

Grazing Systems Management for Climate Resilience

While there is no one-size-fits-all solution to the challenges faced on the ranch, these Best Management Practices (BMPs) are intended to be used as a toolbox to improve environmental outcomes without compromising economic benefits.



Adaptive Grazing Management

Economics

Each individual BMP has a variable economic cost and benefit



Stakeholders

Building lasting relationships is essential to successful implementation of BMPs

Effective long term management operates at the intersection of healthy vegetative, animal and soil practices

Ecology



Agricultural Water Quality Program



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Adapting to a Changing Future

Preparing grazing management for uncertain and complex climatic conditions will require adaptations in land and animal management that create climate resiliency. Impacts of climate change on Colorado rangelands will vary by region but in most areas will include increasing drought frequency, and longer-term shifts in climate including warming temperatures and precipitation changes. These factors will have serious implications for livestock, forage quality and yield. To create a more resilient future for producers, adaptations in land management strategies will be required to create systems that are equipped

to survive into the future. This document focuses on adaptive grazing management as tool for climate-smart grazing management and highlights a number of grazing Best Management Practices (BMPs) that have been supported by research to potentially improve climate resiliency of grazing systems in Colorado. While there is no one size fits all solution to the challenges faced on the ranch, these BMPs are intended to be used as a toolbox to improve environmental outcomes without compromising economic benefits. Below, these BMPs are broken down into reactive and proactive short, medium, and long-term strategies.

What can I do now (<1 Year)?

The following short-term strategies are what a producer can do immediately, in years when drought strikes, or when drought is imminent:

Create a Drought Plan

Creating a strategic drought contingency plan provides management flexibility and the ability to respond quickly and effectively to drought conditions. Below are key elements of drought and climate resiliency planning. Key steps of drought planning, preparing and monitoring include:

- » Take inventory of forage and range resources, identify target conditions, and monitor resources.
- » Use technology to track and monitor dryness and drought across the country.
- » Increase flexibility by making business decisions ahead of time that can reduce the impacts of drought and climate variability (e.g., increase acreage of operation for more heterogenous forage resources).
- » Modify livestock enterprise structure to match forage availability with demand.
- » Utilize decision making tools to weigh enterprise options.
- » See the Colorado Drought Handbook for strategies to create a Drought Management Plan.

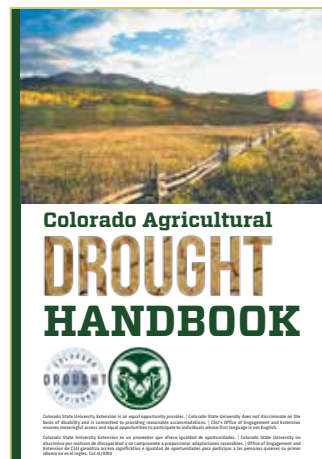
Additional Short-term BMPs:

- » Monitor weather and forage conditions using 1–3-month forecasts and use this information to adjust stocking rates.
 - ▲ Reduce herd size strategically, early in the drought cycle.



Emmett Jordan

Grass clipping is one way to take inventory of current forage and range conditions.



See the Colorado Drought Handbook for strategies to create a Drought Management Plan.





Emmett Jordan

The early weaning of calves is a common practice to reduce forage consumption and lower the nutritional needs of cows on pasture.

Additional Short-term BMPs *Continued*

» Wean early

▲ Weaning calves early is a common practice that is resorted to when forage supply is getting scarce. However, culling spring calves under six months of age does not significantly decrease herd forage demand. In addition, these animals tend to have little market value in wide-spread drought situations.

» **Evaluate cost trade-offs of buying hay vs selling cows.** The Agriculture Business Management team has a decision tool to help evaluate cost trade-offs.

» **Utilize windrow grazing.** This practice reduces associated labor and input costs of baling, storing, and feeding hay which can be beneficial if dry climatic conditions impact yields during the growing season.



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Grazing goats in combination with other species or alone can provide a number ecosystem services and benefits.

» Utilize annual forages/cover crops:

- ▲ Use annual forages/cover crops as a low input emergency forage during drought conditions.
- ▲ Cover crops combined with no-till practices can help retain spring and fall moisture from evaporation.
- ▲ Utilize management-intensive or strip grazing to obtain the greatest efficiency with cover crops.

▲ Use cover crops as a high-quality feed source, to extend the grazing season, or as winter feed.

▲ Use cereal crops as an alternative to a traditional hay crop during times of drought due to their drought resistance.

» Evaluate alternative feeds. Consider:

▲ Delaying grazing in the late spring during and after an extended drought to avoid plant stress by supplementing with hay.

▲ Selecting alternative feed sources such as cottonseed, wheat middlings, soybean hulls, and sorghum-sudan.

▲ Renting additional pasture/moving livestock to another location.

▲ Working with local crop farmers to graze crop residues.

▲ Stockpiling forage to extend the grazing season. Warmer winter temperatures are predicted with climate change which could elongate the grazing season.

▲ Utilizing warm season grasses for forage stockpiling in irrigated scenarios.

» **Create a plan for wildfire emergencies.** The plan should include evacuation details for humans and livestock, an emergency kit and a designated meeting place.

» **Take advantage of disaster payment programs.** For example, Livestock Forage Pasture Insurance, administered by the Farm Service Agency, provide payments based on severity of conditions. These are not insurance programs, and do not require advance sign-up.

» **Stress management:** AgWell connects rural farmers and ranchers to stress management resources including, but not limited to, suicide prevention, substance abuse, general mental health resources, financial resources, and more.

What can I do soon (2-5 Years)?

Extend Grazing Lands Portfolio

Utilizing a mix of different grazing land types can also increase forage diversity and minimize risk within a grazing operation. Consider how the ability to move livestock to different locations and elevations may improve drought flexibility. Many ranchers already practice this by using a range of elevations and BLM and US Forest Service leases. Other examples include:

- » Lease private pasture
- » Grazing on corn stalks
- » Relationships with producers and landowners in other states/ areas
- » Improving production on irrigated pastures
- » Evaluating costs and revenue trade-offs of selling cows and grazing through the winter in corn stalks, or other combinations

Managing Invasive/Toxic Plant Species

Invasive and/or toxic plant species pose great risks to grazing operations. Climate change and drought often favor invasive/toxic plants as these species are often more tolerant of environmental stresses and variability than forage species. Make controlling invasive weeds a priority objective (mechanically, chemically, or biologically).

- » Adopt proper grazing management to avoid overgrazing that can lead to the presence of fire regime altering invasive species.
- » Cost-sharing funds for weed management may be available (see Resources, Tools, and Support section for more information).

Prescribed Fire and Patch-Burning

Using fire as a tool in Colorado is extremely dependent on ecosystem type and historical fire regime. Contact local resources to determine if fire is a viable option for site-specific systems. Utilize prescribed fire or patch burning during non-drought years. Appropriate use of prescribed fire patch burning can be used to:

- » Stimulate above and belowground plant biomass while increasing diversity and heterogeneity
- » Improve forage quality
- » Increase livestock distribution and discourage overgrazing
- » Mitigate invasive species spread and parasite loads on rangeland
- » Promote carbon sequestration

What can I do for the future (6+ Years)?

Long-term strategies are proactive actions that help prepare a grazing operation for drought and long-term climate changes by modifying the physical and planning characteristics of the operation over time. Adaptive grazing management and the following climate-smart grazing BMPs have the potential to support long-term operational risk-reduction and resiliency.

Adaptive Grazing Management: Flexibility Supports Long-Term Climate Resilience

Adopting adaptive grazing management is an important enterprise-level strategy with the potential to improve long-term climate resiliency by increasing operational flexibility and avoiding overgrazing in the face of increasing variability. Adaptive grazing is a goal-based method that encourages managers to make a plan, implement it, and assess whether the actions were successful or need to be changed. This tool provides the operational flexibility that will be needed in the face of an uncertain climate future. Adaptive grazing strategies have been shown to improve rangeland health. Rangelands that are in good condition before drought have greater resilience to drought conditions because they generally have higher diversity of plant species, contain plants with more robust root systems that are more able to extract soil moisture, even when conditions are dry, and have higher amounts of litter (i.e., plant material) which cools the soil surface and helps retain soil moisture. Key components of adaptive grazing management include making careful and flexible decisions about grazing intensity, frequency, and timing (Table 1).

Using fire as a tool in Colorado is extremely dependent on ecosystem type and historical fire regime.

Key Components of Climate-Adaptive Grazing Management

Table 1. Key components of climate-adaptive grazing management: choosing appropriate intensity, frequency, and timing of grazing.

Intensity	Frequency	Timing
<p>Stock conservatively and match supply & demand</p> <ul style="list-style-type: none"> » Determine forage production (e.g., with Satellite-based tools like the Rangeland Analysis Platform). » Balance animal units (AU's) to match forage availability. <p>Shift to a moderate level of forage use</p> <ul style="list-style-type: none"> » Take half and leave half. At 50% biomass removal, roots will continue to growth. Most agencies assume that of the 50% used, only 25% is actually ingested by the animal. Another 25% is lost to trampling, defecation, or used by wildlife. At >70% utilization, root growth slows and stops. <p>Adjust stocking rates according to weather conditions</p> <ul style="list-style-type: none"> » Use annual and short-term (e.g., 1–3-month) weather predictions to iteratively adjust stocking rates on rangeland. » Stocking rates may need to be reduced in the years following a drought depending on pasture condition. <p>Avoid heavy utilization of riparian areas</p>	<p>Invest in Infrastructure: Subdivide grazing land to create greater animal distribution and increased forage utilization</p> <ul style="list-style-type: none"> » This can be done by physical fencing, using herding practices, or strategically placing water and minerals. Virtual fencing may be another experimental approach.  <p>Deferred grazing allows for proper rest and regrowth of forage</p> <ul style="list-style-type: none"> » Repeated grazing events that occur too frequently can damage plants. » Rest/rotation methods allow time for resting pastures to accumulate feedstocks and provides time for rest and regrowth of grazed areas. » “Grass banking” is setting a pasture(s) aside for one of more growing seasons so they can be used as emergency feed in case of drought. 	 <p>Rotate the time at which a pasture or area of land is grazed each year</p> <ul style="list-style-type: none"> » This gives different types of plant species a chance to complete reproductive cycles and set seed. <p>Move livestock quickly early in the season</p> <ul style="list-style-type: none"> » Takes advantage of spring moisture and forage that is available before the drier summer months. <p>Avoid grazing in late spring/early summer in drought years</p> <ul style="list-style-type: none"> » Grazing under dry conditions during this time results in plant moisture stress and poor regrowth.

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Herd Composition, Diversification, and Genetics

Adopting flexibility in grazing enterprise can also be an important climate adaptation strategy, as it is often not economically viable to flex stocking rate with cow-calf operations in response to variability. Another strategy is to iteratively adjust herd composition to take advantage of high production years and minimize the impacts of bad years. Examples include:

- » Add yearling enterprises in high production years, reduce stocking rates in low production years.
- » Adjust to a later calving season (April-June) to match livestock's nutritional needs to forage availability.
- » Utilize multi-species grazing to increase carrying capacity, rangeland plant utilization, economic returns, and overall flexibility in the face of climate change.
- » Select animal genetics that fit environmental conditions and climate resilience.
- » Utilize cattle that meet the climatic and environmental conditions of the specific location.
- » Match cow size to available forage.
- » Select cattle that utilize upland rangeland. This can increase better distribution in pastures creating greater forage utilization avoiding overutilization of riparian area.
- » Select animals with lightly colored coats to combat heat issues.



Emmett Jordan (2)

A later calving season (April-June) balances livestock's peak nutritional demand with the availability of high-quality range—reducing costs for supplemental feed.

Rangeland Restoration as a Climate-Adaptation Strategy

Conditions associated with climate change often result in decreased plant diversity and productivity, soil health losses, and increases in exotic plant invasion. Restoration techniques including upland restoration and revegetation, soil health management, managing invasive/toxic plant species, and wet meadow restoration can be used to improve rangeland health and resiliency. Because rangelands are large and extensive, costs can exceed short term revenue benefits. However, many cost-share programs exist to offset costs associated with restoration techniques (see Resources, Tools, and Support section for more information).



A no-till seed drill can be used to overseed existing pastures or seed reclamation projects.

Upland Restoration and Revegetation

Seeding plant species with high forage quality is an important strategy for increasing plant cover and diversity. However, seeding success in dry rangelands is often limited by dry conditions and soils with low moisture and nutrient availability and these challenges are expected to increase with climate change. Seeding success can be improved with climate-adaptive strategies like:

- » Using short-term weather forecasts to plan seeding efforts in high-moisture seasons.
- » Seeding species with characteristics that promote drought tolerance and competition with invasive weeds (e.g., hearty roots).
- » Seeding with a mixture of cool season (C3) and warm season (C4) species.
- » Consider additional soil health and/or moisture retention treatments to boost seedling recruitment.

Grazing Systems Management for Climate Resilience

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Resources, Tools, and Support

Drought Planning

Colorado Drought Advisors Drought Planning Handbook—Excellent resource to evaluate farm and ranching operations before, during and after drought. Includes worksheets and additional resources.

University of Arizona Guide to Drought Preparation Plans—Specific to livestock grazing on Southwest National Forest lands.

National Drought Mitigation Center Managing Drought Risk on the Ranch—Comprehensive website with tools, webinars, and additional resources.

Range Management During Drought

Colorado Drought Advisors—A multi-organization partnership offering webinars and trainings, and provides one-on-one consulting on creating drought plans with farms or ranches.

CSU Climate Center Climate Smart Agriculture—Provides information to improve the resiliency of farms and ranches in a changing climate.

USDA ARS Adaptive Rangeland Management—Describes the livestock grazing, disturbance, and climatic variation research project.

USDA Northern Plains Regional Climate Hub has an assessment of climate change vulnerability, adaptation and mitigation strategies.

CSU Extension Alternative Feeds—Informative factsheet about options for alternative feed sources.

University of Arizona Drought Management—An article outlining how to manage rangeland before, during and after drought.

University of Arizona Rangeland Case Studies—a case study example of adjusting stocking rates throughout the season is the Rancho Largo Cattle Company in Southeastern Colorado.

Tools

USDA ARS Rangeland Analysis Platform—A free tool that provides vegetation, precipitation and additional data which enables the user to both visualize and analyze multi-year trends specific to the producer's operation.

CSU Rangeland Carrying Capacity App—Provides a sense of the amount of production available on above average, below average and average years.

CSU Agriculture and Business Management—Provides numerous user-friendly tools to evaluate risk via marketing risk, financial, legal, and human risk. “Buy Hay or Sell Cows” and “Strategies for Cattle Herd During Drought” are specifically recommended for Colorado producers.

CSU Eastern Plains Grass-Cast—An Experimental Grassland Productivity Forecast for livestock producers that provides total biomass production at the county level for the duration of the growing season.

Cost Share/Financial Support

Colorado Parks and Wildlife Habitat Partnership Program—Supports restoration, invasive weed management practices, fence repair and other practices.

NRCS Environmental Quality Incentives Program (EQIP)—The most extensive USDA program that provides technical and financial assistance for implementing BMPs.

NRCS Conservation Stewardship Programs (CSP)—This program rewards producers for practices that protect the environment and natural resources.

NRCS Agriculture Management Assistance (AMA)—Provides cost-share and incentive payments for producers to address issues associated with erosion control or water quality.

NRCS Wetlands Reserve Easement Program (WREP)—Voluntary conservation easement program offering landowners to increase the acreage of wetland to increase carbon sequestration.

USDA Noninsured Crop Disaster Assistance (NCCA)—Provide emergency assistance to producers when drought and other disasters affect production.

USDA Farm Service Agency (FSA) provides a 9-month commodity loan that can be used by producers to obtain quick financial aid in times when markets are volatile due to climatic extremes.

USDA Emergency Conservation Program (ECP)—Provide financial assistance to restore conservation practices after a natural disaster.

US Fish and Wildlife Partners for Fish and Wildlife—Supports private landowners restoring wildlife habitat on their property.