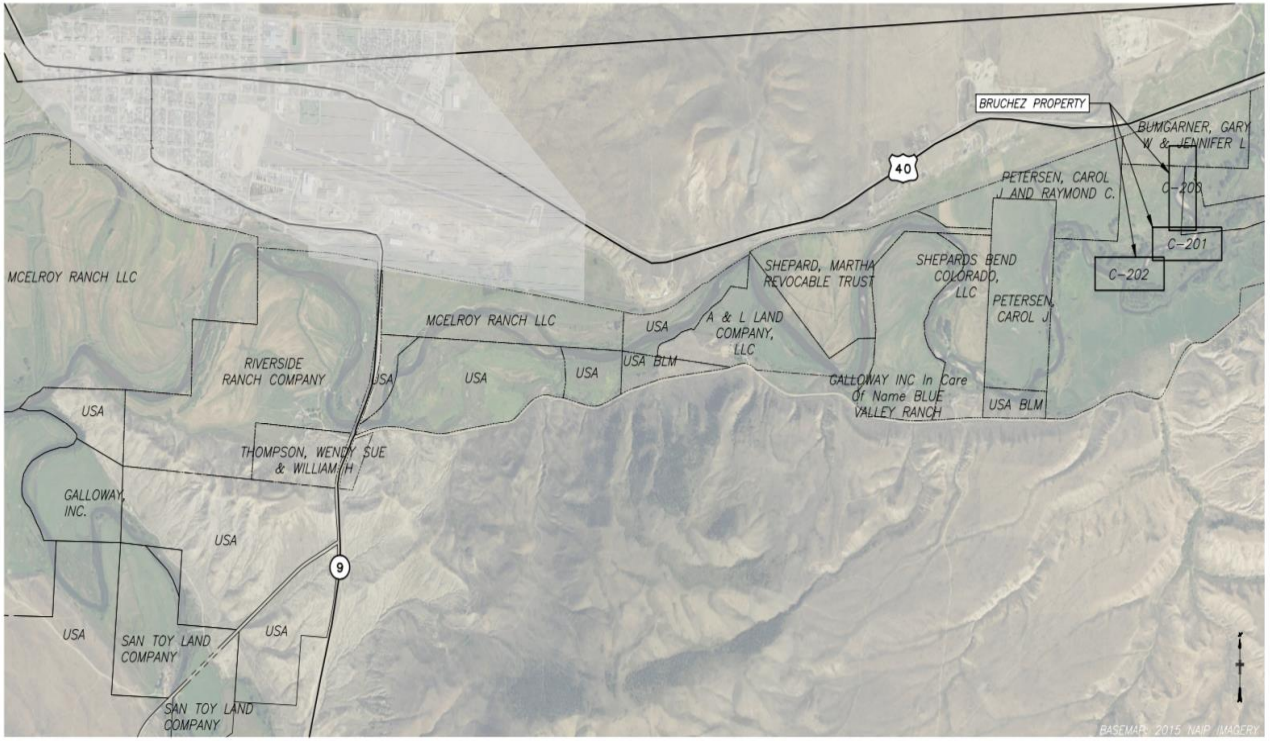
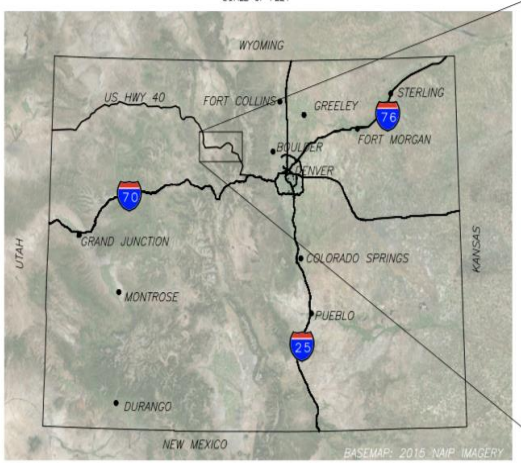
West Slope-East Slope Lower and Upper Basins Food and Water Connection

ILVK
BRUCHEZ
PROPERTY

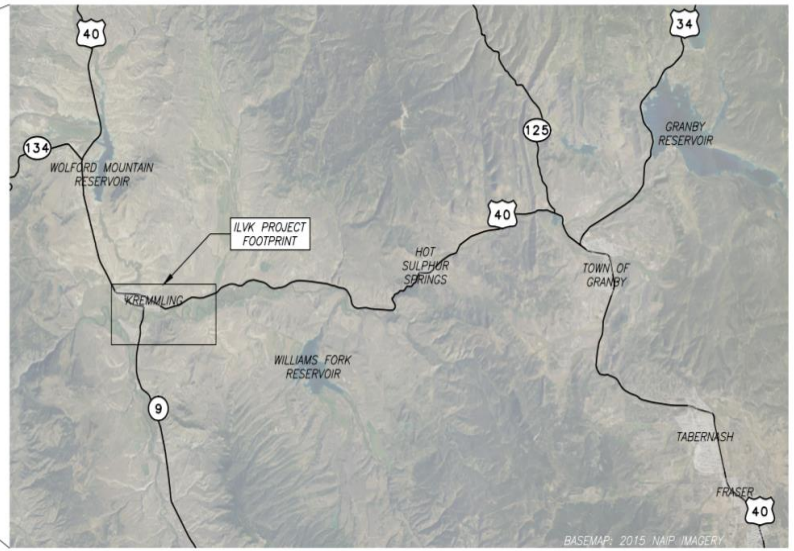


LOCATION MAP

2000 0 2000 4000 6000
SCALE OF FEET



COLORADO STATE MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

*PLAN AND DETAILS ARE PRELIMINARY ONLY, SUBJECT TO MODIFICATION PENDING TOPOGRAPHIC SURVEY, ANALYSIS AND FINAL DESIGN.

SHEET LIST

COVER AND LOCATION
BRUCHEZ PROPERTY
G-100

ILVK
IRRIGATORS OF LAND IN THE VICINITY OF KREMMLING, COLORADO
UPPER COLORADO AND BLUE RIVER

United States Department of Agriculture
Natural Resources Conservation Service

Designed: PMB/CEM
Drawn: BAT
Approved: PMB

Project #: RCE – T373.38.01 ILVK
Date: July, 2018
File Name:

TETRA TECH
3801 AUTOMATION WAY, SUITE 100
FORT COLLINS, COLORADO 80525
PHONE (970) 223-9600 FAX (970) 223-7171
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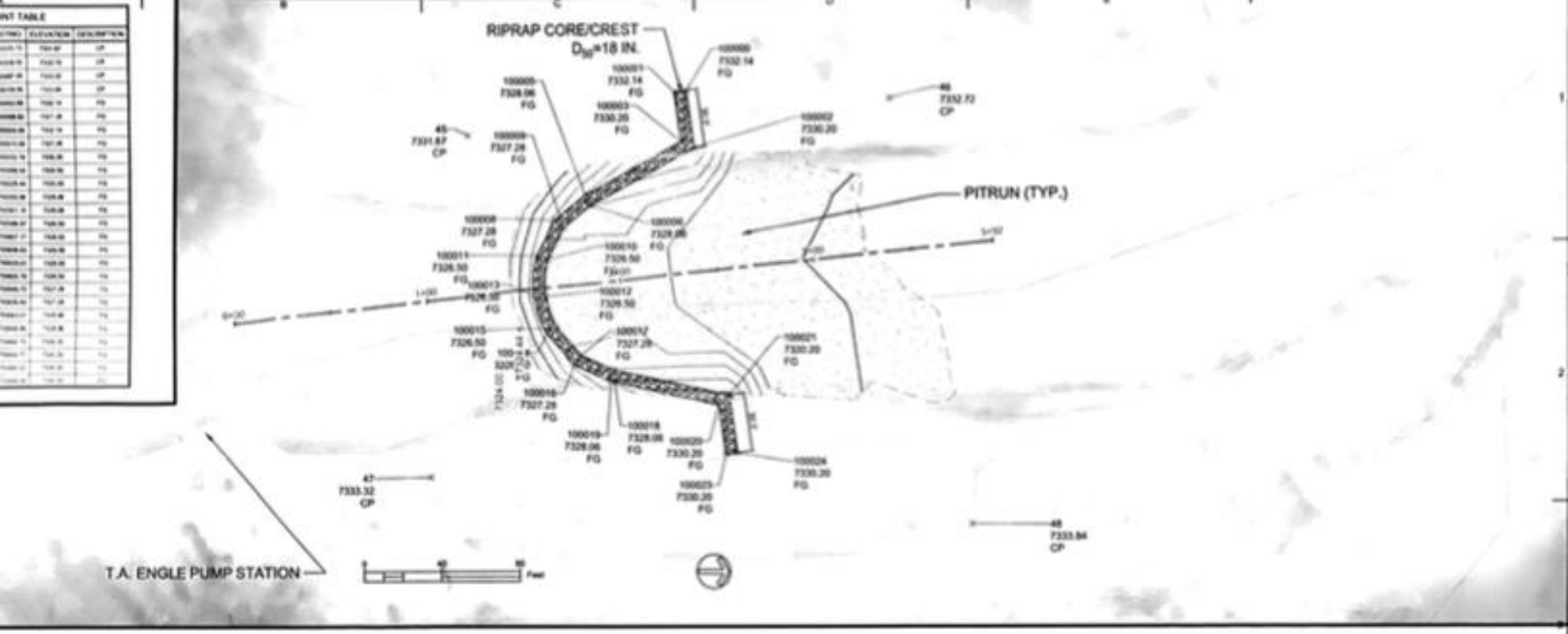
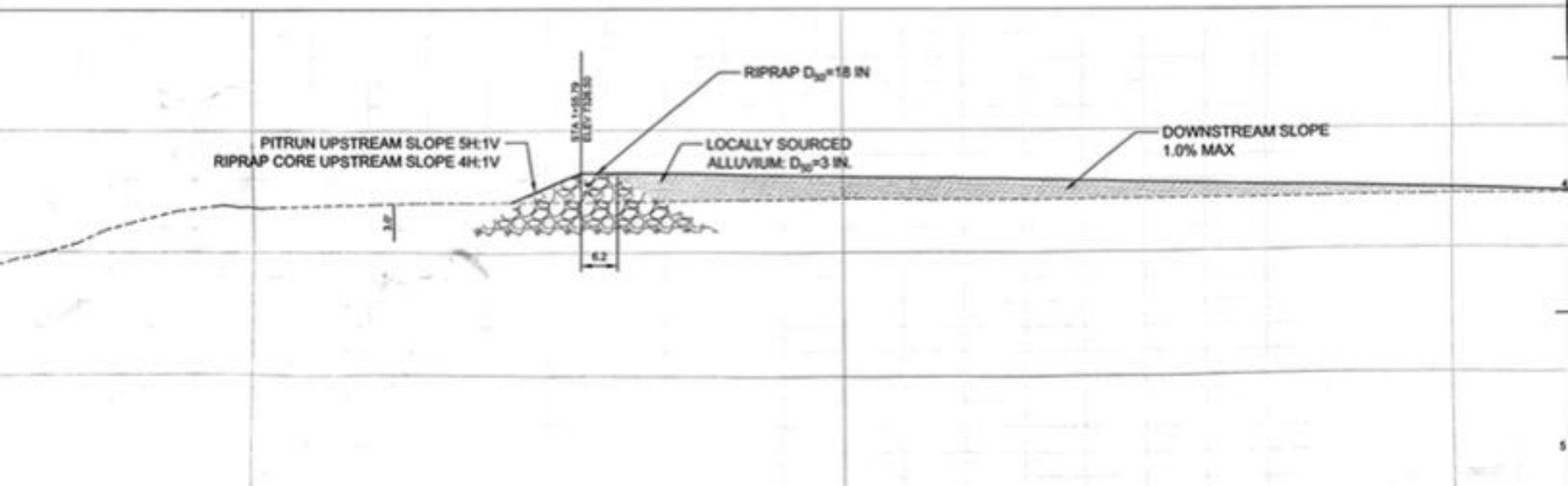

RIPRAP CORE/CREST
D_{50}=18 IN.
PITRUN (TYP.)
T.A. ENGLE PUMP STATION


RIPRAP D_{50}=18 IN
PITRUN UPSTREAM SLOPE 5H:1V
RIPRAP CORE UPSTREAM SLOPE 4H:1V
LOCALLY SOURCED
ALLUVIUM: D_{50}=3 IN.
DOWNSTREAM SLOPE
1.0% MAX
6.2


NOT TO SCALE

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

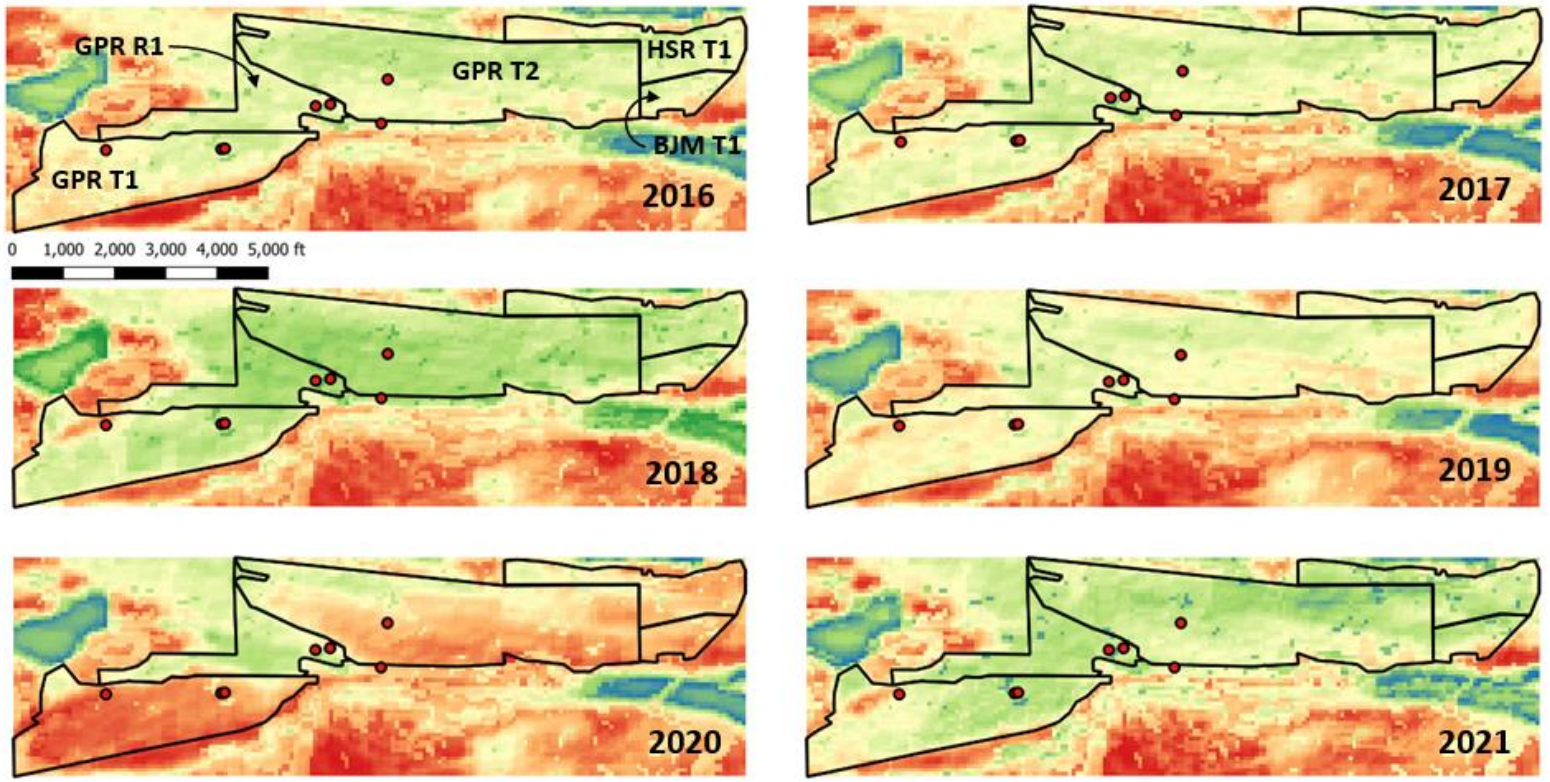


Figure 1. Spatial distribution of ET_a rates during the years prior to curtailment (2016-2019), irrigation shutoff year (2020), and recovery year (2021) for select project sites. Red dots indicate field instrumentation locations. The red to green color ramp is a visual quantification of annual ET_a from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


THE LAND INSTITUTE


Questions?