COLORADO WATER CONGRESS
INFORM | CONNECT | TRAIN | ACT

WATER EDUCATION COLORADO

Demystifying Colorado Water for Legislators –

"201" Level Ag Water Needs and Solutions

March 22, 2023

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Jamie Johnston

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Cathy Shull

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Tim Atkinson

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shelby Chesnut

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Stacey Poland

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shelby Chesnut

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Luke Munchrath

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Cathy Shull

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Luke Munchrath

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Tim Atkinson

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Erin DeTar

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Jimmy Baker

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Luke Munchrath

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Zach Chapman

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Jamie Giacomini

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Megan Knott

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Tatum Chase

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Luke Munchrath

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shelby Chesnut

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shaundra Nelson

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Raquel Wertsbaugh

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shani Rodriguez

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Ben Griffiths

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shelby Chesnut

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Caren Leyva

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Stacey Poland

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Tessa Ringlein

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shelby Schnorr

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Emily Sierra

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Brandee Gillham

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Brad Hensley

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Kaylan Elyse Greiman

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Shelby Chesnut

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Flip Dalfonso

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Karen Mack

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Armando Martinez

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Jennifer Nichols

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Allison Porter

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Brandee Gillham

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Ethan Voth

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Beth Weisensee

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Stephanie Jo Kennedy

COLORADO
Department of Agriculture

Best of Show Photography Contest

Photo by Daniel Bedell

Colorado Springs Utilities

It's how we're all connected

Colorado Springs Arkansas Basin Water Sharing Program

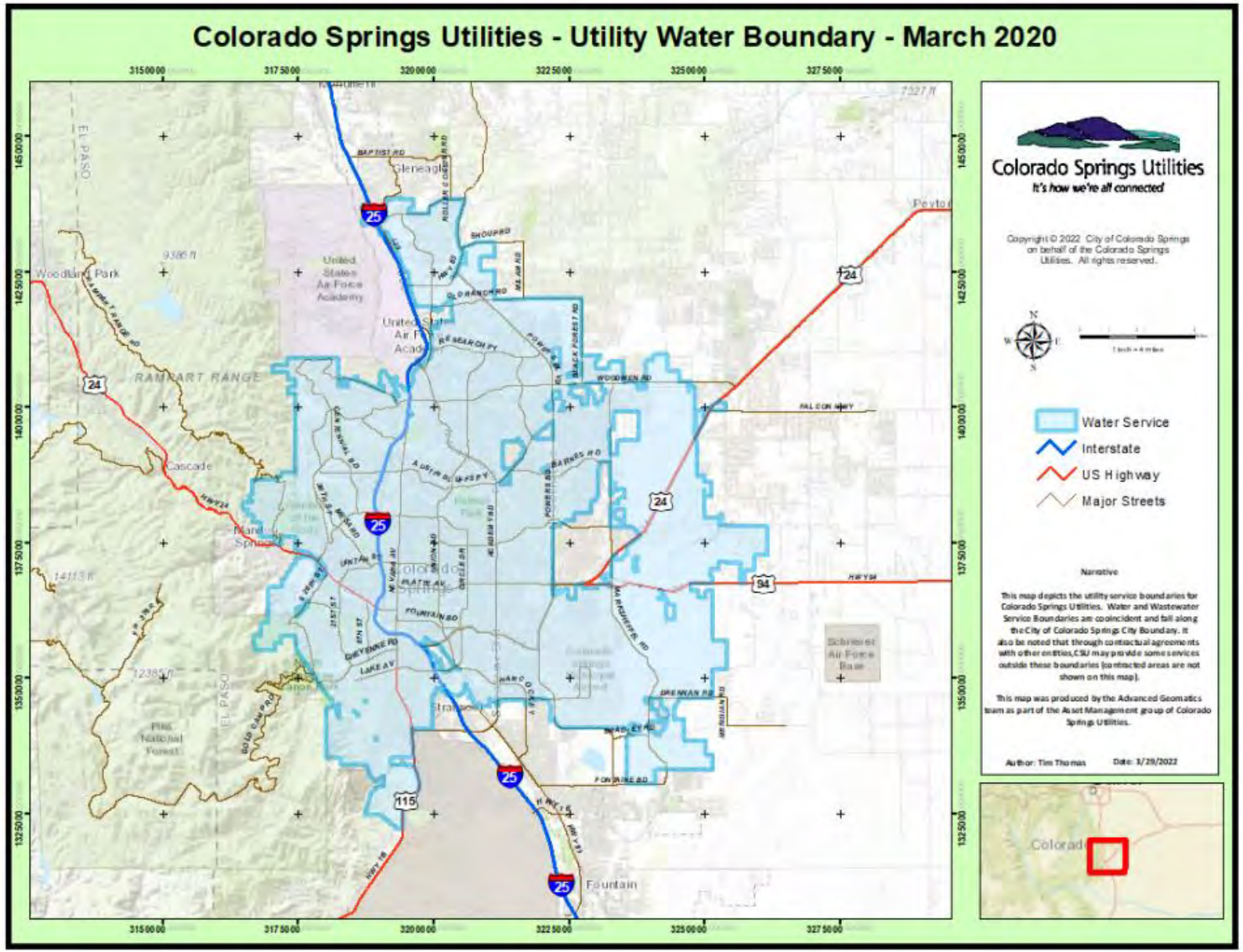
Kelly Roesch, Project Manager-Water Resources

Colorado Springs Water Supply

- Water Service Area
- Future Planning
- Bent County IGA
- Water Sharing Program

Our Customers

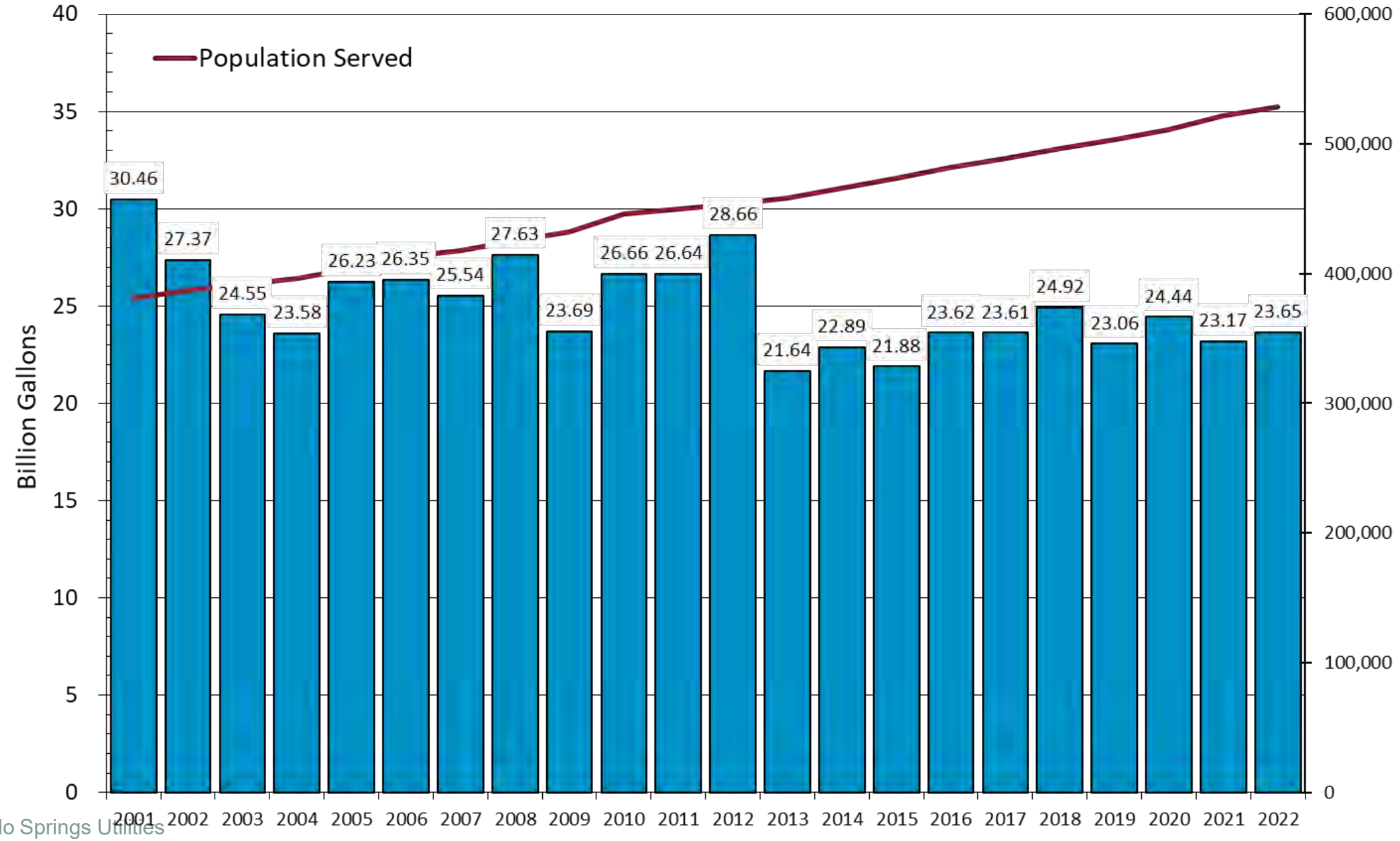
- City Boundary – 195 square miles
- Service Area population of 520,000 (estimated 2022)
  - City residents
  - Ute Pass communities
  - Military bases
  - Other suburban areas outside the City limits
  - 154,000 service connections



Future Planning

- Current system capacity = 95,000 AF
- Expected population in service area by 2070 = 900,000
- Forecasted demand = 129,000 AF

Total Annual Water Use



Using Water Efficiently

- Conservation and Environmental Center
  - Customer Education
  - Xeriscape Garden

- Residential Use has declined since 2001
  - 80 gallons per person per day
  - 45% commercial use/ 55% residential use

- In Colorado 13% of water is used for Municipal and Industrial, 87% is used for Agriculture

We can all use water efficiently!

Facilitating the Transfer

- County 1041 Regulations
- Water Efficiency Rules
- Ditch Company approvals
- Water Court approval

Goals of Bent County IGA

- In 2018 Springs Utilities and Bent County began discussions on how future water projects could be developed to preserve and enhance the local economy.
- Goals were
  - Meet the requirements for Bent County 1041 permits
  - Provide Bent County appropriate mitigation as Springs Utilities develops additional water supply within the County.
  - Provide Springs Utilities an identified path and process to receive Bent County approval of future water supply projects.
  - Protect, preserve, and enhance Bent County economy
  - Do the above while respecting the private property rights of farmers

53

Key Terms

- Applies to 15,000 AF of **new** water supply delivered to Colorado Springs system in either Colorado Canal or Pueblo Reservoir.
- Limited amount of acreage may be removed from irrigation permanently.
- Bent County will have the opportunity to participate in water storage and water supply projects that Springs Utilities develops within the County.
- Bent County will become signatories to the Arkansas Valley Preservation Principles.

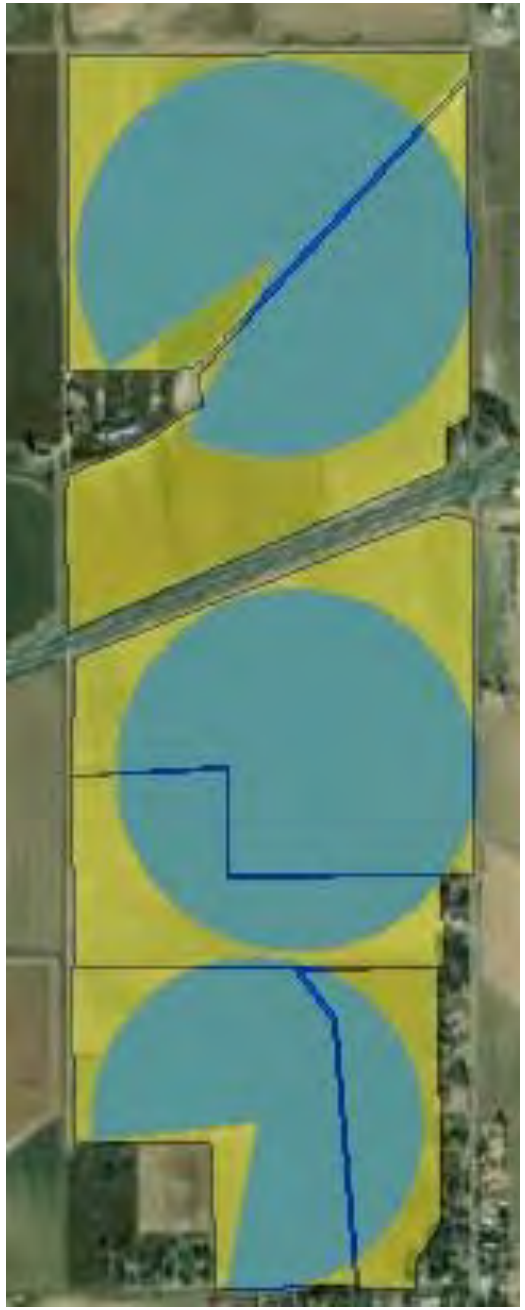
54

Arkansas Basin Water Sharing

Wertz Project - Location

Wertz Project-Overview

- 707 Fort Lyon Canal Company (FLCC) Shares
- 399 Flood Irrigated Acres
- 1.77 FLCC Shares /Flooded Acre
- 3 Center Pivots Installed
- 279 Acres Covered By Pivot
- 120 Acres Outside of Pivot
- 120 acres x 1.77 shares per acre = 213 Corner Shares



Wertz Project-Overview

- Wertz Retains Ownership Of 494 FLCC Shares
- 298 Shares 3/10 Lease
- 168 Acres not irrigated by FLCC Shares In Lease Years
- 494 FLCC Shares Tied Permanently To The Farm through Deed Restrictions

Wertz Project

https://www.youtube.com/watch?v=8F0cRIDESJ8

Questions?


San Luis Valley
Solution Seekers

“Inspiration is not garnered from the recitation
of what is flawed;
it resides, rather, in humanity’s willingness to
restore, redress, reform, rebuild, recover,
reimagine, and reconsider.”

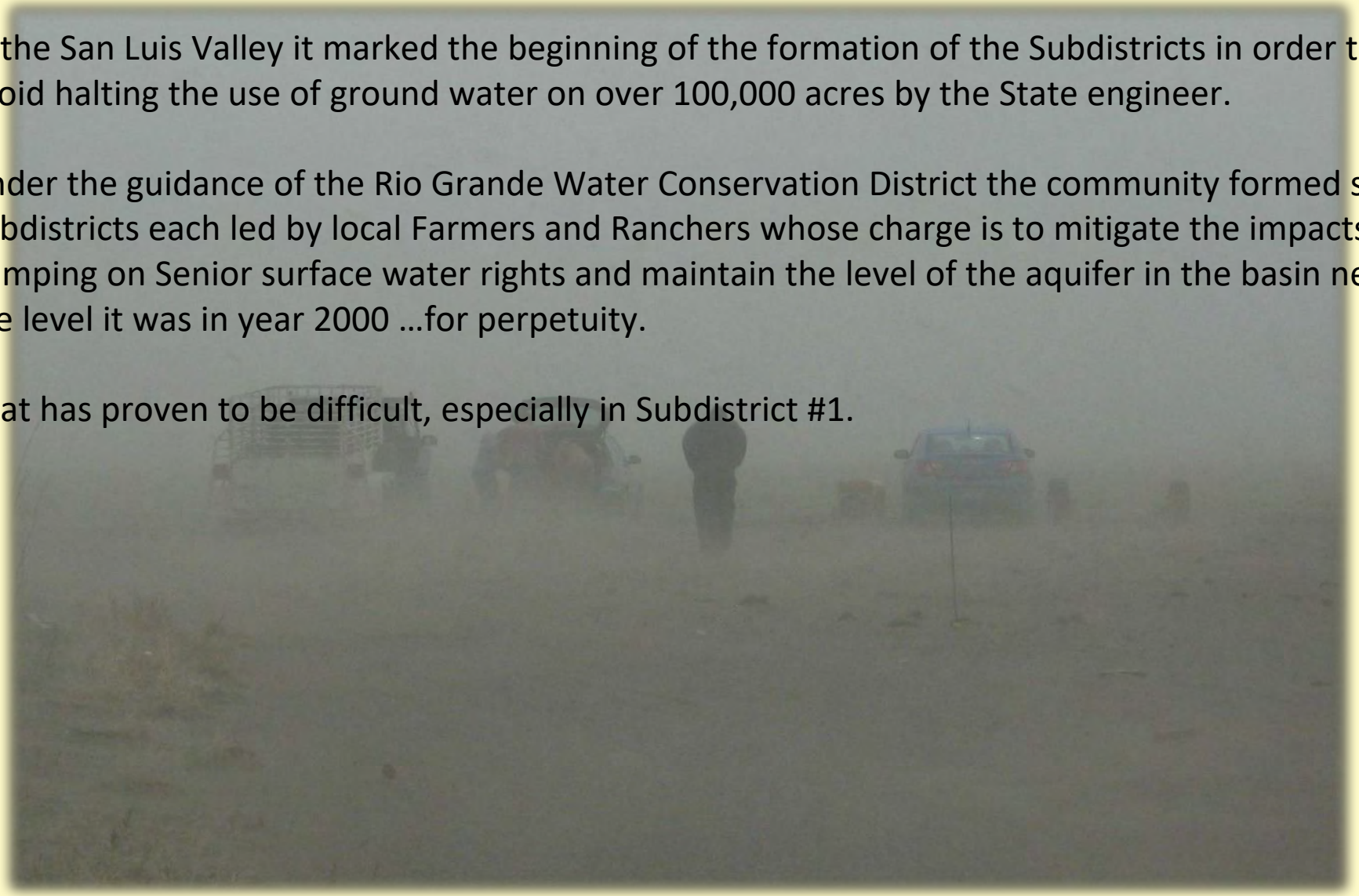
Paul Hawkin, *Blessed Unrest*

The drought of 2003 will be remembered as beginning of the end for many agricultural Producers in the Southwest and beyond.

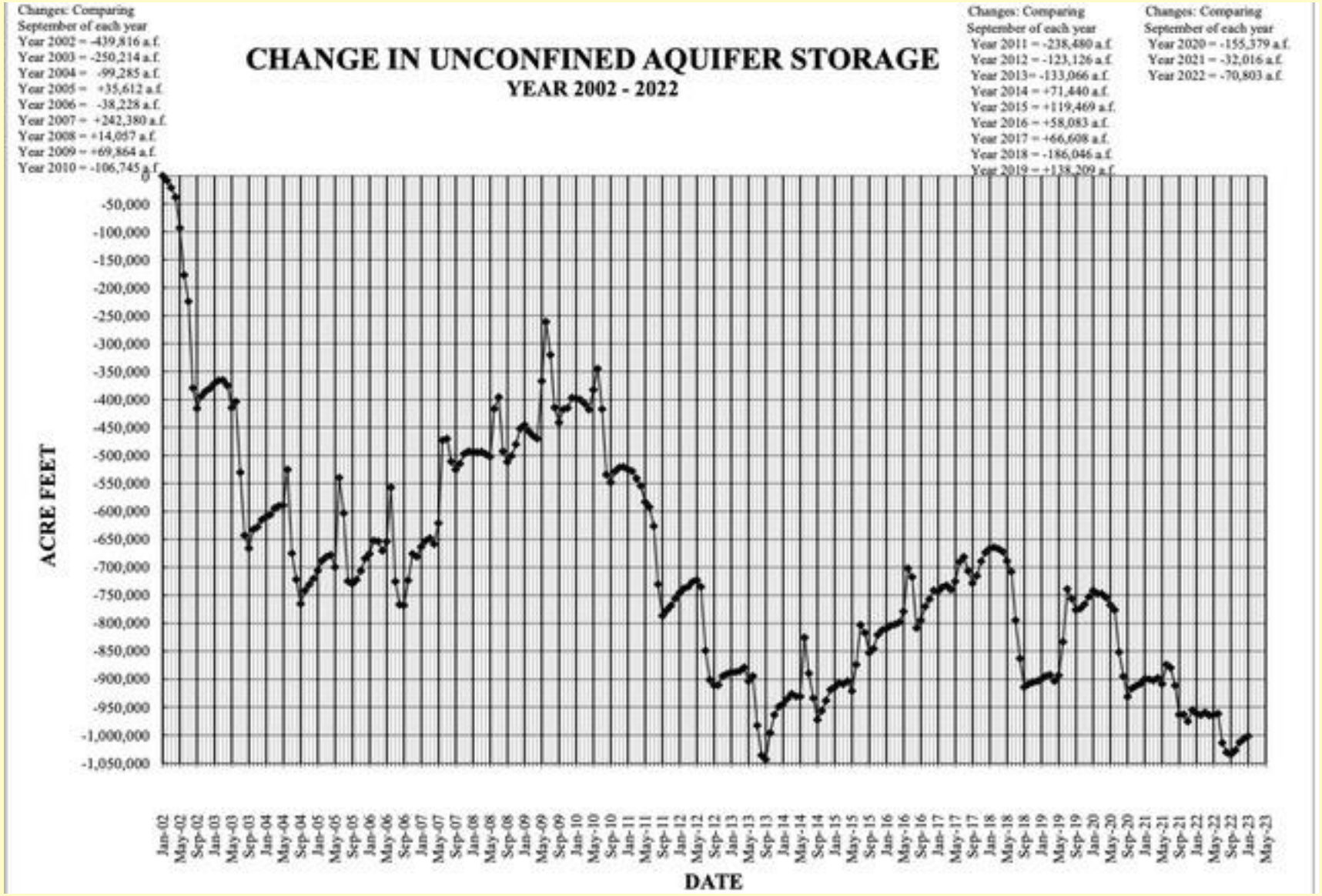
In the San Luis Valley it marked the beginning of the formation of the Subdistricts in order to avoid halting the use of ground water on over 100,000 acres by the State engineer.

Under the guidance of the Rio Grande Water Conservation District the community formed six Subdistricts each led by local Farmers and Ranchers whose charge is to mitigate the impacts of pumping on Senior surface water rights and maintain the level of the aquifer in the basin near the level it was in year 2000 …for perpetuity.

That has proven to be difficult, especially in Subdistrict #1.




CHANGE IN UNCONFINED AQUIFER STORAGE
WEST CENTRAL SAN LUIS VALLEY
Monthly Change
5 yr. running avg.
CHANGE IN STORAGE -ACRE FEET
400000
200000
0
-200000
-400000
-600000
-800000
-1000000
-1200000
-1400000
-1600000
YEARS
DRAFT - January 12, 2023
Data through January 12, 2023
Prepared by Davis Engineering Service, Inc.
For Rio Grande Water Conservation Dist.

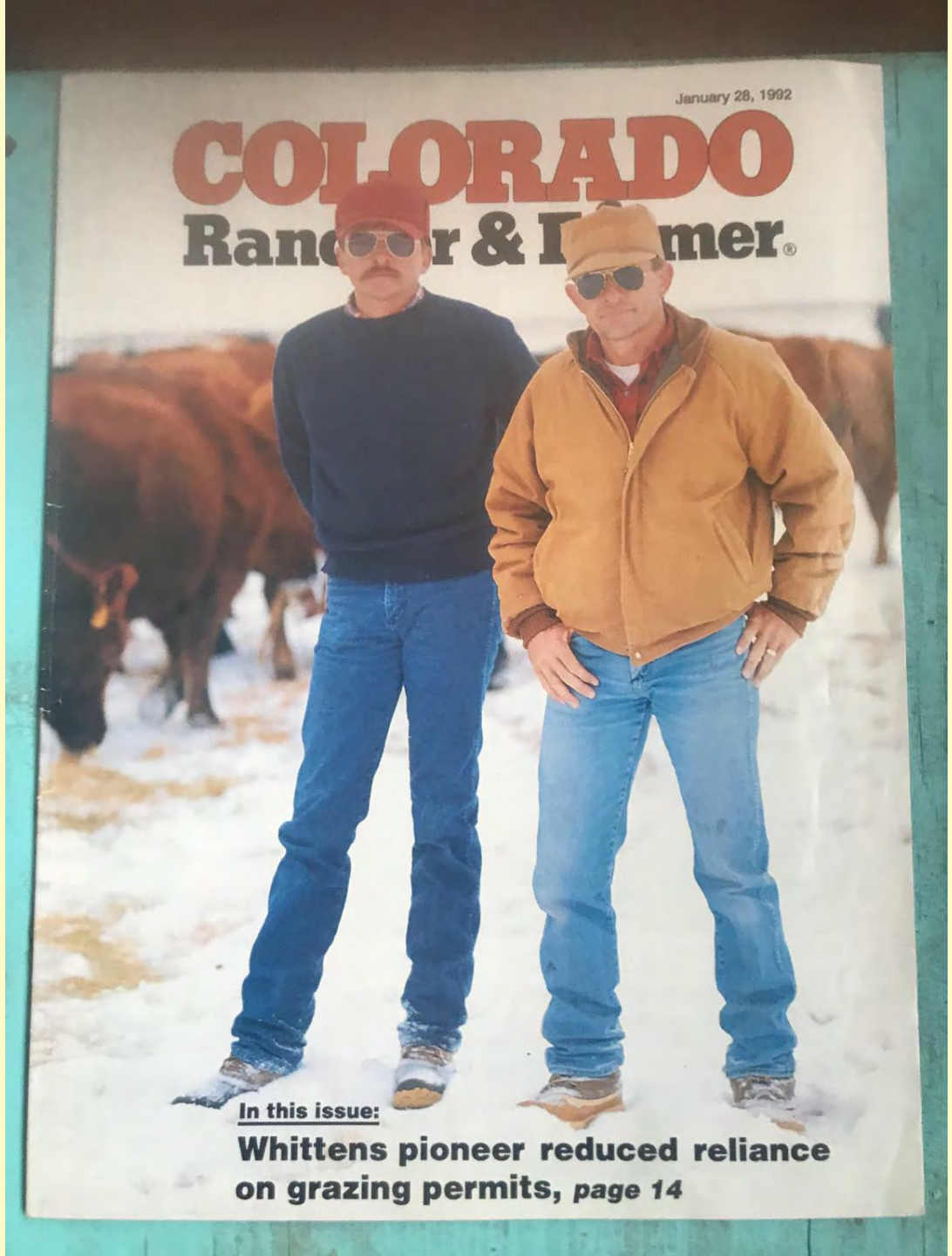

Changes: Comparing
September of each year
Year 2002 = -439,816 a.f.
Year 2003 = -250,214 a.f.
Year 2004 = -99,285 a.f.
Year 2005 = +35,612 a.f.
Year 2006 = -38,228 a.f.
Year 2007 = +242,380 a.f.
Year 2008 = +14,057 a.f.
Year 2009 = +69,864 a.f.
Year 2010 = -106,745 a.f.
CHANGE IN UNCONFINED AQUIFER STORAGE
YEAR 2002 - 2022
Changes: Comparing
September of each year
Year 2011 = -238,480 a.f.
Year 2012 = -123,126 a.f.
Year 2013= -133,066 a.f.
Year 2014 = +71,440 a.f.
Year 2015 = +119,469 a.f.
Year 2016 = +58,083 a.f.
Year 2017 = +66,608 a.f.
Year 2018 = -186,046 a.f.
Year 2019 = +138,209 a.f.
Changes: Comparing
September of each year
Year 2020 = -155,379 a.f.
Year 2021 = -32,016 a.f.
Year 2022 = -70,803 a.f.
ACRE FEET
0
-50,000
-100,000
-150,000
-200,000
-250,000
-300,000
-350,000
-400,000
-450,000
-500,000
-550,000
-600,000
-650,000
-700,000
-750,000
-800,000
-850,000
-900,000
-950,000
-1,000,000
-1,050,000
Jan-02
May-02
Sep-02
Jan-03
May-03
Sep-03
Jan-04
May-04
Sep-04
Jan-05
May-05
Sep-05
Jan-06
May-06
Sep-06
Jan-07
May-07
Sep-07
Jan-08
May-08
Sep-08
Jan-09
May-09
Sep-09
Jan-10
May-10
Sep-10
Jan-11
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
DATE

Subdistrict #5 is a different hydrologic system based on the Confined Aquifer which has improved in recent years primarily due to reduced pumping.

It is considered sustainable by the Division of Water Resources.


1500
1000
2000
GALLONS PER MINUTE
07-10-1088
500
2500
3 4 7 0 6 4 9
3000
0
ACRE FEET X .001
HEMET, CALIFORNIA
McCROMETER

Paradigm Shift 1985.



Holistic thinking : a lens that asks:

- Are we looking in the right place for the answers ?
- Are we asking the right questions ?
- What is the root of the problem?
- Are the cows actually out or is the fence in the wrong place ?

The answers, if we will actually look, are in Nature sometimes right under our feet.

It all comes down to sunlight, soil and animals


WITTEN RANCHES
EST.
1906

A third way
Managing for Abundance

Estimated overhead value of equipment?

about $10,000

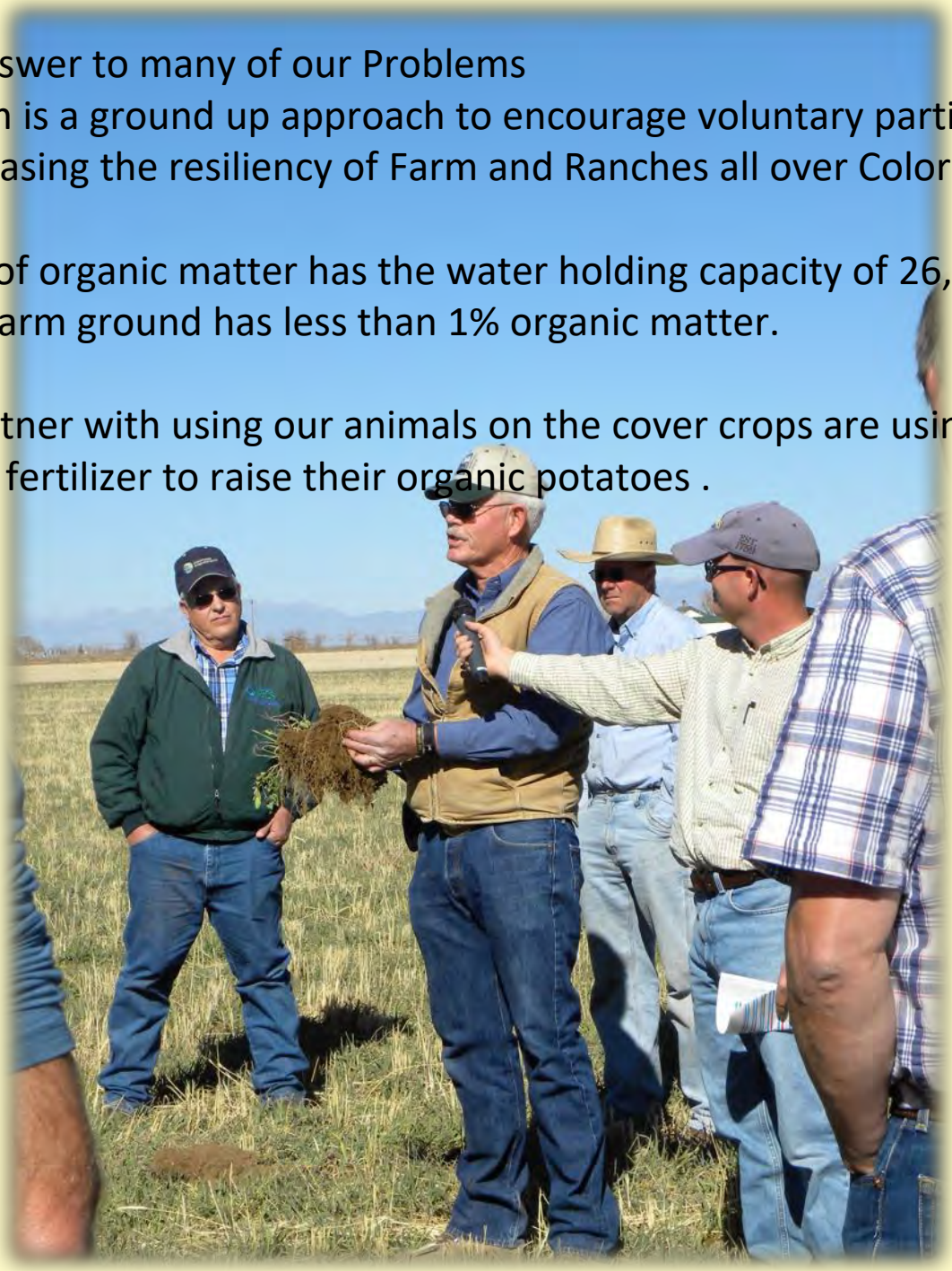
But increasing

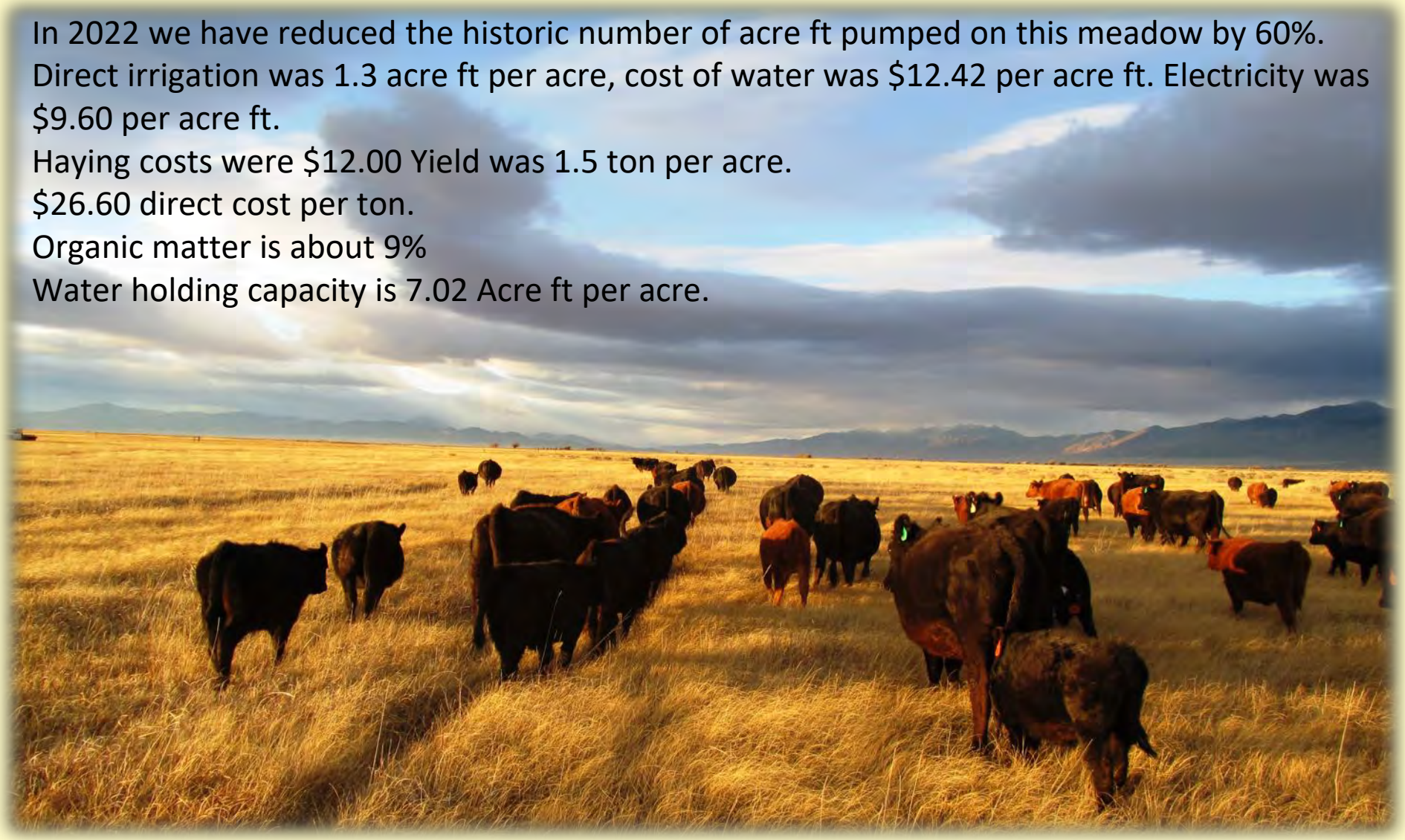
Regenerate: to restore to original strength or properties –

Soil Health is the answer to many of our Problems
CDA's STAR Program is a ground up approach to encourage voluntary participation in local approaches to increasing the resiliency of Farm and Ranches all over Colorado.

Each additional 1% of organic matter has the water holding capacity of 26,000 gallons per acre.
Most heavily tilled farm ground has less than 1% organic matter.

The Farmers we partner with using our animals on the cover crops are using less water and don't need to apply fertilizer to raise their organic potatoes .



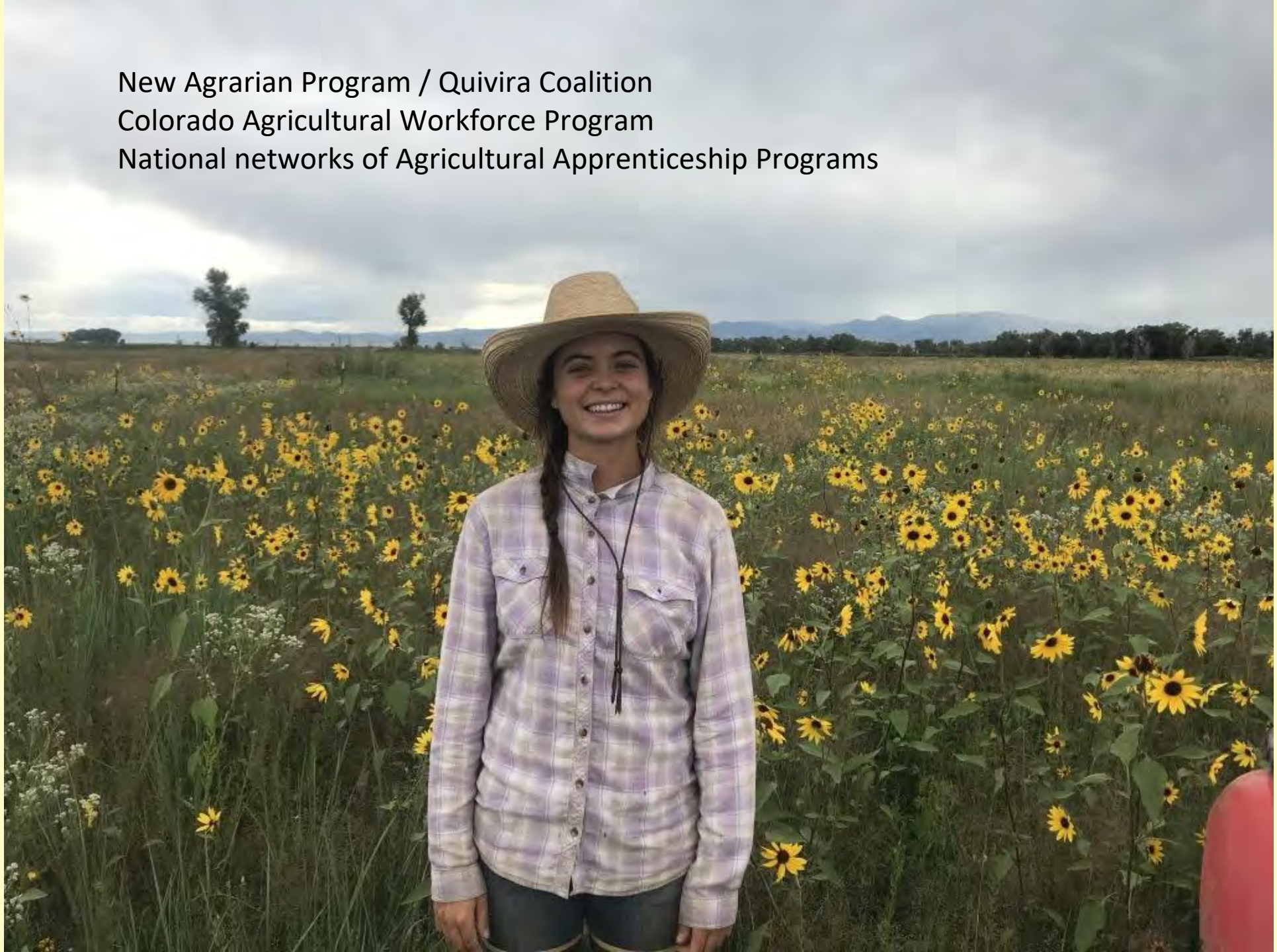

In 2022 we have reduced the historic number of acre ft pumped on this meadow by 60%.
Direct irrigation was 1.3 acre ft per acre, cost of water was $12.42 per acre ft. Electricity was $9.60 per acre ft.
Haying costs were $12.00 Yield was 1.5 ton per acre.
$26.60 direct cost per ton.
Organic matter is about 9%
Water holding capacity is 7.02 Acre ft per acre.

Sharing the Abundance
Cattle as ambassadors

Let animal behavior:

- reduce carbon inputs
- improve ecological processes: water cycle, mineral cycle, plant diversity, and energy flow or yield,
- incorporate litter into soil while planting seeds and adding nutrients.

New Agrarian Program / Quivira Coalition
Colorado Agricultural Workforce Program
National networks of Agricultural Apprenticeship Programs



Abundance

Agricultural Water Needs and Solutions
03/22/2023

Salinity Control

Natural Resources Conservation Service salinity control program

U.S. Bureau of Reclamation salinity control program

Watershed Protection and Flood Prevention

PL566

Natural Resources Conservation Service

Stream Water Quality

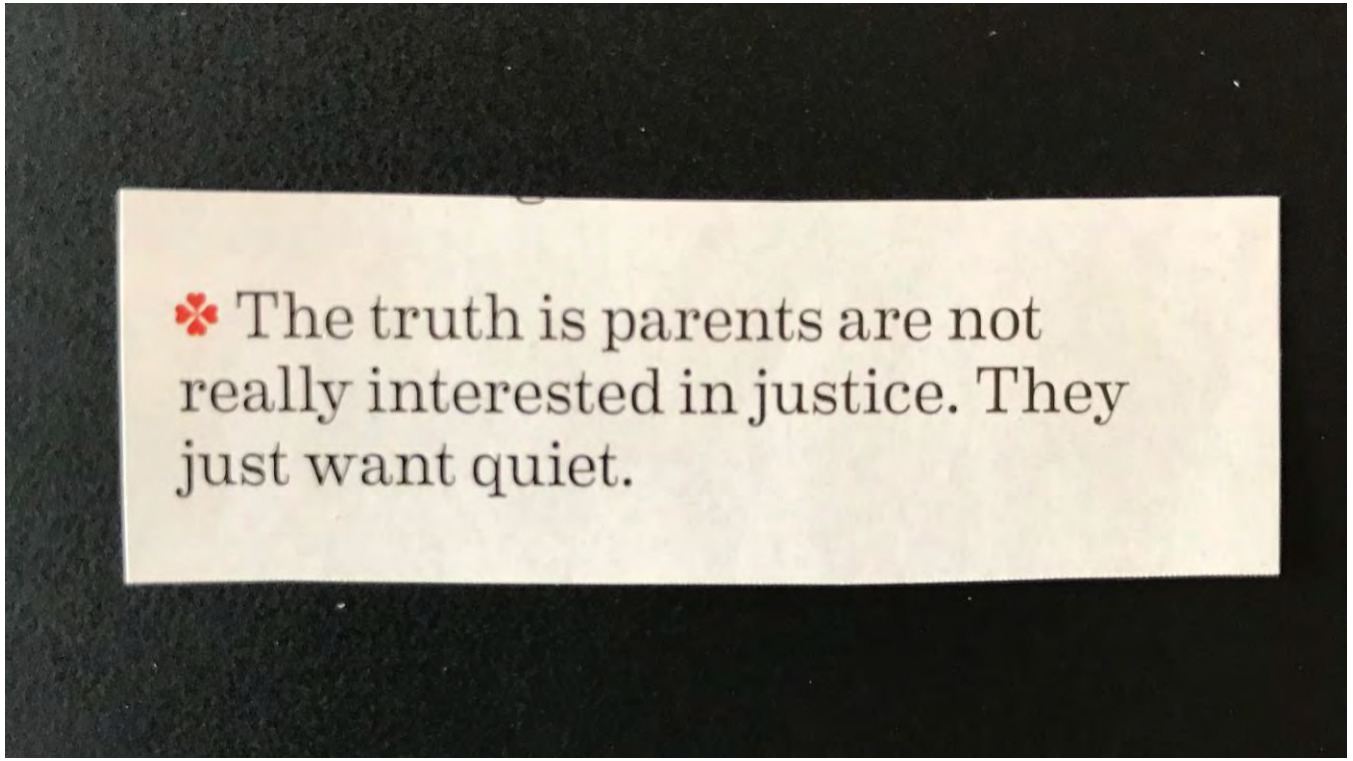
Environmental Protection Agency non point pollution program

Administered by Colorado Department of Public Health and Environment

Environmental, Efficiency, Applied science

U.S. Bureau of Reclamation WaterSMART program

A family of grant opportunities


The truth is parents are not really interested in justice. They just want quiet.

Evaluating Conserved Consumptive Use in the Upper Colorado

2021 Report
(2020-2023 Study)

Study funded by the
Colorado Water Conservation Board

With support from:
Colorado Basin Roundtable
The Nature Conservancy
Trout Unlimited
American Rivers

COLORADO BASIN ROUNDTABLE

COLORADO STATE UNIVERSITY

The Nature Conservancy

TROUT UNLIMITED

American Rivers
Rivers Connect Us

UtahState University

DRI
Desert Research Institute

OPENET

Audubon

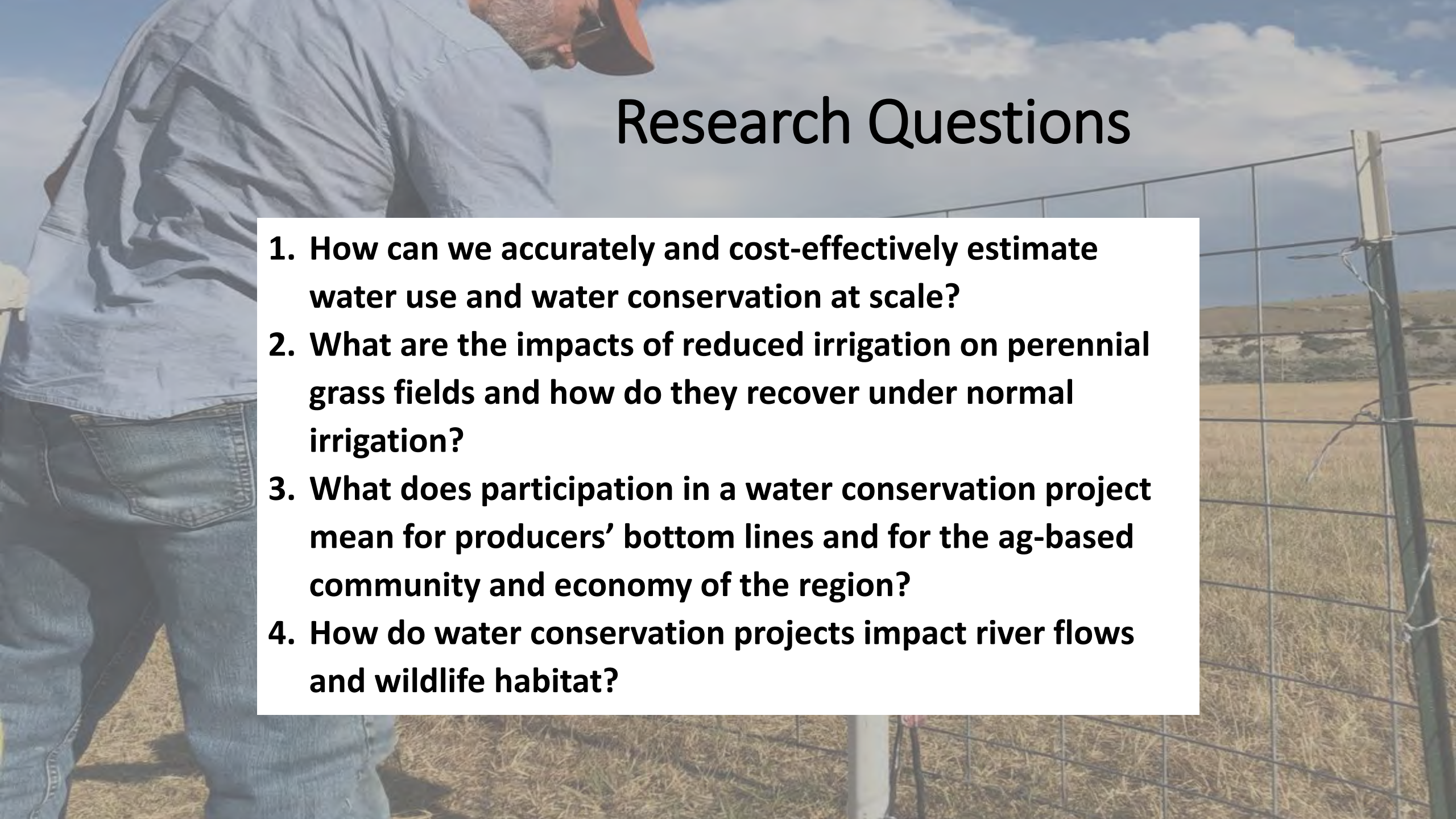
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

COLORADO
Division of Water Resources
Department of Natural Resources

lōtic hydrological

MacIlroy Research & Consulting

AMP Insights



Research Questions

1. **How can we accurately and cost-effectively estimate water use and water conservation at scale?**
2. **What are the impacts of reduced irrigation on perennial grass fields and how do they recover under normal irrigation?**
3. **What does participation in a water conservation project mean for producers' bottom lines and for the ag-based community and economy of the region?**
4. **How do water conservation projects impact river flows and wildlife habitat?**

Estimating Water Use

Remote Sensing: satellite based, cost-effective over large and heterogeneous landscapes, multiple models

Eddy Covariance: site-specific, highly accurate, can be used to compare with estimates from remote-sensing, higher cost to build and maintain

Remote Sensing

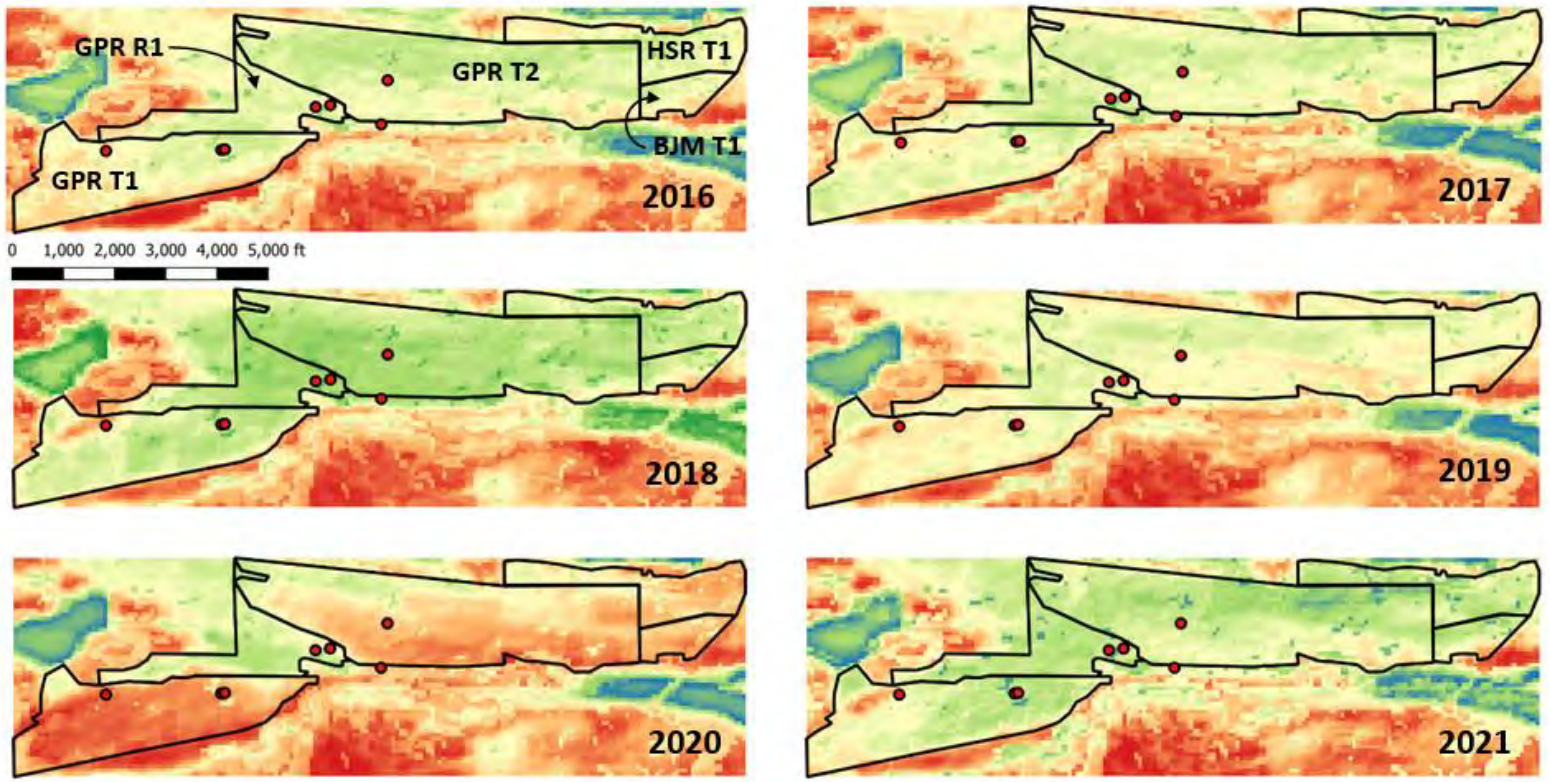


Figure 1. Spatial distribution of ET_a rates during the years prior to curtailment (2016-2019), irrigation shutoff year (2020), and recovery year (2021) for select project sites. Red dots indicate field instrumentation locations. The red to green color ramp is a visual quantification of annual ET_a from 100 mm (3.93 in) to 1,000 mm (39.4 in).

Historical Comparison

Table 1. Comparison of ET_a on treatment sites between 2016-2021 using eeMETRIC.

ET_a in inches	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Sep
Full Season Irrigation Curtailment													
2016	0.03	0.08	0.99	1.61	2.36	7.13	7.90	4.64	2.07	1.55	0.36	0.07	24.10
2017	0.06	0.74	1.00	0.58	2.78	7.23	7.20	4.93	2.06	1.10	1.24	0.48	24.18
2018	0.30	0.62	1.62	1.33	3.48	7.44	6.63	3.07	2.44	1.05	0.29	0.09	23.06
2019	0.03	0.21	0.44	0.98	2.13	5.56	7.34	6.04	2.40	0.86	0.42	0.07	23.46
2020	**0.06**	**0.20**	**0.65**	**0.97**	**2.27**	**2.56**	**2.66**	**2.09**	**1.13**	**0.21**	**0.08**	**0.03**	**10.70**
2021	0.01	0.12	0.60	2.16	2.09	5.44	6.19	4.61	2.50	1.16	0.84	0.43	20.83
Split-Season Irrigation Curtailment (no irrigation after June 15)													
2016	0.01	0.06	0.52	0.24	1.67	5.14	7.71	5.60	2.34	1.74	0.36	0.09	22.47
2017	0.05	0.72	1.92	0.62	1.60	5.49	6.69	5.98	3.14	1.54	0.99	0.57	22.90
2018	0.54	0.67	1.41	0.89	2.50	6.41	7.37	5.77	2.97	1.37	0.34	0.05	25.02
2019	0.02	0.24	0.46	0.69	1.78	5.13	7.32	6.26	1.81	0.86	0.40	0.01	22.29
2020	**0.02**	**0.04**	**0.26**	**0.59**	**2.77**	**6.24**	**5.86**	**3.37**	**1.58**	**0.35**	**0.08**	**0.00**	**19.82**
2021	0.00	0.03	0.42	1.59	1.25	4.01	5.11	5.03	3.67	1.91	0.82	0.27	19.06

Treatment vs Reference

Table 2. Comparison of ET_a for reference and treatment sites in 2020 and 2021 using eeMETRIC.

ET_a in inches	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Sep
Full Season Irrigation Curtailment													
2020 (REF)	0.02	0.08	0.38	1.17	3.68	6.83	7.02	4.95	3.19	0.83	0.19	0.02	25.67
2020 (TRT)	0.06	0.20	0.65	0.97	2.27	2.56	2.66	2.09	1.13	0.21	0.08	0.03	10.71
2021 (REF)	0.01	0.16	0.65	1.89	1.89	5.31	6.15	4.68	2.98	1.82	0.85	0.30	21.01
2021 (TRT)	0.01	0.12	0.60	2.16	2.09	5.44	6.19	4.61	2.50	1.16	0.84	0.43	20.83
Split-Season Irrigation Curtailment (no irrigation after June 15)													
2020 (REF)	0.00	0.01	0.81	1.65	3.41	6.71	7.34	4.52	3.07	1.14	0.22	0.03	25.06
2020 (TRT)	0.02	0.04	0.26	0.59	2.77	6.24	5.86	3.37	1.58	0.35	0.08	0.00	19.82
2021 (REF)	0.00	0.05	0.60	1.56	1.76	5.60	6.68	4.72	2.83	2.16	1.03	0.32	21.58
2021 (TRT)	0.00	0.03	0.42	1.59	1.25	4.01	5.11	5.03	3.67	1.91	0.82	0.27	19.07

Forage Recovery:

Yields in the recovery year ranged from significantly **lower** to significantly **higher** compared to reference fields, with higher production areas generally recovering better.

Grass Forage Impacts of Full Irrigation Curtailment in 2020 on Yield and Crude Protein in 2021 under Full Irrigation

		Low Production Areas						High Production Areas (T/ac)					
Site	Date	Ref T/ac	Trt T/ac	Yield Diff	Ref CP%	Trt CP%	CP Diff	Ref T/ac	Trt T/ac	Yield Diff	Ref CP%	Trt CP%	CP Diff
GPR 1	June	*0.58*	0.41	-29.3%	23.6%	24.1%	1.8%	1.34	0.69	-48.5%	16.8%	14.6%	-12.8%
	July*	***2.07***	**1.57**	**-24.2%**	**12.4%**	**14.0%**	**13.0%**	**2.45**	**2.36**	**-3.7%**	**6.4%**	**9.5%**	**48.4%**
GPR 2	June	*0.58*	0.10	-82.8%	23.6%	24.1%	1.8%	1.34	*0.85*	-36.6%	16.8%	17.6%	4.8%
	July	***2.07***	**0.90**	**-56.5%**	**12.4%**	**14.0%**	**13.0%**	**2.45**	***2.31***	**-5.7%**	**6.4%**	**11.7%**	**81.5%**
SBR	June	0.79	0.79	0.0%	19.8%	15.7%	-20.9%	1.52	1.39	-8.6%	16.1%	18.9%	17.3%
	July	**1.76**	**1.79**	**1.7%**	**11.5%**	**10.6%**	**-8.2%**	**2.13**	**2.93**	**37.6%**	**7.2%**	**10.3%**	**43.4%**
SPR**	June	*0.30*	0.50	67.8%	12.5%	17.7%	41.1%	*0.84*	0.47	-43.7%	15.2%	16.6%	9.1%
	July	***0.26***	**0.75**	**189.6%**	**11.2%**	**9.6%**	**-14.1%**	***1.79***	**1.79**	**0.0%**	**8.7%**	**9.6%**	**10.3%**

**July samples are highlighted, because they correspond most closely to when hay is typically harvested.*

** The low production areas of SPR reference field present anomolously low yield numbers, affecting the yield difference numbers.

While most data comes from composites of samples, in the italicized cells, the fields were grazed, so the data are taken from the enclosure.

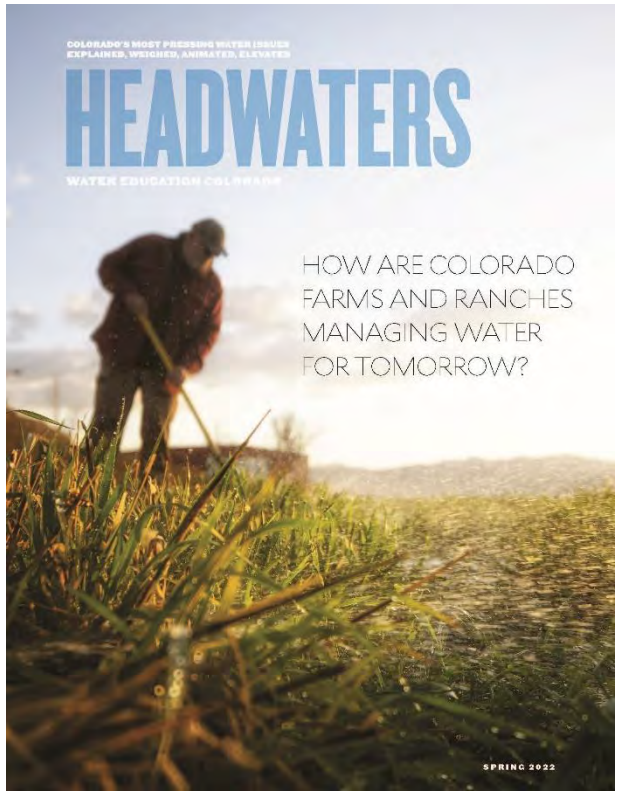
Crude Protein (Quality Measure) was generally **higher** on treatment than reference fields in the recovery year at the time hay is typically harvested.

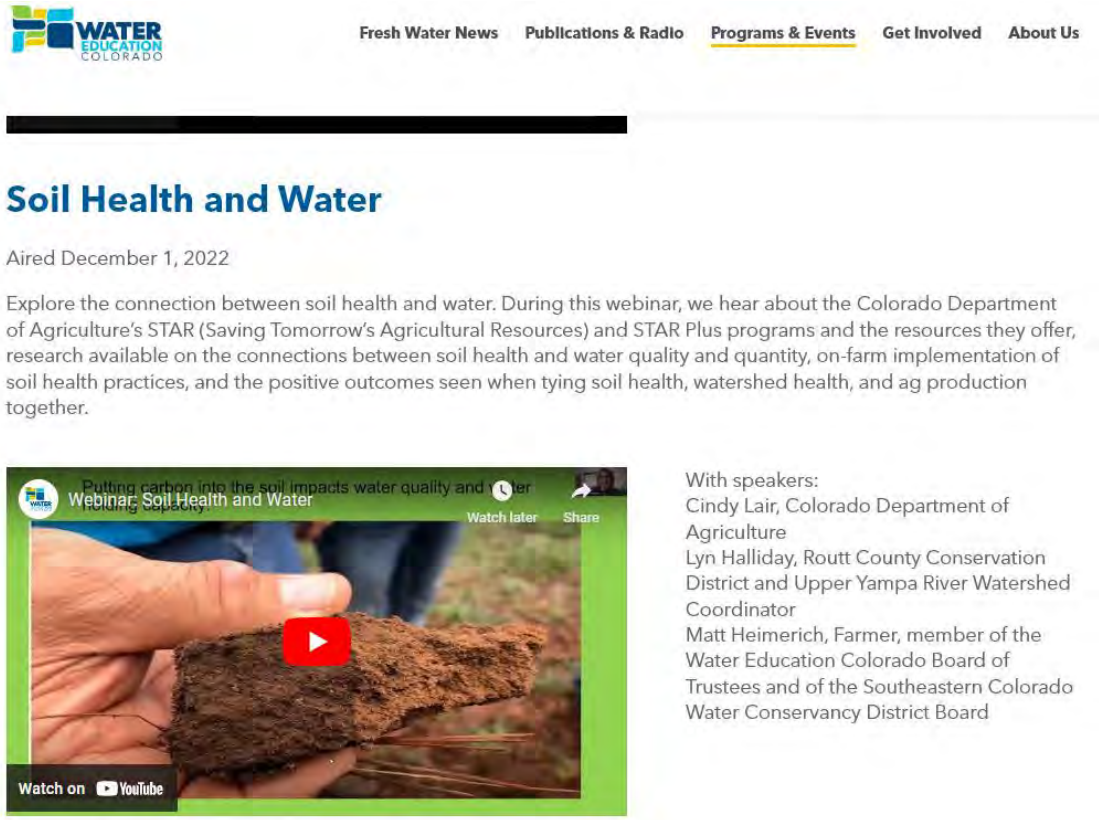
Next Steps

- Continue water use monitoring, adding comparison of remote sensing results to soil moisture data.
- Integrate water use data with forage yield data.
- Complete economic analysis.
- Evaluate a modeling-based approach to understanding potential streamflow impacts.
- Continue bird monitoring.
- Complete sociological analysis.

Questions?

Related Resources





Soil Health Webinar: 12/1/23 **Wateredco.org/programs-events/webinars**

Thank you for coming!
Next “201” on Municipal Water Efficiency, Land Use and Affordability
April 12– 7:15am-8:45am

www.wateredco.org/2023-legislative-water-workshops/

www.cowatercongress.org