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Rangeland Resilience: Using Fire and Grazing Together

Integrating prescribed fire with managed grazing regimes to enhance ecological resilience in fire-dependent rangeland

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Rangeland Resilience

Rangelands are uncultivated landscapes dominated by native grasses, forbs, and shrubs that support livestock production, wildlife habitat, soil health, and water resources. Rangelands have evolved under the influence of natural disturbances that have shaped plant communities, nutrient cycling, and habitat structure. Fire and grazing are two of the biggest examples of these disturbances, and both play a critical role in maintaining healthy, resilient rangeland ecosystems.

Fire and grazing work together as natural disturbance processes. Fire reduces excessive plant litter, suppresses woody encroachment, and stimulates new plant growth. Grazing animals are attracted to this fresh, nutrient-rich regrowth, and their selective grazing, movement, and hoof action further influence vegetation patterns and soil processes.

When applied intentionally, fire and grazing create a mosaic of plant heights, densities, and recovery stages across the landscape (Fig. 1). This diversity increases forage quality, improves wildlife habitat, enhances soil stability, and strengthens overall rangeland resilience.

Figure 1. Early morning backfire ignition in West Central Texas. *Photo by Haley M.*

Why Combine Fire and Grazing?

1. Mimics Natural Processes: Historically, rangelands were shaped by natural disturbances like wildfires and grazing by wild animals. By combining prescribed fires and managed grazing, land managers mimic these natural processes, which helps maintain the ecosystem's health and diversity.

2. Maintains and Creates Diverse Landscapes: The interaction between fire and grazing creates a mosaic of different habitats, including grasslands, savannas, and woodlands. This diversity supports a wider range of plant and animal species (Figs. 2 and 3).

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3. Supports Ecosystem Services: Fire and grazing help maintain essential ecosystem services like soil conservation, water conservation, and wildlife habitat. These services are crucial for both the environment and human communities that depend on rangeland.

4. Enhances Biodiversity: By creating a patchwork of burned and unburned areas, the combination of fire and grazing supports a wider range of plant and animal species. In Texas grasslands and savannas, the variation promotes native warm-season grasses, flowering forbs that are important for pollinators, and browse that benefits both wildlife and livestock. A more diverse plant community helps stabilize forage production between the wet and dry years and improve wildlife habitat for ground birds, browsers, and grazers, while also strengthening the nutrient cycle. Landscapes with greater plant diversity tend to be more resilient to droughts, invasive species, and environmental stress, making them more reliable for both livestock production and conservation goals (Fig. 2).

5. Supports Pyric Herbivory: Where grazing patterns follow fire-impacted patches, pyric herbivory becomes a self-reinforcing ecological process that creates a variety of different plant growth stages and species composition across the landscape. Ungulates prefer to graze burned areas, which helps recycle nutrients through their manure. At the same time, unburned patches are left to recover. Together, these patterns mirror historical disturbance processes that shaped grassland biodiversity and are important for long-term rangeland resilience (Fig. 3).

How to Integrate Fire and Grazing Into Rangeland Management

Prescribed Fire

Prescribed fire is a purposeful and careful tool used in rangeland management to achieve specific ecological goals. Prescribed burns can be conducted safely and efficiently by selecting the appropriate season, weather conditions, and trained crew. In Texas rangelands,

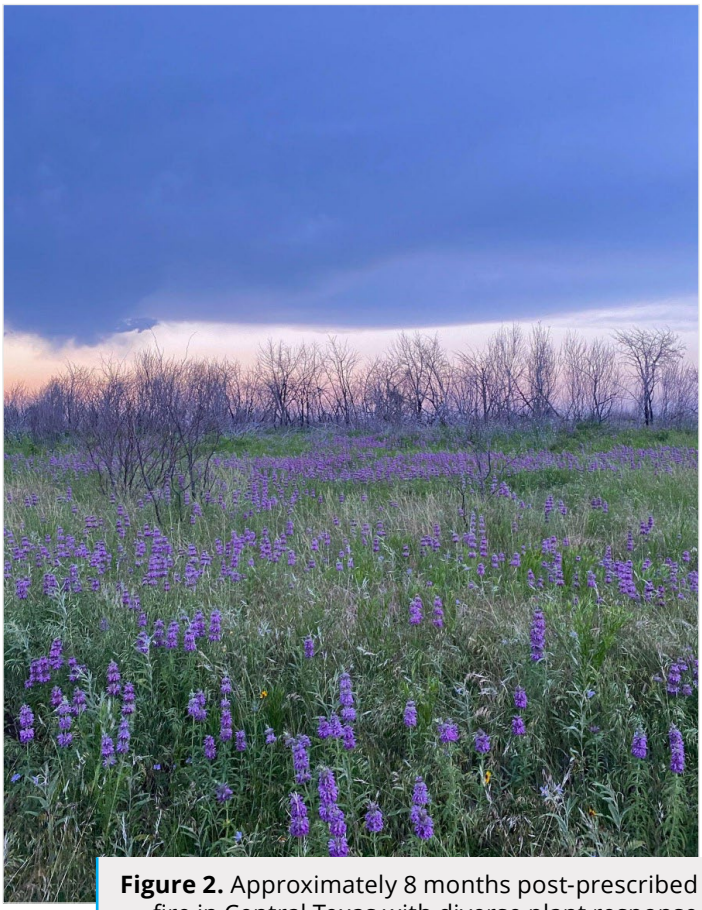

Figure 2. Approximately 8 months post-prescribed fire in Central Texas with diverse plant response and structure. *Photo by Haley M.*

Figure 3. 14 days post-prescribed fire in Central Texas with native perennial grass growth, pricklypear mortality, and opened canopy on honey mesquite. *Photo by Haley M.*

from the rolling plains down to the Edwards Plateau, prescribed fire is commonly used to reduce cedar, mesquite, and prickly pear encroachment, while restoring native grasses and forbs.

Fire removes accumulated litter while recycling nutrients back into the soil and stimulating new plant growth that is more nutritious and palatable for grazing animals. Following a burn, native warm-season grasses, such as little bluestem and Indian grass, respond very quickly. Post-fire regrowth typically has elevated nutrient density during the growing season, attracting livestock and wildlife to the most recently burned areas. The concentration of these grazing animals helps prevent dominant grasses from excluding or overpowering other plant species, maintaining species diversity across the rangeland. This is a very important fact for livestock productivity, wildlife habitat, and long-term rangeland resilience. More information about planning and implementing a prescribed fire can be found at the *Prescribed Burn Alliance of Texas website*.

Pyric Herbivory – Integrated Grazing and Fire

Pyric herbivory is a managed grazing system where grazing animals are strategically allowed to graze on new growth after a fire. By carefully planning the timing and intensity of grazing to avoid overgrazing and allow plants to recover, rangeland managers can maintain plant species diversity and prevent any one species from dominating the landscape. Pyric herbivory promotes the growth of a diverse range of plants, which in turn supports a wider range of animal species.

Pyric herbivory is combined with targeted grazing, which uses combinations of livestock species, such as goats, sheep, and cattle, to achieve specific and desired goals. It involves controlling where and how long these animals graze to change the type or amount of vegetation in a particular area. This can help reduce fire fuels, control weeds, and promote healthy plant growth. By managing the grazing carefully, rangeland managers can use animals to improve the health and balance of the ecosystem.

A phased post-fire grazing plan to balance livestock nutrition with ecological recovery could look like this:

- **0 to 12 months post-burn:** Intensive grazing on high-nutrient regrowth; great for goats.
- **1 to 3 years post-burn:** Moderate grazing on mixed grasses/forbs.
- **3+ years post-burn:** Rest periods allow fuel accumulation for future burns.

When properly planned and implemented, the interaction between fire and grazing can help organize the grazing pressure during drought. If adequate fuel is present prior to burning and sufficient rainfall follows, prescribed fire can help stimulate nutritious and palatable regrowth that the livestock prefer. The initial concentration of grazing on burned patches can provide unburned areas with temporary rest, helping protect roots and ground cover. However, the outcome depends on stocking rate, time of burn, and rainfall. In prolonged drought conditions, which are common in Texas, livestock will be forced to utilize the unburned areas once green grass growth is depleted; without adjusting stocking rates, the entire pasture may become overgrazed. For this reason, integrating fire and grazing during a drought requires strict monitoring, flexible stocking rates, and conservation management to maintain proper soil cover and long-term rangeland resilience.

Combining fire and grazing mimics historical rangeland processes in which fire creates patches of new growth that grazing animals target, giving other areas time to recover. This approach, known as patch-burn grazing, creates a mix of different plant growth stages, benefiting wildlife and increasing biodiversity. This management practice deliberately applies the ecological process of pyric herbivory—the symbiotic interaction between fire and grazing—to create a shifting mosaic of habitats. By burning portions of a pasture rotationally, it drives livestock to graze the nutritious new growth in burned patches, leaving unburned areas to rest, which boosts biodiversity and controls woody plant encroachment (Fig. 4).

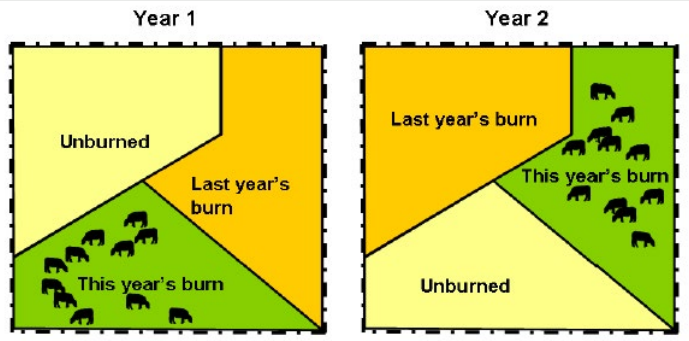

Figure 4. The basic patch-burn grazing model, where livestock concentrate their grazing within the most recently burned patch, even though they have access to the entire prairie. When a new patch is burned, cattle shift their grazing to that patch, allowing older burned areas to recover.

Benefits of Integration

- **Increased biodiversity:** More types of plants and animals can thrive in a diverse landscape.
- **Improved soil health:** Fire and grazing help cycle nutrients and improve soil structure, making it more fertile and productive.
- **Reduced wildfire risk:** Prescribed burns reduce the buildup of fuel that can lead to large, dangerous wildfires.
- **Enhanced ecosystem function:** Rangeland shows improved vegetation cover, species diversity, and soil stability, increasing plant growth and ground cover, which can intercept rainfall, promote better infiltration, and reduce erosion, overall strengthening the reliability of ecological processes across the landscape.
- **Drought resistance:** Healthy rangelands are more likely to withstand periods of drought, reducing the risk of rangeland degradation and loss of productivity. As plants intercept rainfall and allow it to soak into the soil, moisture is retained in the soil layers while live vegetation cover slows evaporation.

Examples of Integrated Fire-Grazing Systems

1. Livestock production and forage management

a. Implement rotational patch-burning:

i. Divide pastures into 3+ units with natural/man-made firebreaks.

ii. Burn 25 to 33 percent annually, prioritizing areas with invasive grass or woody encroachment.

1. Burn frequency and size should be designed and developed consistent with the historic fire return interval specific to the region, with the understanding that the frequency of fire activity differs from east to west across Texas. In addition, weather conditions vary in any season on a yearly basis, including fuel production and soil moisture, which will affect the implementation of the burn plan.

If rainfall is sufficiently high, creating large amounts of fuel, allocating certain forages to use with a prescribed burn may be a beneficial option. However, when a drought situation presents itself, a critical and fast decision must be made on how much forage to retain for grazing versus how much for a burn. Livestock grazing directly affects fuel continuity.

Adaptive planning, flexible approaches to stocking management, and development of contingency plans for unfavorable weather are important considerations for linking fire to range management.

iii. Allow free animal movement to burned patches to exploit grazing preferences with drought monitoring and mitigation in place.

b. Outcome: Produces small-scale habitat diversity (e.g., bare soil patches, young grasses) while preserving expansive undisturbed areas that serve as ecological sanctuaries during droughts or wildfires

2. Wildfire risk mitigation

a. Use grazing-maintained fuel breaks (30 to 60 feet wide):

i. Establish monitoring of key indicator species.

ii. Manage stocking to maintain 50 to 70 percent vegetation cover.

b. Outcome: Reducing fine fuel loads using livestock can balance animal forage needs while reducing wildfire risk more effectively than mechanical clearing alone. Prescribed fire also suppresses most resprouting brush and trees and works to keep grassland and savannas open.

3. Adaptive management for drought

a. Maintain non-burned patches to serve as drought buffers:

i. Stockpile forage in non-burned units during wet years.

ii. Prioritize grazing on burned areas first during drought.

iii. Adjust stocking rates based on annual fuel load assessments.

b. Outcome: This strategy minimizes overgrazing while maintaining soil cover. During droughts, standing non-burned forage can feed livestock while reducing the loss of soil in recently burned or grazed areas.

Coordinating Fire and Grazing Through PBAs and TXGLC Coalitions

Prescribed fire and targeted grazing are most effective when planned and applied together strategically over time (Fig. 5). Prescribed Burn Associations (PBAs) and Texas Grazing Land Coalition (TXGLC) partner coalitions help provide the framework and resources needed to coordinate these tools safely, strategically, and meaningfully.

PBAs support the use of prescribed fire by grouping together labor, equipment, and experience, allowing all rangeland managers to work as a team to conduct productive burns that prepare rangelands for high-quality regrowth and improved grazing distribution. Fire resets plant structure, reduces excessive fuels, and creates the nutrient-rich forage that grazing animals prefer.

TXGLC coalitions help landowners design grazing strategies that build on post-fire conditions. By adjusting stocking rates, timing, and animal distribution, grazing can be used to extend the benefits of fire: maintaining fuel breaks, shaping plant recovery, and reinforcing habitat diversity.

Figure 5. Sheep grazing after a recent prescribed fire (<10 days) in Schleicher County. Sheep readily consumed the burned prickly pear and new grass growth. *Photo by Morgan Treadwell*

Working with PBAs and TXGLC coalitions allows managers to:

- Align burning timing with grazing objectives;
- Use grazing to manage fuels before and after fire;
- Reduce risk and cost through shared resources; and
- Apply fire and grazing in a coordinated, landscape-scale approach.

By integrating fire and grazing through these partnerships, rangeland managers can better mimic natural processes, improve rangeland resilience, and sustain productive, diverse landscapes.

Conclusion

Integrating livestock grazing with prescribed fire reintroduces the historical cycle of pyric herbivory in rangelands. Working with these natural processes and being adaptable and responsive to changing conditions, like weather patterns or shifts in plant and animal populations, allows for the long-term sustainability of rangeland. Through the careful planning of fire and grazing, rangeland managers can mimic natural processes and improve rangeland health and resilience. Integrating fire and grazing helps rangelands better handle drought, invasive species, and wildfire risk. This approach promotes healthy ecosystems, supports biodiversity, and enhances ecosystem services that benefit both landowners and communities.

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Resources

- *Texas Grazing Land Coalition*
- *Prescribed Burn Alliance of Texas*
- *The Prairie Project*

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