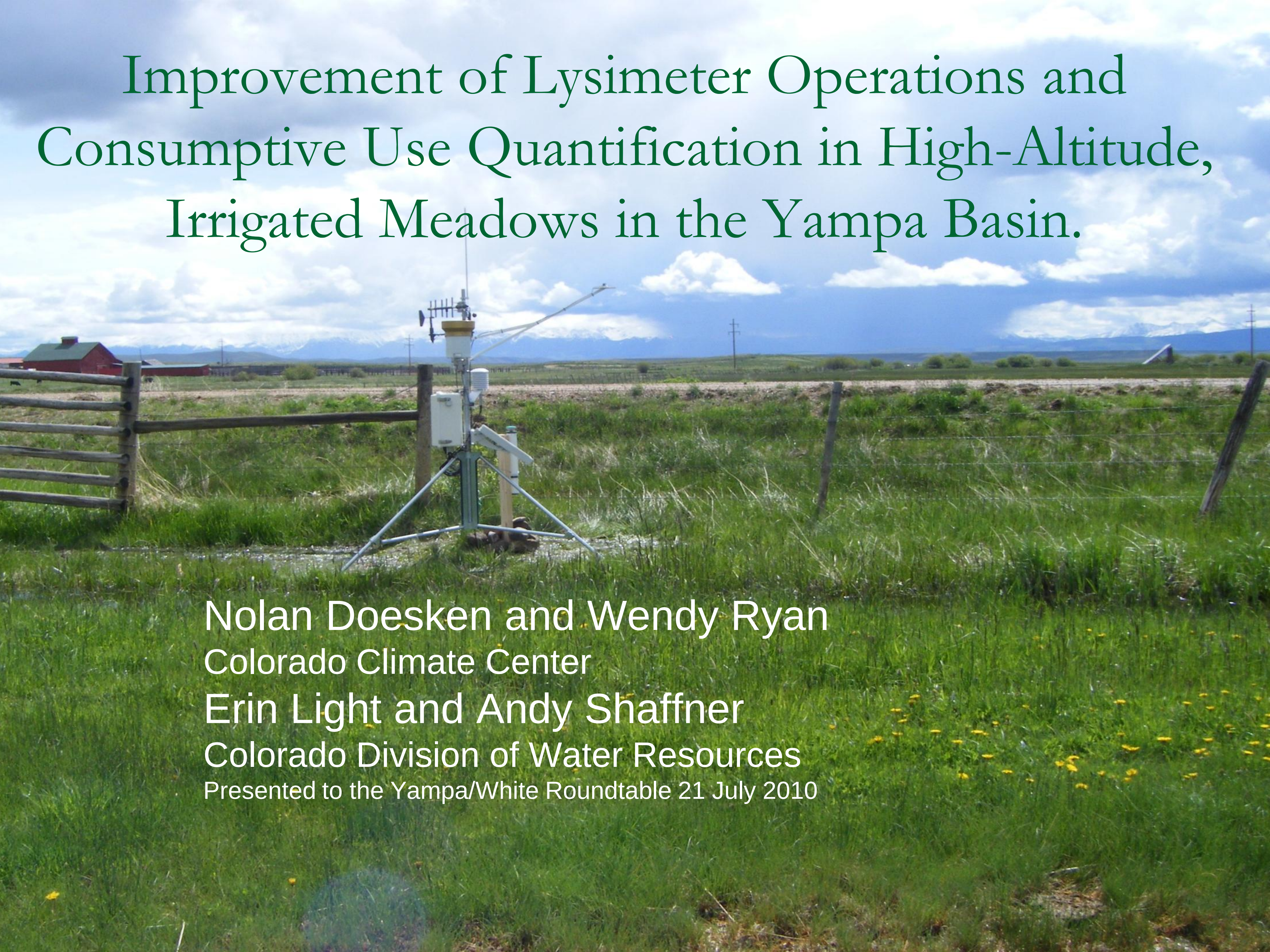


Improvement of Lysimeter Operations and Consumptive Use Quantification in High-Altitude, Irrigated Meadows in the Yampa Basin.

Nolan Doesken and Wendy Ryan
Colorado Climate Center
Erin Light and Andy Shaffner
Colorado Division of Water Resources

Presented to the Yampa/White Roundtable 21 July 2010

Background

- A recent look at historical lysimeter data collected in the Yampa Basin questions the representativeness of the measurements
  - Water may have been limited due to the method of compensating lysimeters being flooded then possibly drying before being refilled again.
  - Also, the CYCC location did not have irrigation surrounding the lysimeters.
  - As a result of lysimeter operations being questioned, so are the derived crop coefficients.
  - (See Dan Smith evaluation of Division 6 Lysimeters for further information)

Proposed Work

- Colorado Climate Center
  - Install and maintain a full CoAgMet weather station.
  - Maintain an ongoing database capable of serving hourly and daily data and graphics: ccc.atmos.colostate.edu/~coagmet
  - Assist Division 6 with additional research work as needed.

Proposed Work

Proposed Work

- CDWR Division 6 Staff/Carpenter Ranch Staff
  - Install, maintain and monitor weighing bucket lysimeters co-located with weather station
    - Bucket lysimeters will mimic irrigation practices in the basin (i.e. not flooded, filled to AWC of soil based off ET data or mass difference)
    - 4 bucket lysimeters will be installed:
      - 2 with grass reference vegetation (50% meadow brome grass, 50% orchard grass)
      - 2 with surrounding pasture vegetation.
    - The bucket lysimeters need to be weighed every 3 to 4 days to ensure water is not limited to the vegetation.
      - Grass in the lysimeter and surrounding area needs to be clipped to 12 cm.

Proposed Work

- Following the data collection period (ideally 5 years, minimally 3) the CDWR Division 6 will quantify consumptive use.
  - Crop coefficients can be directly calculated from the bucket lysimeter data.
  - Weather station data will be used to calibrate Hargreaves (temperature-based) grass-reference ET to measurements using the ASCE standardized Penman equation from the weather station data (ASCE, 2005).
    - The Hargreaves method grass ET is highly correlated with Penman-Monteith estimates (Hargreaves and Allen, 2003).

Proposed Work

- Once these tasks are accomplished accurate estimates of crop ET can be determined through the use of low-cost temperature sensors in unmonitored areas.

Budget: Weather Station(s)

Number of Stations	Total Station Cost	Total Cost - Verizon, 3 Years (O&M)	Total Cost - Verizon, 5 Years O&M
1	$5,579	$14,877	$19,677
2	$11,157	$29,755	$39,355
3	$16,736	$44,632	$59,032
4	$22,315	$59,509	$78,709
5	$27,894	$74,386	$98,386
6	$33,472	$89,264	$118,064

Includes 20% Total Direct Cost University Overhead

O&M $2,000/year

Budget: Scope of Work (Assumes 1 Weather Station for 5 years)

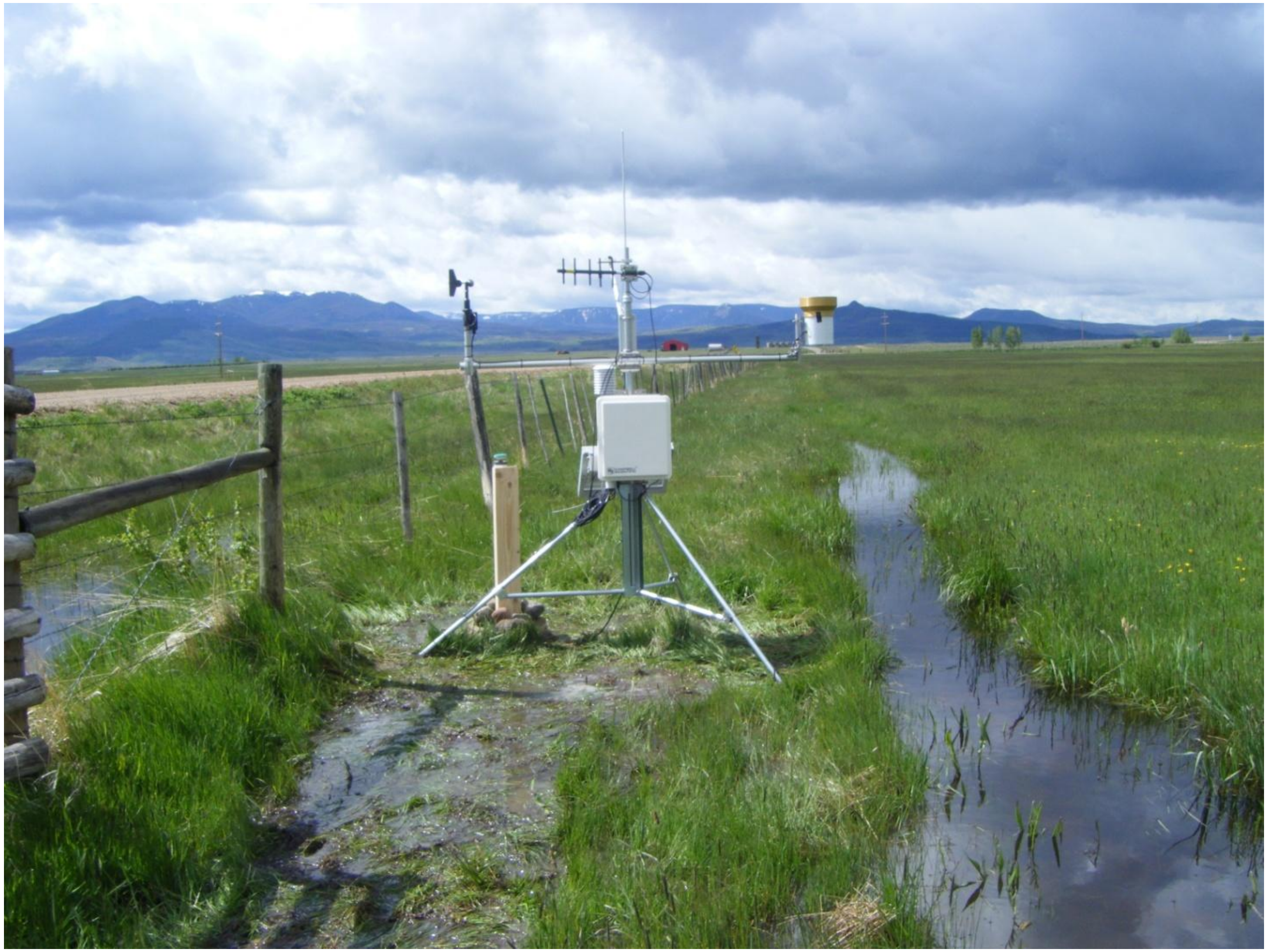
	Total Cost -- 5 year project		
	CDWR/Carpenter*	**CCC**	**Project Total**
Task 1: Installation	**$960**	$19,677	$20,637
Task 2: Development of Crop Coefficients	**$19,600**		$19,600
Task 3: Calculate Crop ET	**$5,000**		$5,000
Total	**$25,560**	$19,677	$45,237

***In-Kind Contributions**

Includes 20% Total Direct Cost University Overhead

For total cost of additional weather stations, use the previous table and insert into CCC under Task 1.

Questions?



References

- American Society of Civil Engineers. 2005. The ASCE standardized reference evapotranspiration equation. R.G. Allen, I.A. Walter, R. Elliot, T. Howell, D. Itenfisu, and M. Jensen (ed.).
- Hargreaves, G.H. and R.G. Allen. 2003. History and evaluation of Hargreaves evapotranspiration equation. J. Irrig. Drain. Eng. 129:53-63.