Evaluating Conserved Consumptive Use in the Upper Colorado

2022 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

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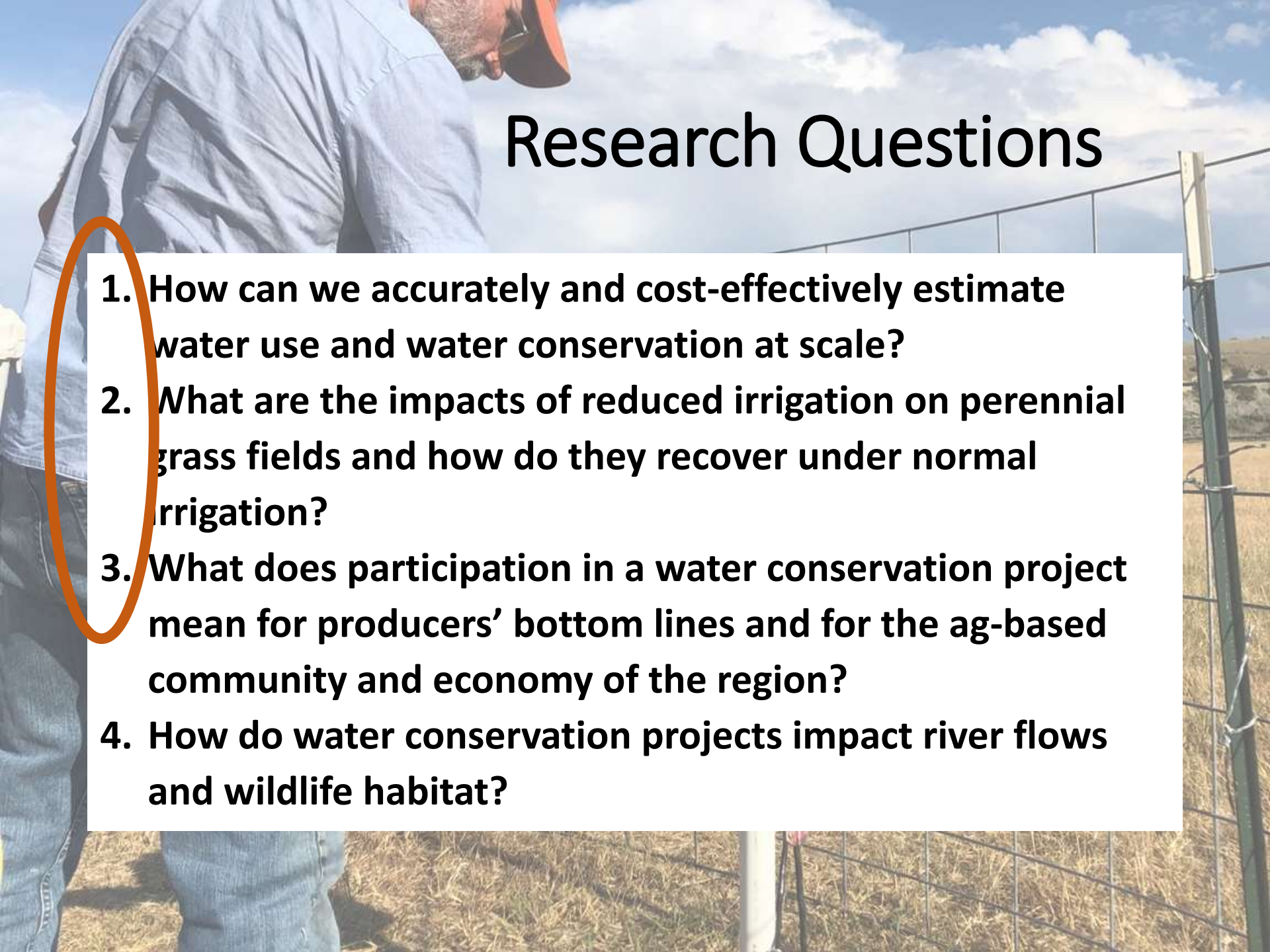


Research Questions

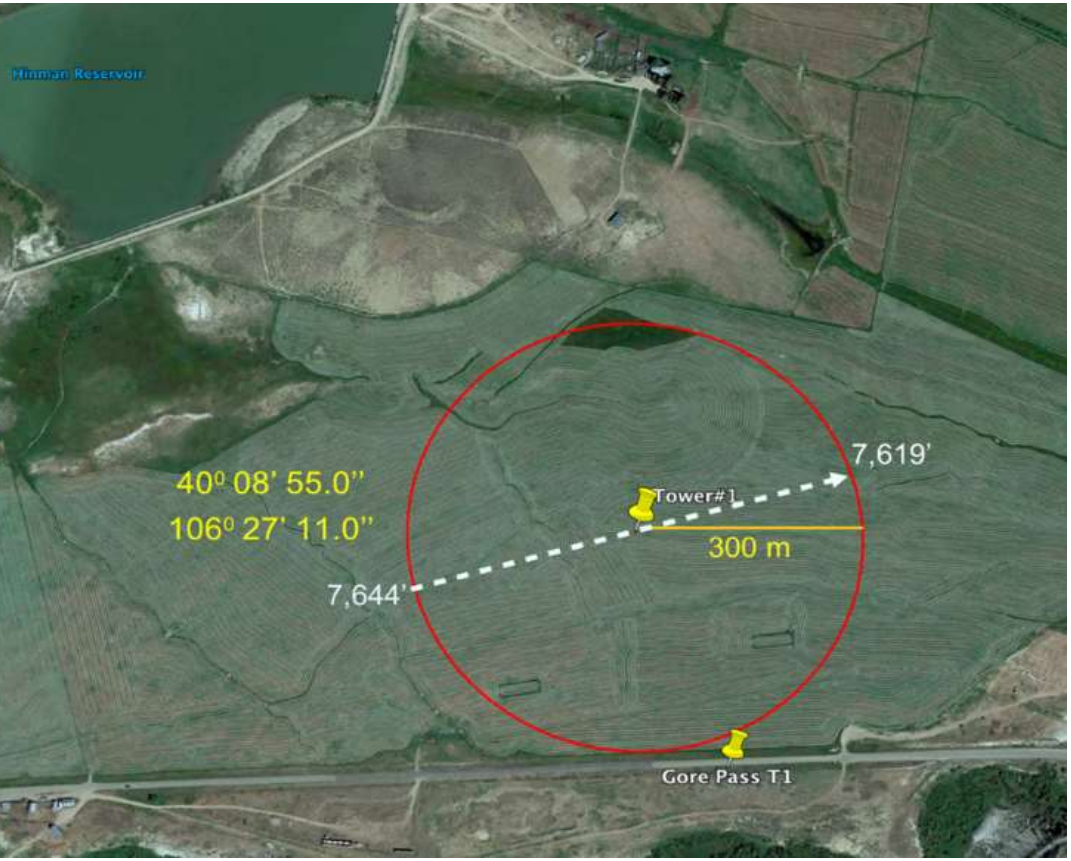
1. How can we accurately and cost-effectively estimate water use and water conservation at scale?
2. What are the impacts of reduced irrigation on perennial grass fields and how do they recover under normal irrigation?
3. What does participation in a water conservation project mean for producers' bottom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

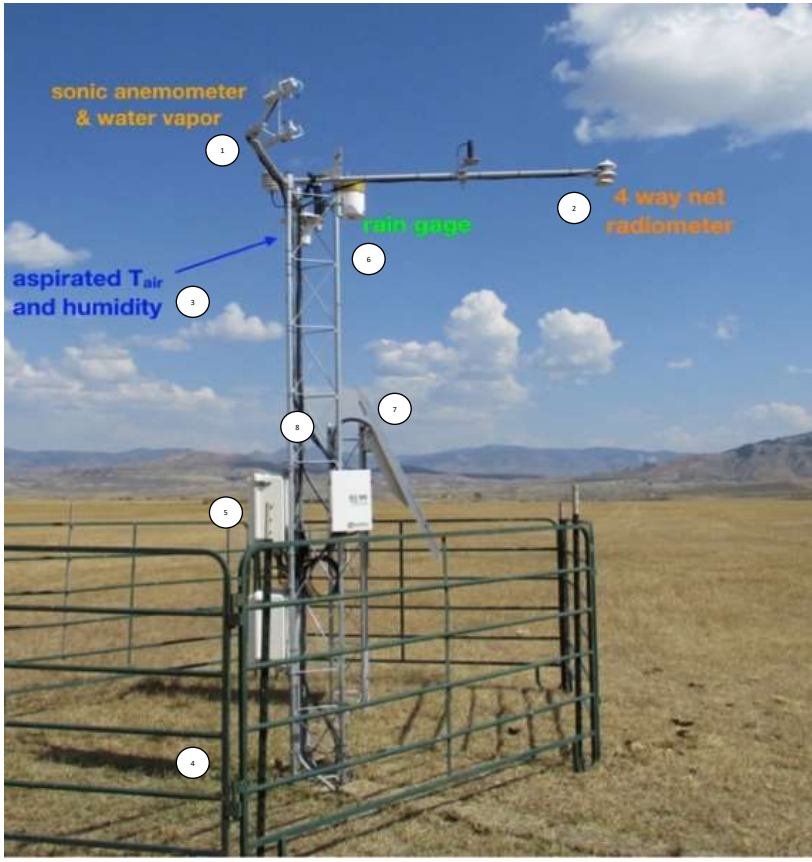
Estimating Water Use

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

Eddy Covariance Instrumentation

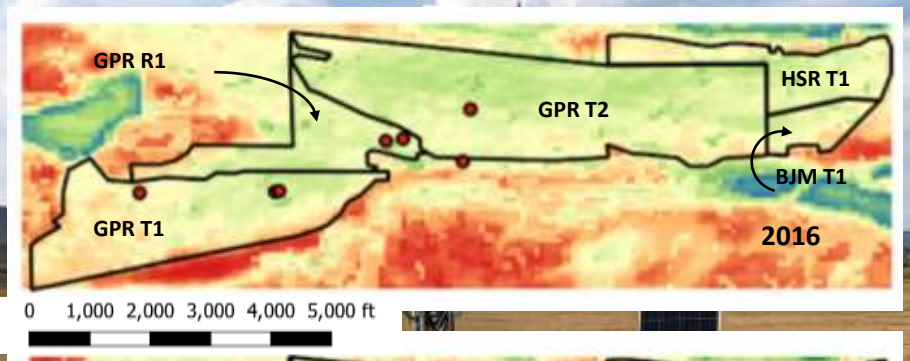


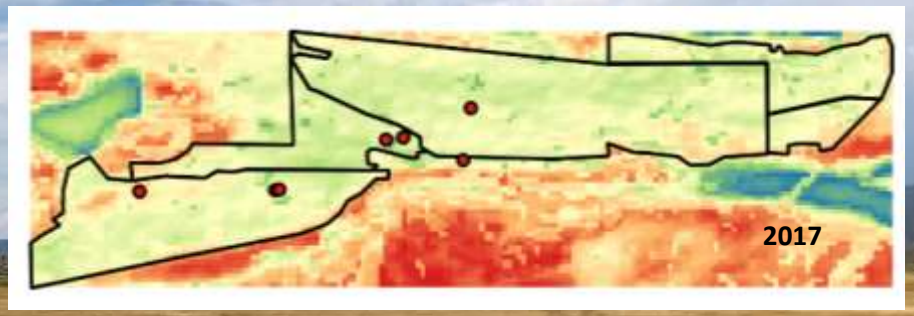


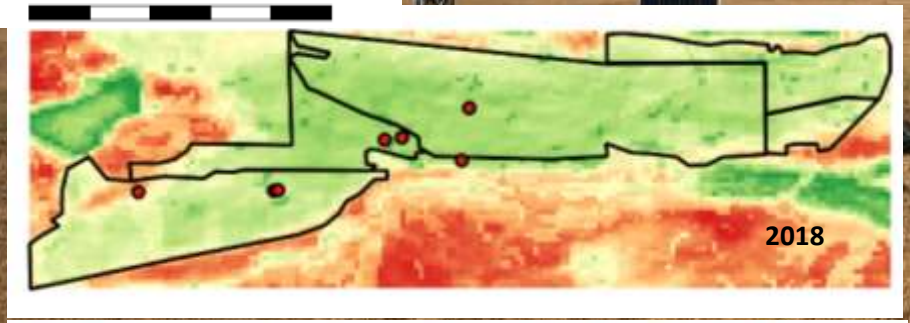
Estimating Water Use
Key Conclusions

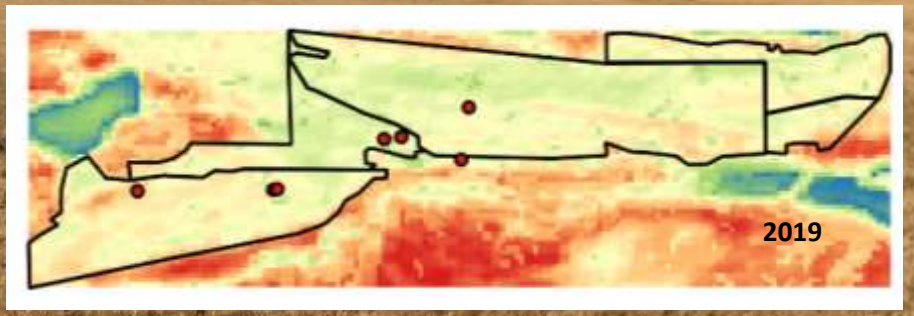
- Data from the project's eddy covariance tower is high quality and accurate in estimating local water use.
- A comparison with the remote sensing data showed certain models are less accurate in water-deficit conditions and that the eeMETRIC model performed best overall.
- This supports the UCRC decision to use eeMETRIC as the preferred model for the Upper Basin.
- This comparison also gives us confidence in using remote sensing as a viable tool that is scalable, cost-effective, and accurate in estimating ET.

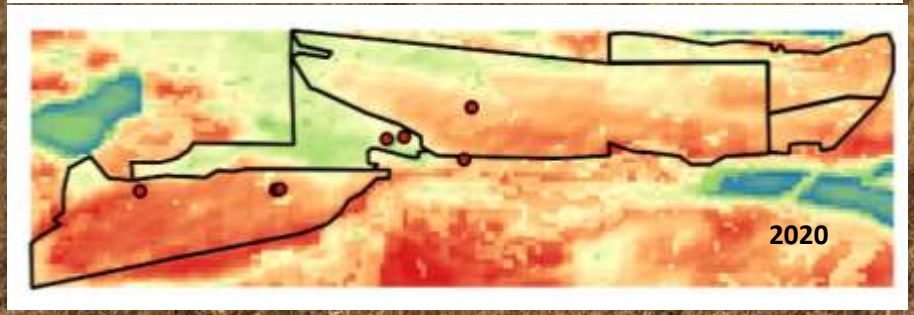
Estimating Water Use
Remote Sensing

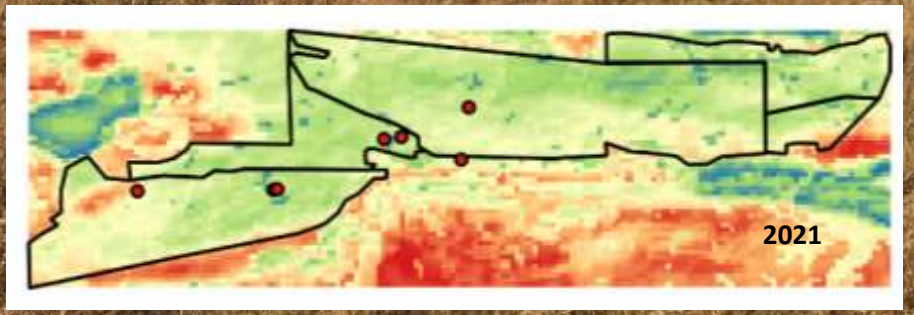












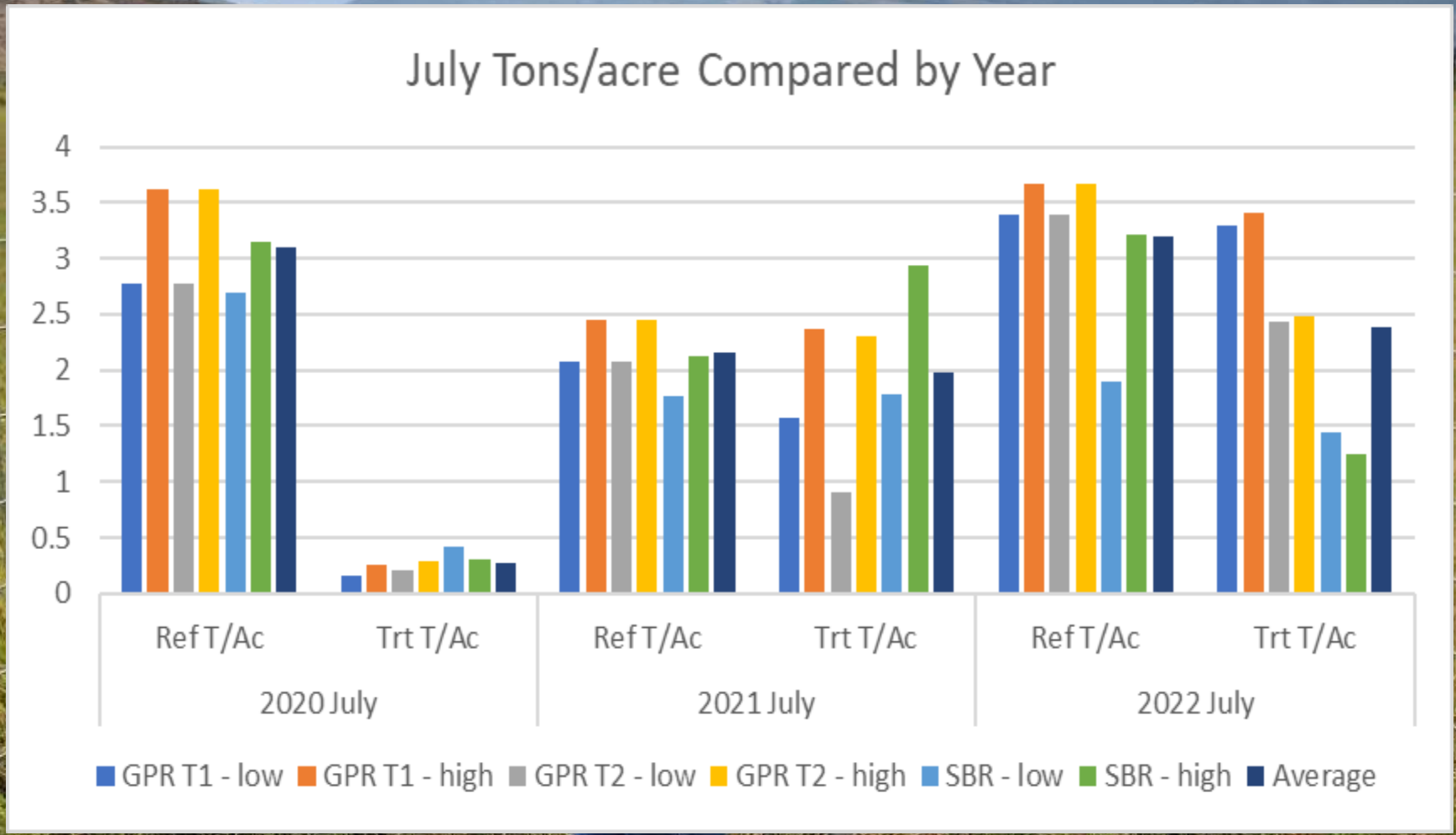
Water Conservation Key Conclusions

- 2020 Reductions in water use ranged between 53.4 - 57.5% for sites under full irrigation withdrawal, and from 14.7 - 20.9% for sites with partial-season withdrawal (no irrigation after June 15)
- Water use lagged on these fields in both 2021 and 2022, suggesting ongoing water conservation, and the need for any program to take a multi-year approach.
- These findings on water use track similar trends in forage impact and recovery.

Forage Recovery

Grass Forage Impact and Recovery Evaluations

Forage Recovery



Forage Recovery - Key Conclusions

- Forage productivity on the fully curtailed fields was **very low** compared to reference fields in **2020**.
- In **2021**, when these fields were returned to full irrigation, productivity on treated fields compared with reference fields was **mixed**.
- In **2022**, the second year in which treated fields were returned to full irrigation, yields on the treated fields were on average **higher than in 2021**, but still tended to be **lower than on the reference fields**.
- **Large differences** between how different treatment fields compare to their reference fields persist.

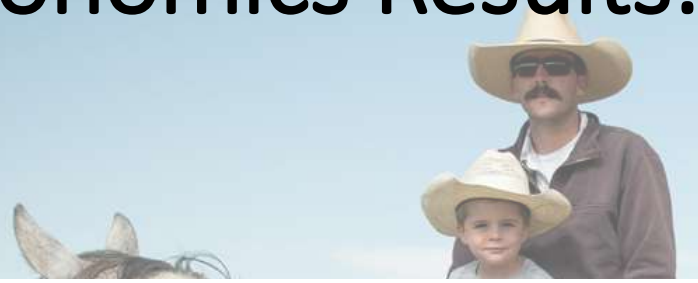
Economics

The economic impacts to Grand County, Colorado hay producers from curtailing irrigation water in exchange for set payment rates in 2020.

Economics Results: Hay Only

Average Per-Acre across Full and Split Season Curtailment Fields without Livestock					
Additional Income	$550.63			**Additional Costs**	$230.07
Reduced Costs	$262.97			**Reduced Income**	$362.35
Total	**$813.60**			**Total**	**$592.42**
		Net Increase/Decrease to Income			**$221.18**

Economics Results: With Livestock



Average Per-Acre across Full and Split Season Curtailment Fields with Livestock					
Additional Income	$550.63			**Additional Costs**	$800.91
Reduced Costs	$262.97			**Reduced Income**	$362.35
Total	**$813.60**			**Total**	**$1,163.26**
		Net Increase/Decrease to Income			**-$349.66**

Economics – Key Conclusions

- Payments of $621/ acre of land subjected to a full season of irrigation curtailment brought **economic gains of $393.22/ acre to producers that grew hay strictly for sale**. Split season payment of $281/acre brought a gain of $150.03/acre to these producers.
- **Producers that relied on their hay fields to feed cattle during the late fall and winter months experience a loss of profit,** despite the payments.
- Producers with livestock would have needed an average payment of at least $970.66/ acre to fully compensate them for the additional costs they incurred.

Economics – Key External Factors

- Drought Conditions – 2020 was particularly bad year.
- Challenging Location – high elevation, short growing season, harsh winter conditions.
- Coordination Across Operations – site specific conditions are important; need to consider impacts to all aspects of the operation.

Key Findings Overall

- We **can make accurate estimations of water use with satellite based remote sensing**, and eeMETRIC is the model of choice.

- **Water was conserved in 2020**. And while water use **continues to improve** towards reference and prior years conditions**, there is a lag** that suggests ongoing water conservation and the need for a multi-year approach for any water conservation program.

- Forage recovery has been varied. In general, **yields are continuing to improve, but there is significant variability**. This indicates a need for further research to better understand key factors in recovery.

- Economic analysis showed that **full season reduction was more profitable than split-season reduction,** but that **compensation would need to be increased significantly for those producers that raise cattle.**

Complete reports available at:
https://www.coloradobasinroundtable.org/agriculture/upper-colorado-study/

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→ **Core Areas**

→ **Agriculture**

Questions?