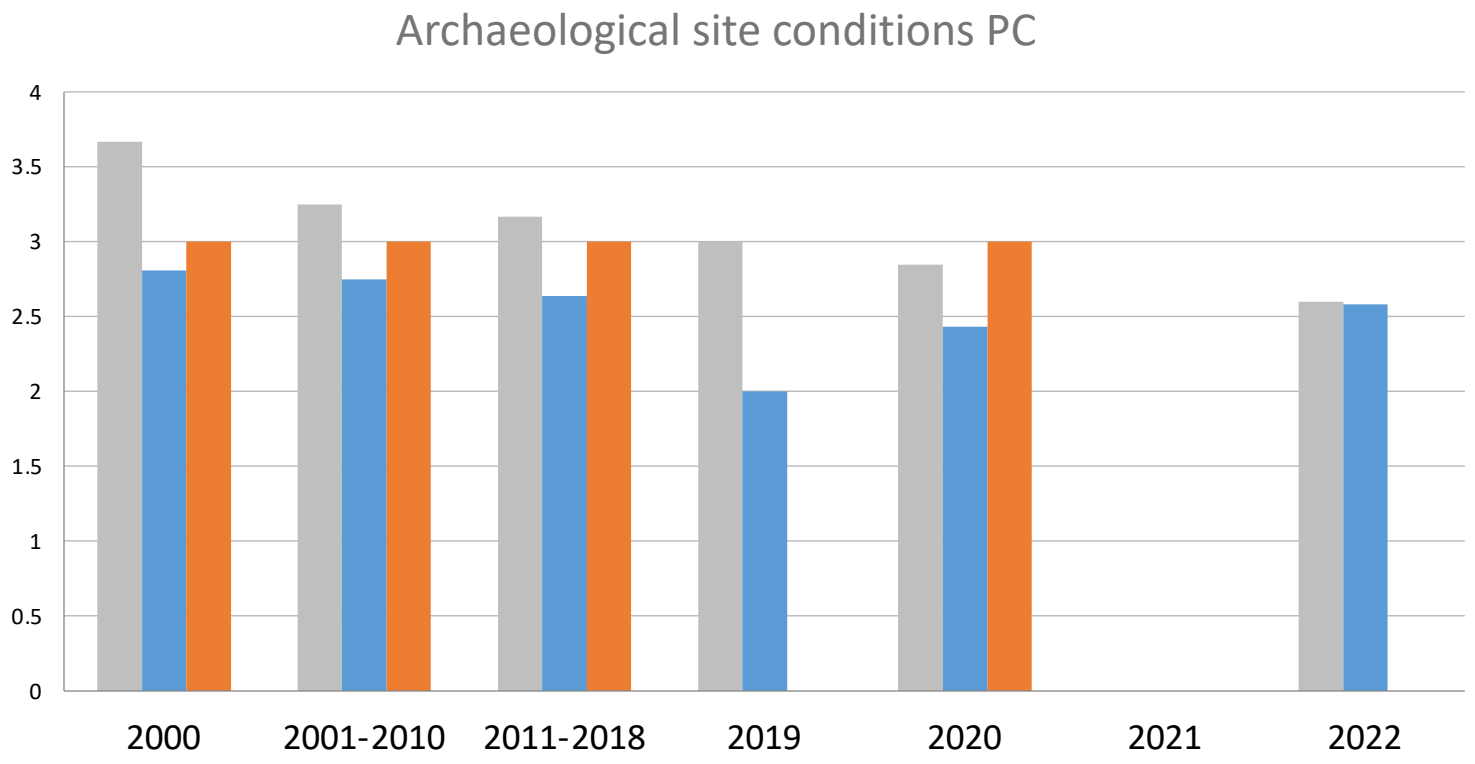


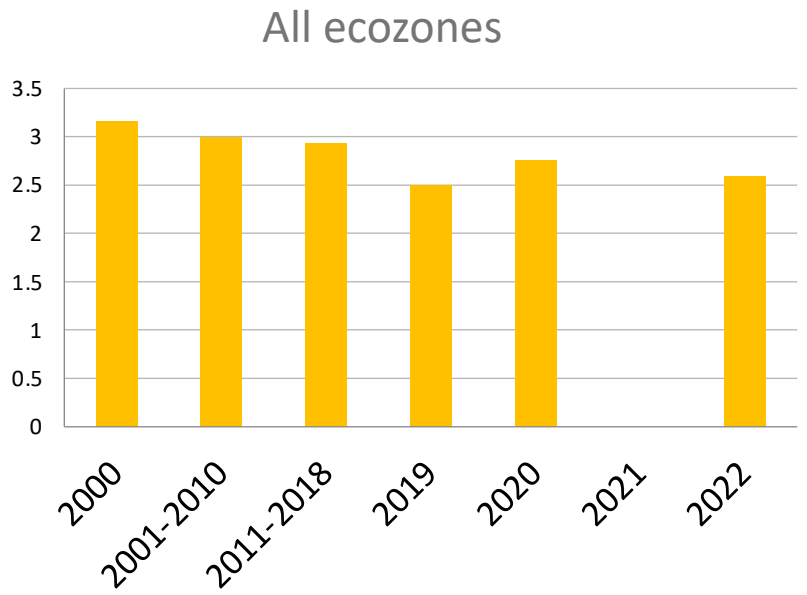
Key:
1= poor
2= poor-to-fair
3= fair
4= fair-to-good
5= good
6 = very good
7 = excellent

Turnover of BLM archaeological staff left a gap in site monitoring and reporting in 2022.

Source: Chris Schrager and now Clint Dalton, BLM

Archaeological Site Conditions –Preserve





Key:

1= poor

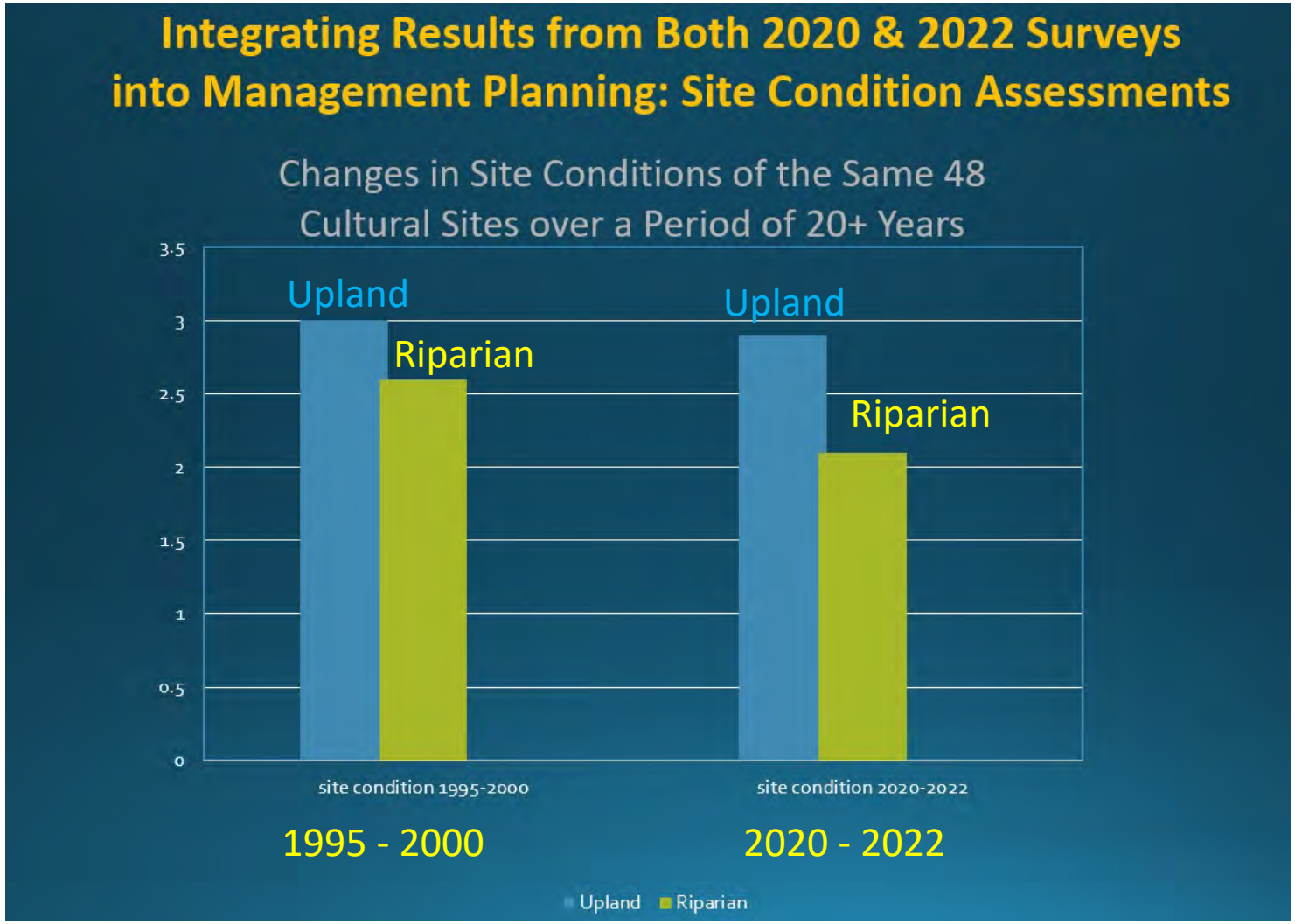
2= fair

3= good

4= very good

Source: Courtney Rose – Pima County

Archaeological Site Conditions – Pima County



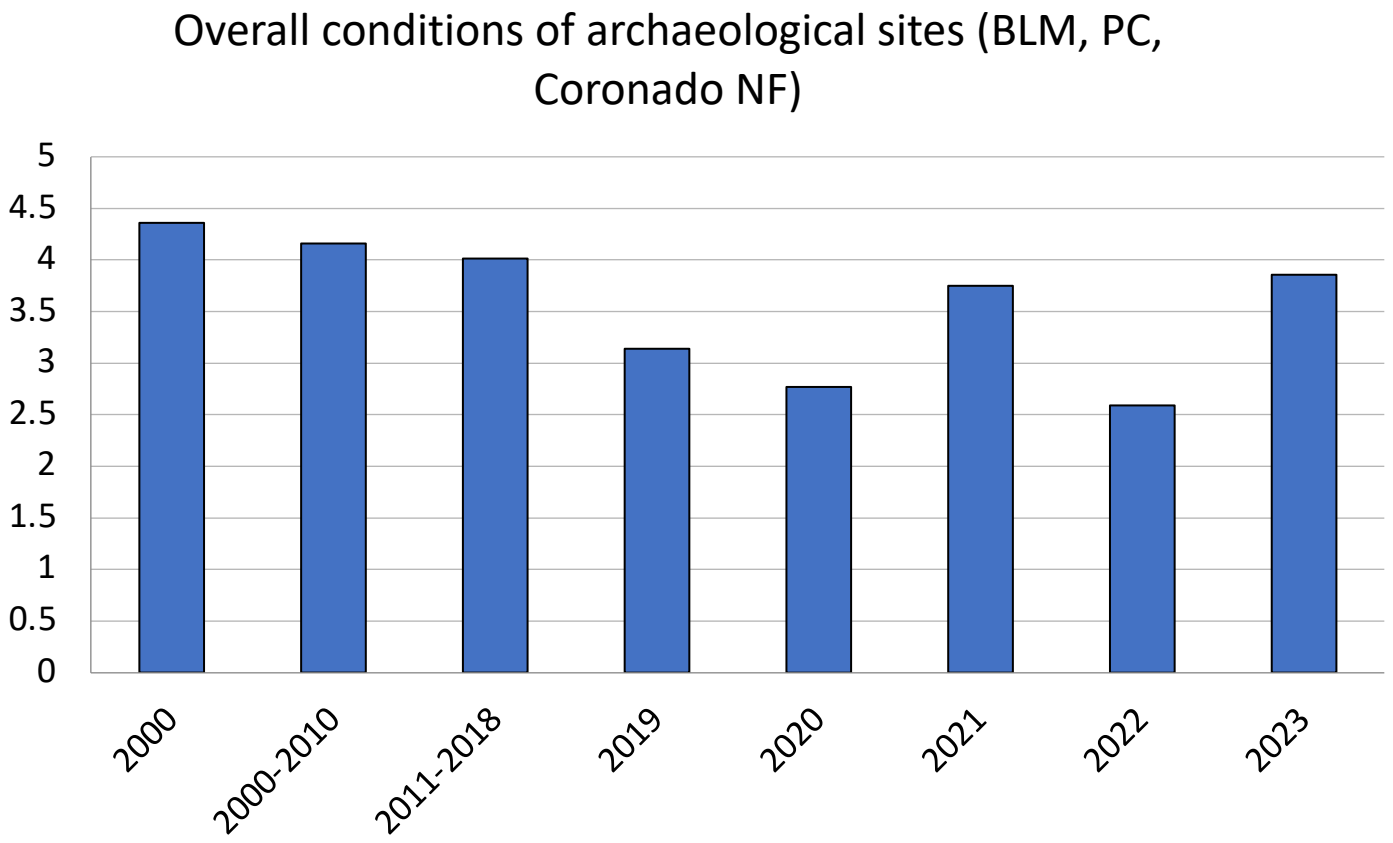
"Note that there are a couple (of sites) with reverse condition assessments!

… for many of the sites that were in fair condition previously, the old signs of dirt roads and other human caused impacts have been covered up by recent vegetation increase (due to the strong 2021 monsoon season) and because the County is managing the property and discouraging incompatible uses. So, although those original impacts never went away, it is more difficult to see those old impacts - reversing the conditions."

Courtney Rose, Pima County

Source: Shela McFarlin – CWP; Courtney Rose – Pima County

Archaeological Site Conditions – All sites

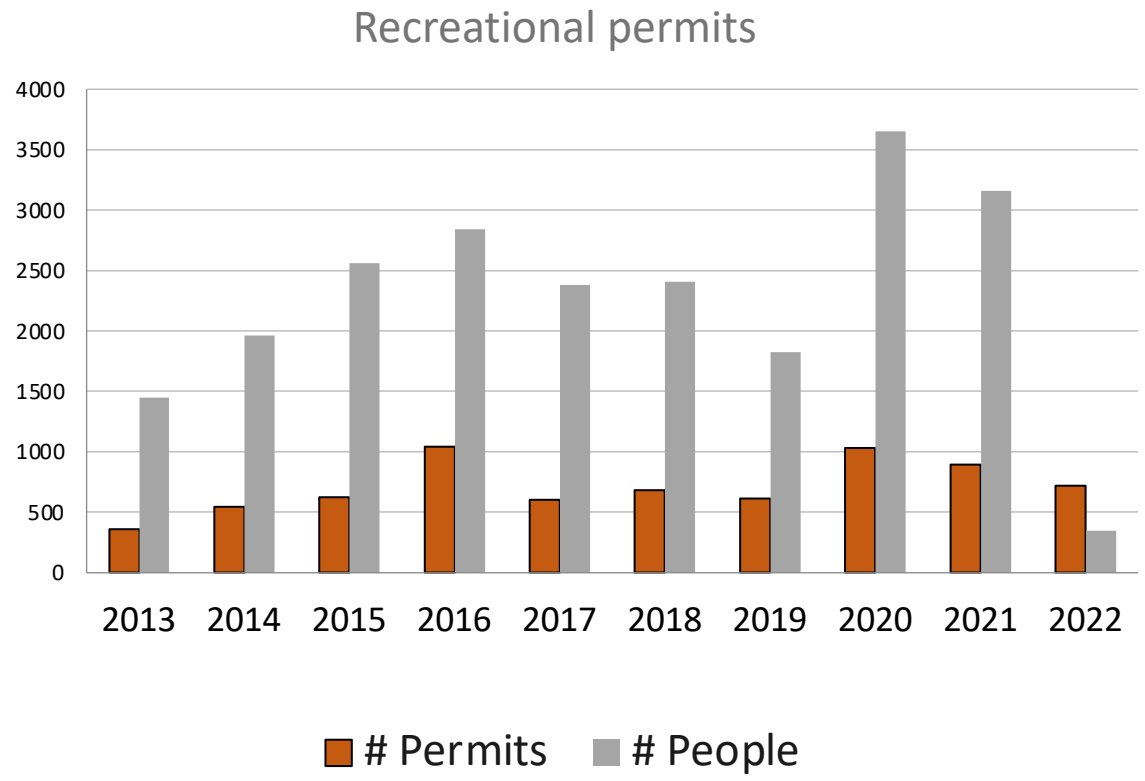


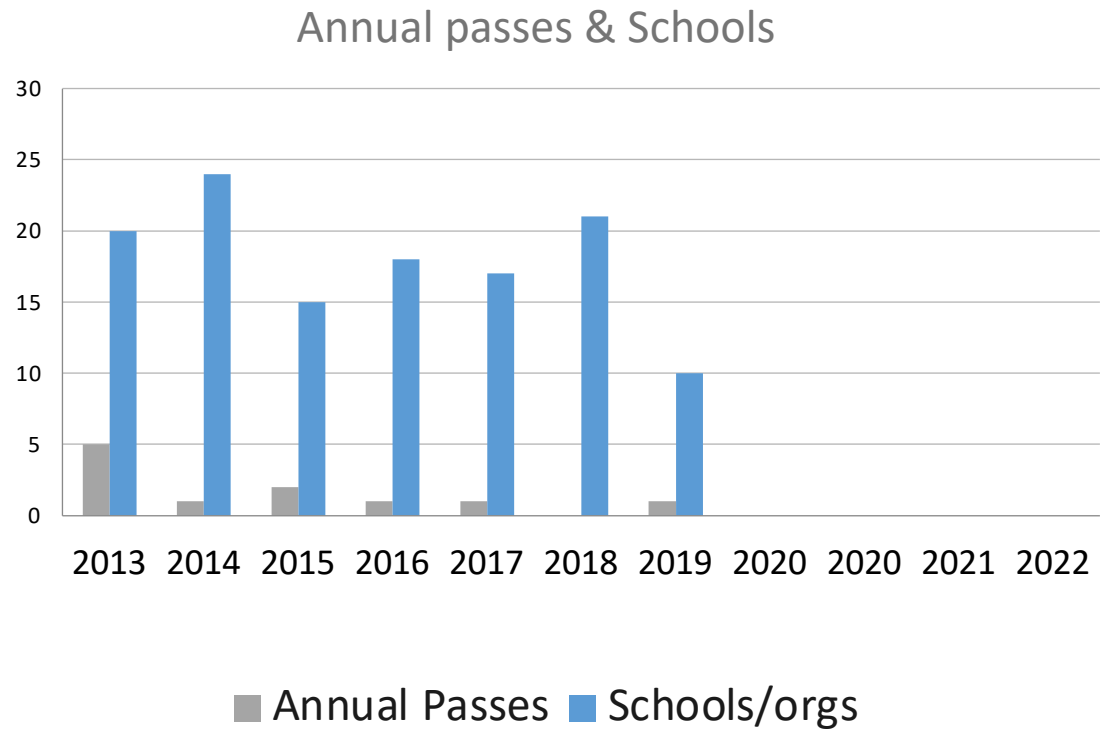
The eroded area near the archaeological site.

Vandalism near the Arizona Trail.

Source: Shela McFarlin – CWP; Chris Schrager – Forest Service; Clint Dalton - BLM, Courtney Rose – Pima County (new Susan Bierer – FS)

Number of recreational permits - Preserve

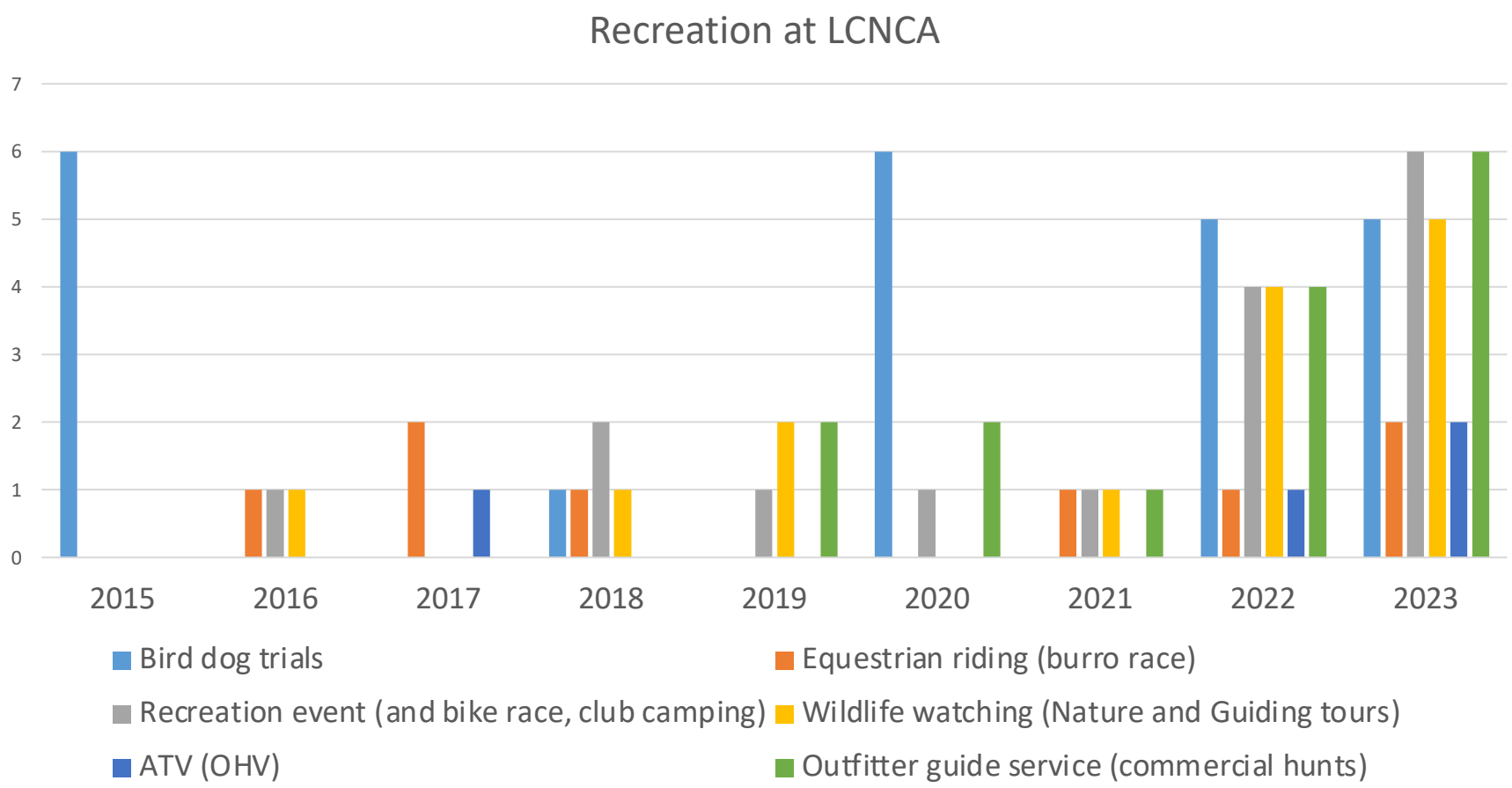




- Due to Covid 19, they did not extend permits to large groups in 2021.
- Annual Passes are no longer given for Cienega Creek (2022)

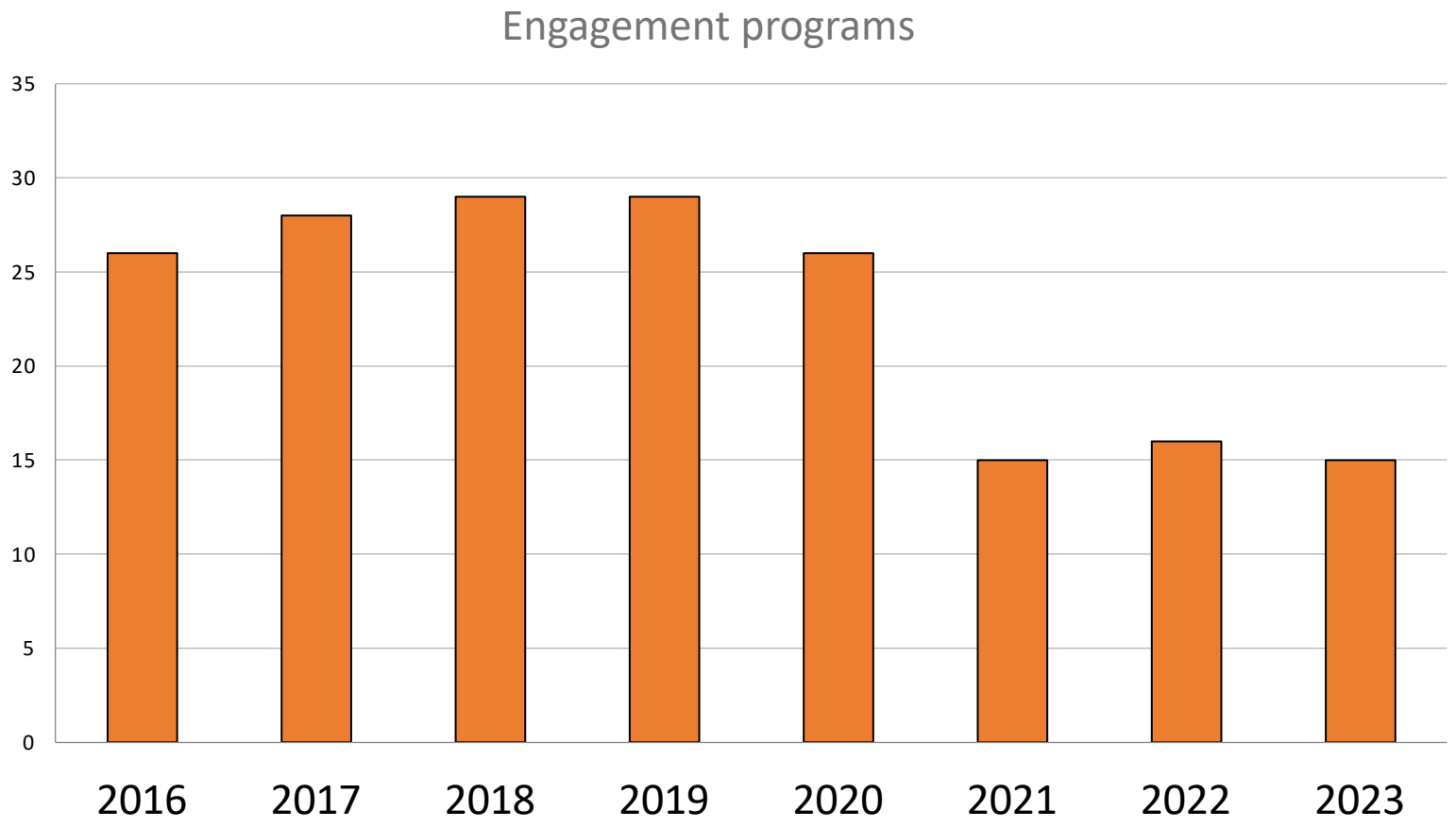
Source: Melissa Sanchez, from Pima County Parks and Recreation

Number of recreational permits - LCNCA



Source: Robert Walter from BLM

Stewardship engagement programs



"Unfortunately, since covid, we haven't engaged any Scout, church, or school groups for projects at the site."

Chris Schrager, BLM (2023)

Sources: Shela McFarlin, Robert Walter, Chris Schrager, JJ Lamb, Alison Buntin, Emily Burns, Jody Baker (new Susan Bierer – FS)

Discussion questions

1. Is this monitoring effort useful for your work? Should we continue with this? If so, how can we sustain this effort (tech/institutional support, funding)?

2. Is a broad qualitative interpretation of this assessment necessary (thumbs-up/down/sideways)? If so, who should do this? What could be other ways to show this impact of this assessment in a comprehensive way?

3. Are there other indicators we should be using? Are we missing any important indicator(s) that can help us assess watershed health?

4. How can we better communicate and share this experience with others?

CIENEGA WATERSHED Partnership

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Thank you!