Regenerative Management Practices in Beef Production

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Regenerative management directly applies to lands and soil. Regenerative is not a label to be added to the livestock. However, there are certification/verification standards developed by soil health experts for farmers and ranchers who desire to produce agricultural commodities under regenerative management and track continual progress of their management. The metrics are directed toward soil and land measurements and management practices that align with soil health principles to improve ecosystem function. The intent is to produce healthier, more nutrient-dense commodities while improving the soil health and the ecosystem processes. In the beef production system, cattle are a tool — the primary tool — used to accomplish those outcomes.

Perspective

Historically, pre-European settlement in North America, most of the U.S. prairies and other grasslands were grazed by ungulates such as bison, elk, antelope and multiple species of deer. As the new U.S. population moved westward, the European cultural activities of farming and running livestock displaced the native fauna. With their settlement of the West, the large herds of bison were eliminated, and fences were erected. Settlers grazed beef cattle, and sheep to some extent, on the land resources with little understanding or appreciation of the management required to sustain the natural flora of the native lands. Overgrazing occurred and native grasslands were turned into crop fields, often on soils not suitable for crop production. Fertilizers became commercially available and could be purchased inexpensively proceeding World War II. The “Green Revolution” soon followed, with advancements in plant breeding bringing to market more productive crops, including introduced forages that were very responsive to fertilizer. With the application of synthetic fertilizers, grazing lands and croplands could be more productive than using natural production methods. Introduced pasture forages like hybrid bermudagrasses and tall fescue could be easily established on worn-out crop fields and overgrazed native pastures, and, with fertilizer, could become immediately productive, providing forage for grazing animals, especially cattle.

There are three components to soil: physical, chemical, and biological. Healthy soils are considered a living system, and of those three components, only the biological has life. The biology of the soil has been underappreciated and certainly less understood compared to the physical and chemical components. Soil science focused primarily on the physical and chemical components for decades, and the biology and health of soils has steadily declined. Only in recent years have scientists begun to study the biology of the soil and its contributions to the

physical and chemical components that collectively result in a healthy soil and highly functioning ecosystem processes. The Haney Soil Health Test, the Cornell Soil Test, PLFA test (Phospholipid fatty acid analysis) — tests in which soil health variables are measured, have become commercially available in the last 15 years as result of these studies. In regenerative agriculture, the focus is on applying management practices in alignment with soil health principles that result in improvements in the water cycle, energy flow, nutrient cycle, and community dynamics (diversity). Grazing livestock are an important tool in the process of rebuilding soil health, and the integration of livestock is one of the soil health principles. It is the application of grazing livestock to a grazing land that forms the basis for regenerative management.

Regenerative Ranching

At Noble Research Institute, we use the phrase "regenerative ranching" to describe our management of our grazing lands. Our definition of regenerative ranching is the process of restoring degraded grazing lands using practices based on ecological principles. Regenerative ranching focuses on enhancing and restoring the land, making it more resilient and supporting the health of the overall ecosystem. Healthy soils and ecosystems produce a variety of ecosystem services enjoyed by all of society, including carbon sequestration and water retention and filtration. Regenerative ranching is generally associated with holistic management and decision-making as well as with managed grazing. Intentional management is good for ranchers, land managers and beef producers. It is through the intentional management of grazing lands that beef producers can rebuild or regenerate soil health. Regenerative management implies working with nature and the natural environment, mimicking nature in our practices, seeking to better understand and work in synchrony with ecosystem processes.

In beef production, the focus is on grazing lands in multiple land-use categories: native range, introduced pasture, grazed cropland, etc. Each land use requires different management strategies but makes use of similar grazing techniques. Regardless of land use, the objective of regenerative management is to improve soil health. That includes managing intentionally to:

1. increase soil organic matter and soil carbon
2. increase energy capture with plants
3. increase soil biotic activity (earthworms, fungi, bacteria, protozoa, other organisms)
4. improve soil aggregation and soil structure
5. improve water infiltration and water holding capacity
6. increase abundance and availability of organic nutrients
7. increase plant diversity, animal diversity, soil organism diversity.

Regenerative practices in beef production are management practices that align with the six soil health principles. The six soil health principles are:

1. Know your context
2. Cover the soil
3. Minimize soil disturbance
4. Maintain continuous living plants/roots

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5. Increase plant diversity
6. Integrate livestock

We will cover each of these principles and some practices that, when applied well and regeneratively, contribute to improvements in the ecosystem processes and soil health of grazing lands.

The Six Soil Health Principles

Context. Context refers to the variables inherent to the managed grazing land. These include variables such as climate and weather, soils and topography, precipitation and the timing and variability of precipitation, soil and forage types, current and recent management. Other considerations include distance from markets; community and cultural norms; ranch financial condition; individual knowledge and experiences pertaining to region and management practices; animal husbandry; and land stewardship. Context also includes the historical perspectives: pre-settlement conditions of fauna and flora, management and cultural activities that altered the landscape. All contextual variables should come into consideration in the holistic framework of a regenerative mindset and subsequent application of practices.

Cover the soil. Covering the soil and then keeping it covered is one of the most basic soil health principles. Covering the soil limits erosion potential, contributes to greater water infiltration and retention, and protects the soil from temperature extremes, which allows for greater biological activity. Practices that contribute to improved soil health are managing for total plant cover with plenty of plant residues covering the soil surface between plants. This means one should minimize tillage or removal of soil cover and maintain perennial and annual forages on grazing areas year-round. It means grazing the upper leaves of plants and leaving more after-graze plant material. It means providing full recovery of plants between grazing events.

Minimize soil disturbance. Minimizing soil disturbance has several meanings with the obvious being directly related to covering the soil – minimizing tillage. If planting annual crops, use no-till planters. However, this principle encompasses much more than that. It also includes minimizing other disturbances to the soil and the plants that cover the soil. Disturbance such as chemical and fertilizer applications should be use only as needed and should not become annual management practices. As we strive to work with nature, we want to build the natural fertility and resiliency of the soil. Fire and prescribed fire in particular should be strategically applied as needed, but while minimizing the soil's exposure to potential erosion. Soil disturbance also includes grazing. During a grazing event, there are mostly negative impacts to the plants and land; therefore, the grazing event should be short, not too severe and followed by ample recovery.

Maintain continuous living plants/roots. On grazing lands, keeping a living root in the ground is an obvious principle for beef producers, as it is the plants on the land that the cattle use as feed. Cattle are the harvesters and converters of plant material into a marketable commodity – the live animals or the beef products. Management practices should ensure that we have perennial plants and annual plants in ample quantity to cover the soil, regenerate grazed or lost plant tissues, feed our livestock and feed the organisms in the soil. Living roots provide sugars to soil

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organisms such as fungi, bacteria and protozoa in exchange for mobile nutrients in the soil. The more living roots and actively growing plants that are present in and on the soil, the more rapidly our soil health can improve. The greater the diversity of plants, the greater the number and variety of living roots at any given time.

Increase plant diversity. As a soil health principle, increasing diversity applies most directly to the plant community. As a regenerative management practice, monocultures should be avoided. We should strive for increasing diversity similar to what is observed in native plant communities. In an ecological sense, the greater the diversity of plants, the greater the diversity of other organisms that can occupy an environment. That includes terrestrial animals and those that live in the soil. The greater the diversity of life in an environment, the greater the nutrient cycling that can occur, which improves the natural soil fertility as more organisms live, reproduce, die, and decay. However, diversity begins with the plants, which means we need to manage for plants from all plant types – grasses, forbs, legumes, perennials and annuals, warm-season and cool-season, and woodies, if a component of the natural ecosystem. In introduced pastures, which are primarily monocultures, the introduction of additional/multiple species and the reduction of fertilizer and weed spray inputs (striving for elimination of both) are practices that lead to improved soil health. In grazed croplands, using multiple-species mixes for both warm-season and cool-season grazing is a recommended regenerative practice.

Integrate livestock. The sixth soil health principle is to integrate livestock – properly integrate livestock. Properly integrating livestock to improve soil health begins with being properly stocked. That means your stocking rate never exceeds the carrying capacity of the land. Carrying capacity changes season by season and year by year due to management and weather conditions (especially rainfall). Grazing lands should be managed with grazing animals such that there is always forage for the livestock into the future and for the other organisms that also rely on the plants for feed. Since precipitation varies over time, so does forage production. Therefore, stocking rates need to be flexible and adjusted to growing conditions, or else one should be stocked conservatively enough so that stocking rate adjustments are only needed in extreme situations.

Another element of properly integrating livestock could mean using other grazing animals in addition to cattle. Cattle prefer grass. Sheep prefer forbs. Goats prefer browse. If your grazing resource includes forages that cattle don't make efficient use of, consider the possibility of using other grazing animals such as sheep and goats as well. Using sheep and goats in complement to the cattle improves the cycling of nutrients that are not usually consumed by cattle, which positively contributes to soil health. Oftentimes sheep and goats can become profitable enterprises, too. One of the most important elements in integrating livestock in regenerative management is grazing management. For that reason, we will focus on grazing management separately.

Regenerative Grazing

How we graze our livestock, beef cattle in particular, can have a huge effect on soil health and the rate of improvement (or degradation) possible on our grazing lands. Properly applied grazing management practices can be most impactful in regenerating soil health, and

regenerative grazing is the most powerful tool a beef producer has to improve ecosystem function of grazing lands.

Key practices of regenerative grazing. There are several practices a beef producer can employ that form the basis of regenerative grazing. These are grazing practices that align with the soil health principles and are adaptively applied to grazing lands based on a holistic approach centered on observation and monitoring. The following are key practices that, when applied collectively, provide the greatest benefits towards improving soil health.

1. **Stock at or below carrying capacity.** As stated earlier, the first step in regenerative grazing is stocking at or below carrying capacity. The more conservative the stocking rate, the less frequently one would have to adjust stocking rate. However, managing at or near carrying capacity provides for greater ecologic efficiency while also requiring more monitoring of forage production and stocking rate adjustments.
2. **Stop using fertilizer and chemicals as routine management practices.** Too often when managing introduced pastures and grazed annual forage crops, we support production with inputs that negatively impact soil organisms and plant diversity. The objective is to mimic nature, so leverage the use of multiple species from multiple plant types so that nutrient enrichment and greater cycling can occur naturally. Only use fertilizer as needed, such as starter nutrients when nutrients levels are very low, but do not use fertilizer to elevate carrying capacity as excess nutrients loading has a negative effect on soil organisms and soil health. The use of lime to correct pH deficiency is an exception, as a pH level near neutral (7.0 pH) facilitates soil health.
3. **Minimize number of herds.** One of the quickest means to begin regenerative grazing is to eliminate continuous grazing of pastures. Overgrazing occurs one plant at a time, and cattle are selective grazers that prefer what usually are the more productive grasses. They also tend to re-graze previously grazed plants. Under continuous grazing, the more-productive grasses tend to be grazed out of existence, especially with heavy stocking. Grazing with fewer herds — preferably just one herd— and using multiple pastures allows for recovery of grazed grasses to occur. If allowed to fully recover, the preferred, more-productive grasses become more resilient and productive, which in the long term can increase carrying capacity.
4. **Apply adaptive high stock density grazing.** High stock density grazing can be one of the most powerful tools to improve pasture condition and soil health, if applied well and adaptively. Adaptively means adjusting stock densities as well as timing of grazing events and recovery of grazed pastures based on growing conditions, forage types and the ecological outcomes desired. To be most successful, using this method of regenerative grazing requires a greater number of paddocks or grazing allocations per herd than a simple rotation would provide. It usually requires 20 or more paddocks per herd in higher-rainfall environments and 30 or more in low-rainfall environments. Grazing events are then kept very short so that we avoid repeat grazing of a grazed plant. Plants begin to regrow after about three days under good growing conditions, five days in less favorable conditions.

Ideally, cattle would be moved to a new grazing paddock before plants begin to regrow. It is important to move the cattle before they consume too much of the plant material. Grazing events should be terminated in a timely manner to leave plenty of residual after grazing. During the active growing season, that means leaving at least half of the leaf area to continue photosynthesis, allow plant roots to continue to grow and expedite recovery. Grazing more than half the leaf area of a plant causes the plant to stop root growth, which slows recovery. During the dormant season, we want to maintain ample residual to provide grazing for cattle and protect the plants and the soil from extremes of winter. In regenerative grazing, we also want to allow full recovery before we graze a pasture again. That means that we want grass plants to have at least three, preferably more, mature leaves before being grazed, and we base that on observing the more-productive grasses, which require more time to recover than less-productive grasses. Constant visual monitoring is needed to know how to adjust grazing rotations. As a rule, we rotate faster in good growing conditions and slow our rotations as soil moisture becomes more limiting. Although the optimal grazing with high stock density grazing means daily allocations or multiple allocations per day, we can still manage for longer recoveries when needed and maintain adequate post-graze residuals. This is part of the adaptive application of grazing. The added benefit of these frequent rotations is the impact that the high stock density has on the residual plant material that was avoided, which is often overly mature and less palatable. The high stock densities create a trampling effect that makes this additional plant material more available to the organisms at or near the soil surface. More of the material is then consumed and incorporated into the soil, making those nutrients more available to the plants. The trampling effect can also stimulate the germination and establishment of new and additional plants to fill gaps on the soil surface.

Other Management Considerations

Plan grazing events and recovery, other management activities. To successfully implement regenerative grazing practices, one should have a management plan to focus efforts. We want to make the optimum use of our resources and our time. Therefore, developing a calendar of management activities helps you visualize and think through what ideal scenarios would look like (knowing actual will deviate from planned), what areas should be prioritized, and what strategies are most likely to accomplish our objectives. In this process, identify the most productive resources and begin management activities including regenerative grazing practices, on those areas. The most productive grazing lands will provide the most return on effort and investment and will respond more rapidly to regenerative practices.

One of the most limiting factors in most grazing operations is water. Improving livestock water infrastructure provides the best return on investment in a grazing operation for ranchers who want to manage regeneratively. Water distribution allows for greater efficiencies in land utilization, grazing effectiveness, and soil health improvements. Again, plan infrastructure improvements such as water and fencing on the most productive grazing resources. When possible, utilize temporary electric fencing to facilitate grazing paddocks and minimize permanent fences.

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Integrate multiple species grazing if possible/feasible. Integrating multiple species grazing has been mentioned earlier, with the benefit being that sheep and goats prefer different forages than cattle, and there can be a complementary effect. Small ruminants do require additional infrastructure, yet most cattle operations are prepared for such. There are an increasing number of ranchers who are raising hair sheep and goats and are looking for opportunities to run their stock on beef cattle operations. The ecological benefit of introducing sheep and goats to a cattle ranch often exceeds the economic benefits. Allowing someone to run sheep and goats on your cattle ranch at a conservative stocking rate and for a defined season (e.g., the growing season), is very beneficial to improving soil health.

Cull livestock that don't adapt to environment or management. One of the acknowledgements that needs to be made in regenerative ranching is not all animals work in a regeneratively management system. Animals need to adapt to the management, and usually there is a significant percentage (20-30%) of animals that fall out of the operation unless there is additional supplementation included over a significant time. Ideally, in a regeneratively managed ranch, there is a minimal amount of supplemental feeding occurring. This means calving and breeding in complement with nature, ideally during peak forage production – late spring and early summer. If calving and breeding takes place outside the peak forage season, supplemental feed inputs are likely required. It does not make the ranch any less regenerative as long as the grazing and land management continues to align with the soil health principles. It is just more costly, but there may be economic implications that dictate such management decisions.

Certifications for livestock produced under regenerative management. There are several different certifications available to cattle producers that indicate that their livestock have been produced under a regenerative type of management. These often include some organic and all natural-raised programs, each program with its own criteria for participation, usually including livestock-specific management criteria as well. There are also a few land certification programs for croplands and grazing lands that are now available to producers. Regenified™ and Soil Regen's Regeneratively Verified™ and Regeneratively Grown™ are such programs, each with their own criteria and monitoring program. For a cattle producer serious about regenerative ranching, there definitely needs to be a monitoring program in place. It is not necessary to participate in a certification program unless required by your marketing program. However, benchmarking and routine monitoring of data using soil heath tests like the Haney Test and your own grazing records are good practices for any ranch. Noble Research Institute provides training on what to monitor and how to implement a monitoring system through its regenerative educational programs. For more information, see the Noble website at www.noble.org.