

## Brief #2: Assessing Forage Impacts

# Evaluating Yield Performance across a Spectrum of Irrigation Withdrawal Scenarios in Pasture-Livestock Systems

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## Overview

- We evaluate how different irrigation curtailment scenarios affect forage yields in pasture-livestock systems across two ranches in western Colorado. This is a companion to Brief #1 that estimated water conservation.
- Biomass yields were modeled across eight irrigation treatments—from full irrigation to complete season withdrawal—at each location across large, field-scale plots.
- The results offer producers and policy makers insight on maintaining forage production while contributing to water conservation—especially under voluntary compensation programs for reduced consumptive use.

## Purpose

This brief presents data on forage yields in pasture-livestock systems for a range of irrigation withdrawal strategies.

The insights gained can assist producers, policy makers, and other stakeholders:

- Assess the trade-offs between maintaining forage production and conserving water resources in pasture-livestock systems through voluntary irrigation curtailment.
- Provide data to inform the design and implementation of flexible, site-specific water management practices that support voluntary compensation programs.

## Approach

A pasture at each ranch was divided into 8 zones, about 5 acres each, with zones receiving specific irrigation treatments.

- Scenarios ranged from full-season irrigation to various shutoff schedules, compared to a fully irrigated reference.
- Pastures were actively grazed according to typical schedules to replicate real-world conditions.

Forage yields were estimated using spatially-averaged actual evapotranspiration values derived from remote sensing data, which captured field-scale variability in crop water use.

- Modeled forage yields were compared with exclusions in each zone to derive more detail regarding yields.

## Findings

ET-based crop production functions provided reasonable estimates of forage biomass across irrigation scenarios.

- Exclusion-measured yields provided some agreement where expected in full-irrigation and withdrawal scenarios.

At Banner Ranch, the more uniform site, dry matter yields for the no irrigation withdrawal strategy measured:

- 1.07 t/ac through July 18 within the exclusion, versus 1.08 t/ac modeled using ET-based production function
- An additional 1-1.5 tons was produced from July 18 through the second sampling in September
- In contrast, the full season irrigation withdrawal strategy yielded 56% lower through the July sampling date

Field ET rates were non-zero, contrasting with greater and almost total forage losses on heavily water stressed fields.

- Reflects stored soil moisture availability and evaporation, highlighting some ET continues even when grazable yield is unavailable for typical stocking rates.
- However, ET thresholds exist, below which grass growth will be functionally useless for pasture operations.

## Insights

Partial season strategies show potential for modest water conservation while maintaining some forage output

- A tradeoff will be required under voluntary compensation programs for forage yield versus conserved CU.

ET mapping is a useful proxy for estimating forage biomass production across varied irrigation scenarios

- Offers research-based, landscape-scale approach for conventional CO smooth brome, orchardgrass, tall fescue.
- Important for normalizing against localized variability in species composition, soil moisture, and grazing pressure.

In-field biomass sampling provides valuable ground-truth data for calibrating ET-based yield estimates

- Can help to validate remote-sensing or modeled assessments.
- Diverse range of single-point samples across field conditions is essential

Continued evaluation of fields after withdrawal is important in subsequent years to assess recovery or continued impacts.



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