Brief #3: Managing Implementation

Practical Guidance for Implementing Voluntary Irrigation Withdrawals on Pasture-Based Livestock Operations

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Overview

➢ Livestock producers need practical, experience-based guidance on how voluntary irrigation reductions affect haying and grazing schedules, along with strategies for successfully implementing these practices.

➢ This brief presents key insights and lessons from demonstration-scales trials of limited irrigation practices implemented on working pastures in Colorado's West Slope region.

➢ We highlight tradeoffs in hay and grazing outcomes to inform both producers considering these strategies and program designers aiming to reduce disruptions to pasture-based operations.

Purpose

Drawing on demonstration-scale trials at Western States Ranches, we assessed workable approaches to sustaining pasture operations under voluntary irrigation withdrawals.

The findings will help stakeholders and policymakers:

- Understand how participating in water conservation programs may affect livestock operations, including forage availability and grazing schedules.
- Identify program design features that better align conservation objectives with the operational needs and constraints of pasture-based livestock systems.

Approach

We compared four scenarios: full-season irrigation, shut off on July 1, shut off on June 1, and no irrigation (full withdrawal).

Used expert judgement to estimate likely impacts of each scenario on forage production and grazing outcomes.

- Considered spring, early summer, late summer, & winter periods. Trials conducted on pastures at two locations.

Assessed potential ranges of effects on hay yield, stocking days, and pasture recovery.

- During both the implementation year and the following year.

Findings

Observed tradeoffs: Forage reductions increased with earlier irrigation shutoffs, resulting in lower hay yields, fewer grazing days (from winter stockpiles), and greater pasture fragility.

Late shutoff (July 1) supported hay potential and stocking days similar to full-season irrigation.

- Expect moderate reductions in winter grazing days (up to 25-50% lower compared to full-season irrigation).

Earlier shutoff (June 1) required more active management to adapt to less irrigation.

- Expect reduced crossover grazing and eliminating hay cutting in year of reduction, leave forage for winter grazing.
- Less regrowth in late summer results in reduced winter grazing days (up to 50-75% lower compared to full-season).

Full-season withdrawal (no irrigation) likely necessitates fully resting pastures.

- Mostly eliminates crossover grazing in implementation year and year after, and haying in implementation year.
- Expect very restricted winter grazing days (up to 75-100% lower compared to full-season irrigation).

Insights

Limited irrigation can work on pasture-based systems, but requires planning and adaptive management

- Within and across years in response to water availability and pasture recovery conditions
- No one-size-fits-all solution: Programs should accommodate varying pasture types, elevations, and grazing systems.

Timing matters:

- Late shutoff improves forage outcomes, less disruption.
- Early shutoff achieves greater water conservation but requires adaptation and may increase herd/pasture stress.
- Full curtailment is likely incompatible with pasture use.

We observed additional factors for producers to consider:

- Pasture fragility can persist into the year after irrigation reduction, especially with early or full-season cutoffs.
- Early shutoff and no-irrigation plots showed increased weed pressure and shifts plant communities, potentially complicating long-term pasture management.

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Supplemental Information

Background and Motivation

Previous studies on limited irrigation often overlooked how the timing of irrigation reductions interacts with pasture-based livestock operations, especially among the remarkably varied and unique livestock grazing operations in the Upper Colorado River Basin. Grazing system performance depends on multiple interrelated factors such as forage yields, herd size, weather, and post-grazing pasture recovery time. Seasonal shifts in precipitation, forage demand, and irrigation availability further complicate herd and pasture management. Therefore, evaluating the feasibility of limited irrigation practices across grazing periods is important for understanding its practical impacts.

Such assessments help producers weigh tradeoffs and make informed decisions about the timing of implementation of voluntary irrigation reduction practices. In years with limited irrigation, adjustments may be needed to irrigation practices, winter stocking rates, forage supplementation, and grazing schedules. These changes can extend into the following year due to yield drag and increased pasture fragility, which may reduce hay yield and stocking days while requiring extended rest periods. A single irrigation strategy is unlikely to work uniformly throughout the season without prompting intra-annual management shifts.

Without this information, producers may hesitate to join water conservation programs due to concerns about disrupting forage production and grazing schedules. This brief addresses that gap by offering practical guidance for Colorado's Western Slope, including an example grazing schedule and potential forage and herd management responses to irrigation curtailments at different times of the year.

Example Grazing Calendar

Table 3.1 describes an example grazing calendar for a mid-elevation pasture (5,000 – 7000 feet) in Colorado's Western Slope region. It presents a stylized version of a schedule used by Western States Ranches on some of their pastures.

Table 3.1 Example grazing calendar for a mid-elevation grass pasture (5,000–7,000 feet) in Colorado's Western Slope region

Period	Season/name	Approximate dates	Description of management activities
1	Spring/crossover period	April to May	• Irrigation season begins, and the pasture begins to green up. Some residual forage from prior year may be available. • Livestock move to this pasture from winter permits or another farm. • Livestock consume a mix of new growth and old residues over 1-2 grazing rotations in small paddocks where they are grazed for three days and then moved.
2	Early summer/ initial growth period	June	• Grazing and irrigation cycles continue as forage growth accelerates and reaches maturity. • Livestock move off this pasture to summer permits as they become available.
3	Late summer/ regrowth period	July to October	• Livestock remain off this pasture with forage regrowth ending by late October. • One cutting is common in late July or August. • Forage regrowth left standing as stockpile for winter grazing period.
4	Winter/winter grazing period	November to March	• Livestock graze standing (stockpiled) forage, typically limit consumption to 25% of the stockpiled biomass. • Leave another 25% of stockpiled biomass for the crossover grazing period. • Feeding of hay may occur in late winter if grazing resources are depleted.

Notes: Stylized example grazing calendar based on recent experience at Western States Ranches near Delta, CO.

Table 3.2 Description of four irrigation scenarios

Scenario	Description	Treatment
1	Standard irrigation (SI)	Full-season irrigation (non-limited)
2	Limited irrigation 1 (LI1)	Shut off irrigation on July 1 (early season)
3	Limited irrigation 2 (LI2)	Shut off irrigation on June 1 (late season)
4	Limited irrigation 3 (LI3)	Full-season curtailment (no irrigation)

Notes: The standard irrigation (SI) treatment serves as the reference strategy for comparing the performance of the three LI strategies

Livestock producers in this region commonly divide the grazing season into four periods, summarized in the table under what we term a full-season or 'standard' irrigation (i.e., non-limited) scenario.

The "crossover" period (Period 1) occurs in spring when cattle are typically brought onto the pasture following early forage growth. Residual forage from the previous year is often still available, and intensive systems (e.g., rotational grazing) may support up to two grazing rotations through this pasture. In "early summer" (Period 2), livestock are moved off the pasture to summer USFS permits, typically available by June or early July.

During "late summer" (Period 3), the focus shifts to promoting hay development, with a cutting common in late July or August. Livestock remain off the pasture; any regrowth after haying is stockpiled for winter grazing. In the "winter" period (Period 4), pastures are grazed to meet herd needs while maintaining enough residual forage for recovery during the crossover grazing period in the following season. In all periods, forage removal (grazing, haying) is managed with sufficient rest to promote forage recovery the following year without reducing pasture health.

Limited Irrigation Practices and Expected Impacts

To explore feasible opportunities for livestock producers to participate in agricultural water conservation programs, we evaluated four limited irrigation scenarios and their anticipated impact on the example calendar. Table 3.2 summarizes these scenarios, which mirror a subset of the scenarios we implemented in the on-farm demonstration trials with Western States Ranches. Two scenarios (LI1 and LI2) use a split-season approach: irrigation is applied normally until a designated shutoff date, after which it is fully curtailed.

We then assess how these limited irrigation practices may alter livestock grazing systems compared to the standard irrigation (SI) scenario, outlined in Table 3.1. The analysis is divided into two parts: Table 3.3 presents the anticipated

Table 3.3 Expected effects of voluntary irrigation reductions on the affected pasture during the year of implementation

Practice implemented	Grazing period			
	Spring/crossover (Mar – May)	Early summer (Jun)	Late summer (Jul – Oct)	Winter (Nov – Feb)
Shut off July 1	• No effect on grazing, shutoff comes later in the summer • Expect two grazing rotations like SI	• Saturate soil water profile in late June • Evaluate profitability of hay cutting vs stockpiled forage	• Expect less forage regrowth than SI • Expect stockpiled yields 25-50% lower than SI	• Expect fewer grazing days based on less stockpile • Adapt by finding other pastures, supplementing hay, backgrounding fewer calves
Shut off June 1	• Proactively reduce grazing pressure • Expect one less grazing rotation than SI	• Expect forage yields 25-50% below SI • No hay cutting, leave for grazing	• Expect less forage regrowth than SI • Expect stockpiled yields 50-75% lower than SI	• Expect fewer grazing days based on less stockpile • Adapt by finding other pastures, supplementing hay, backgrounding fewer calves
Full season curtailment	• No crossover grazing due to pasture fragility • Some forage growth occurs due to precipitation	• No hay cutting, leave for grazing	• Expect stockpiled yields 75%-100% lower than SI	• Expect fewer grazing days based on less stockpile • Adapt by finding other pastures, supplementing hay, backgrounding fewer calves

effects during the year of implementation, while Table 3.4 outlines potential impacts in the following year, reflecting the first year of recovery under resumed standard irrigation.

Impacts in Year of Implementation

During the implementation year, we observed that earlier irrigation curtailment had more pronounced impacts on pasture and herd management (Table 3.3). For example, a July 1 shutoff had no effects during the crossover and early summer forage growth periods because there were no irrigation restrictions and only minimal to moderate effects on late-season and winter grazing. This latter observation is because producers can saturate the soil water profile around the end of June, helping to sustain hay production and forage regrowth even after irrigation stops.

With a June 1 shutoff, producers may need to proactively reduce grazing intensity during the crossover period and consider forgoing haying in mid-summer—even if conditions appear favorable—to preserve pasture health for later in the season. In many cases, leaving the forage standing as stockpile may be more economically beneficial than attempting to cut hay. Under full-season curtailment, producers will likely skip crossover and summer haying entirely, relying instead on limited precipitation-driven forage growth to support some winter grazing—if conditions allow. In dry years, the pasture may need to remain fully rested for the entire season.

Impacts in Year After Implementation

In the season following irrigation reduction, lingering effects on forage production and grazing management will likely depend on the timing (how early irrigation was curtailed) and severity (how much natural precipitation occurred) of the previous years' curtailment (Table 3.4). Later shutoff dates will generally result in fewer carryover impacts, while earlier or full-season curtailments may require ongoing management adjustments. In contrast, earlier cutoffs or full-season curtailments will require ongoing management adjustments to maintain pasture health and productivity.

For example, for pastures with a July 1 shutoff, producers may benefit from choosing to graze more conservatively during the crossover period—for example completing one rotational pass instead of two—to allow for pasture recovery. Otherwise, normal operations, including haying and winter grazing, can generally resume under standard irrigation. In the case of a June 1 shutoff, producers may need to reduce grazing pressure across multiple periods. Crossover grazing, haying, and winter use are possible but occur at lower rates to prevent stressing recovering stands. To help mitigate potential declines in pasture performance, a cautious approach is warranted, with delayed grazing, limited haying, and close monitoring of recovery indicators recommended before resuming typical stocking levels.

Table 3.4 Expected effects of voluntary irrigation reductions on affected pasture in year after implementation (that is, in the year of return to full-season irrigation)

Scenario	Grazing period			
	Spring/crossover (Mar – May)	Early summer (Jun)	Late summer (Jul – Oct)	Winter (Nov – Feb)
Shut off July 1	•Graze conservatively •Expect 1 less rotation compared to SI	•Expect no yield drag on hay •Hay yield similar to SI	•Expect no yield drag on regrowth •Stockpile yield similar to SI	•Expect no yield drag on winter stockpile •Grazing days similar to SI
Shut off June 1	•Allow recovery, pasture will be fragile •Minimal crossover grazing	•Expect small yield drag on hay •Example: 10% after 1 year, 5% after 2 years	•Expect small yield drag on regrowth •Example: 5% after 1 year, 0% after 2 years	•Graze less based on reduced stockpile •Minor management challenges (weeds, plant mix shifts)
No irrigation	•Allow recovery, pasture very fragile •No crossover grazing	•Expect moderate hay yield drag on hay •Example: 15% after 1 year, 7.5% after 2 years	•Expect small yield drag on regrowth •Example: 10% after 1 year, 5% after 2 years	•Graze less based on reduced stockpile •Management challenges (weeds, plant mix shifts)

Following full-season curtailment, recovery is likely to take longer. Grazing should be delayed until sufficient regrowth is evident, and haying and grazing may not be feasible in the recovery year. Producers will need to closely monitor pasture conditions and recovery progress before returning to normal stocking levels.

Additionally, one significant, but difficult to quantify, observation from the demonstration plots was the increase in weed pressure and shifts in plant community composition in response to limited irrigation. These observations were most pronounced in the no-irrigation zones, but early-season shutoff scenarios-like June 1—also showed similar signs. Such changes may pose longer-term management challenges and could further affect forage quality and productivity.

Producer Timing Considerations for Voluntary Irrigation Reductions

The main outcome of this discussion is that livestock producers must carefully consider the shutoff timing when implementing voluntary irrigation reductions to contribute to regional water conservation goals. Different irrigation shutoff dates will present distinct tradeoffs in terms of forage availability, adjustments to grazing schedules, and water conservation performance. To navigate these timing considerations while keeping their livestock operations running, producers will need to coordinate their grazing plans around the modified irrigation schedules but also taking into consideration their additional grazing permit availability and the forage supplementation (e.g., find other grass, purchase hay) strategies available to them. Future tools such as long-term water contracts are being explored in the region and could support water conservation strategies and that work in tandem with reduced stocking rates.

The irrigation shutoff scenarios discussed in this brief present opportunities for livestock producers to participate in agricultural water conservation programs. Late-season shutoffs preserve early-season forage growth and minimize disruptions to livestock operations (i.e., adjustments to haying and grazing calendars) but have smaller water conservation potential compared to earlier shutoff dates. Later curtailment means the forage plants have adequate time to grow, making the affected pastures relatively resilient to grazing pressure and water stress. Mid-season shutoffs, however, are likely to offer a balanced approach that enables some forage utilization and moderate water conservation. Continuing irrigation for part of the season should provide for some forage growth and winter stocking days, but does not maximize the total amount of water conserved. Early season shutoffs or full-season fallow do maximize water conservation but significantly reduce or eliminate all forage availability. This slows pasture recovery and increases the risk of stress, particularly under drought conditions, making it harder to restart grazing in subsequent years.

Takeaways

This brief explored the tradeoffs between voluntary irrigation reductions and pasture management in grazing systems on Colorado's Western Slope, with a focus on mid-elevation pastures that support livestock operations. While water conservation initiatives aim to lower consumptive water use, limited irrigation practices can affect forage growth, grazing calendars, and pasture recovery. To promote wider use of voluntary curtailment practices, the timing of irrigation reductions must be carefully aligned with other livestock management activities. Drawing on on-farm trials at Western States Ranches, we highlighted how the timing of irrigation cutoffs—across spring, early summer, late summer, and winter grazing periods—influenced forage outcomes and operational adjustments. Producers implementing voluntary irrigation restrictions will need to adapt grazing strategies seasonally, to align grazing plans with irrigation schedules, permit availability, and forage supplementation strategies. Proactive management and future tools such as long-term water contracts will further support producer irrigation decisions and related stocking adjustments and minimize impacts on those working ranches.