

Written Testimony
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Managing for Soil Health: Securing the Conservation and Economic Benefits of Healthy Soils

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Chairwoman Spanberger, Ranking Member LaMalfa, Members of the Committee, thank you for this opportunity to submit a written statement on behalf of the National Grazing Lands Coalition as their Chairman and as the Industry Relations and Stewardship Manager for the Noble Research Institute.

Established in 1991, the National Grazing Lands Coalition is as a grassroots, nationwide consortium of individual agriculture producers and organizations that support voluntary, ecologically and economically sound management of all grazing lands for their adaptive uses and multiple benefits to the environment and society through science-based technical assistance, research and education.

The National Grazing Lands Coalition is led by a national steering committee dedicated to America's grazing lands resource and its sustainability. The Steering Committee is made up of individuals representing the National Association of Conservation Districts (NACD), National Cattlemen's Beef Association (NCBA), American Forage and Grassland Council (AFGC), American Sheep Industry (ASI), American Farm Bureau Federation (AFBF), Society for Range Management (SRM), the Dairy Industry, the Soil and Water Conservation Society (SWCS), the National Farmers Union (NFU), and the Noble Research Institute, LLC.

Grazing lands are one of America's greatest natural resources. They provide the nation and the world with a secure food supply, renewable energy, improved water quality and availability, productive plants that sequester carbon, robust wildlife habitat, and healthy soils and serve as the foundation for our country's farming and ranching families. Grazing lands contribute \$78 billion annually to the U.S. economy by supporting an estimated 60 million head of cattle and 8 million head of sheep. To sustain agricultural production, grazing lands must be conserved and properly managed to produce robust, resilient stands of grasses and forage. All of this starts below our feet with "soil health," the foundation of our operations.

Grazing lands are those lands not cultivated by man. As America developed westward in the 19th century, farmers began to cultivate soils by clearing timber and destroying many of the natural prairies that existed, all in an effort to grow what are now known as commodity crops. The fertile, productive prairies of the Great Plains that once teemed with diverse grasses, forages and large herds of bison were tilled and farmed. These practices depleted the soils of nutrients, organic matter, and biological life. The natural biological processes of grazing by roaming herds and

periodic fire that created the natural grazing lands, were no longer at work. Combined with a decade-long drought, these poor management practices contributed to the great Dust Bowl of the 1930s. This disaster brought about the birth of land conservation and the Conservation Act of 1935, which created the Soil Conservation Service, now the NRCS. Notwithstanding, in the 1950s the Green Revolution took hold, and great advancements were made in agricultural technology, including the development of commodity and forage crops that responded well to fertilizer, advanced farm machinery and other technological advancements that expedited crop production with less need for labor.

In the years that followed, the agricultural industry operated on cheap feed, cheap fertilizer and cheap fuel. Our industry and our research during that time focused on the chemical and physical characteristics of soils with little to no consideration of biological interactions within the soil.

In recent years, however, prices for feed, fertilizer and fuel have increased to a point that has become unsustainable for many operations. Many producers have had to make a choice: continue doing what they have always done or work *with nature* to find a new way to farm and ranch. Born out of equal parts necessity and frustration, producers began to experiment with farming and ranching techniques that limited the use of inorganic fertilizer, fuel and feed.

They began to see that limiting or eliminating tillage reduced their fuel bill, using the ageless practice of “cover crops” to keep their fields covered provided numerous benefits to the soil (i.e., preventing erosion, increasing water holding capacity and increasing biodiversity), converting marginal soils to perennial pasture land to eliminate tillage and minimize erosion, and through managed rotational grazing the pastoral lands improved in composition and production due to the recovery allowed between grazing events.

In essence, they built a foundation of principles that many producers follow today to manage healthy soils and restore deteriorated soils. These soil health management principles were set forth to achieve specific goals that are inherent to all soils. They are based on mimicking highly diverse, heterogeneous, native grazing land plant communities by harnessing the power of biologic interactions between plants, soil microbes, fungi and other of life in our soils. These principles build soil aggregation, which further builds soil structure.

These principles have proven the path forward for many innovative producers and substantiated that the conventional farming and ranching practices of the last six decades are not the only way.

The following soil health management principles were developed by producers for producers, and these apply to both croplands and grazing lands:

- 1) **Armor the soil:** Soil health cannot be built if the soil is moving. Building organic matter on the soil surface armors and protects the soil from erosive processes. Keeping the ground covered also serves as a mitigation mechanism for soil temperature. Excessive increases in soil temperature can have drastic and destructive effects on soil microbial life. Once soil temperatures reach 140° F, soil bacteria die. The soil must be covered to minimize bare ground, this is largely accomplished by forage and crop residue. In grazing lands, this means managing lands to retain forage cover year round either in the form of growing plants and plant residues.
- 2) **Optimize disturbance:** Physical soil disturbance, such as tillage, alters the structure of the soil and limits biological activity. If the goal is to build healthy, functional soil systems,

tillage should only be use in specific, limited circumstances. While tillage is a detrimental disturbance, not all disturbances harm the soil. In fact, some are quiet beneficial and should be optimized. Grazing, prescribed fire, herbicide applications, among others, are all disturbances that can, if properly managed, be beneficial. For this reason, we use the term optimize disturbance to ensure that the timing, frequency, intensity and duration of these management activities are implemented in a planned manner. In grazing lands, the act of grazing is a disturbance, but if properly managed, the grazed plants are allowed to regrow. In addition, fire is a type of disturbance that when administered periodically as a tool can have positive effects on plant composition and reduce unwanted woody plant encroachment.

- 3) **Increase diversity:** Increasing plant diversity above ground allows for a more diverse community below ground. Specific soil microbes require specific plant types. The more diverse the microbial population in the soil, the better the plant species will perform due to increased biological activity. In grazing lands, this means inter-seeding forage species into monocultures of introduced pastures and providing appropriate periods of recovery following grazing events.
- 4) **Keep living roots in the ground all year:** Soil microbes tend to utilize active carbon first. Active carbon is the exudates from living plant roots. Therefore, to keep soil biology working as long as possible, a living root in the ground is ideal. A living root provides a food source for beneficial microbes and provides opportunity for symbiotic relationships between plant roots and mycorrhizal fungi. In grazing lands, this means inter-seeding cool season forages into warm season pasture and vice versa depending on the predominate type of pasture.
- 5) **Properly integrate livestock:** Grazing lands naturally evolved under grazing pressure. Soil and plant health is improved by grazing, which recycles nutrients through improved manure distribution, reduces plant selectivity and increases plant diversity. The most important factor in grazing systems is the management of stocking rate and allowing, in some manner, adequate rest periods for plants to recover before being grazed again. This principle is critical to both native and introduced grazing lands.

Principles over Practices

The great challenges facing the U.S. agricultural industry as a whole are numerous and daunting. However, to solve those challenges, one must determine the root of the problem. For much of the past sixty years, the agriculture industry admittedly focused on treating symptoms with practices and inputs rather than addressing the problem with science-based, holistic principles. Innovative producers today understand that we do not solve ecological problems by implementing practices, rather, we implement principles. We can and are addressing ecological degradation by following principles that rebuild ecological processes and habitat from the ground up rather than focusing on specific singular species or management practices. It all begins with maintaining a solid foundation with healthy soil as the cornerstone to any agricultural enterprise. Properly applied grazing is the capstone to building soil health.

Applying the Principles Today

In properly managed grazing lands, whether in introduced pastures or native range, all five of the soil health principles can actively build more productive, more profitable and more sustainable agricultural production systems. In fact, it is often easier to apply the soil health principles to grazing lands (rather than cultivated croplands) because the soil health principle of properly integrating livestock (the grazing animals) is already in place. Healthy grazing lands begin with a management philosophy that properly manages grazing livestock and addresses the physiological needs of the forages being grazed.

Similar to the five soil health principles, there are four guiding principles, natural laws, of grazing management that, when understood and properly implemented, can help restore and rebuild the soil. These principles contribute to improved soil health and the function of both native range and introduced pastures.

- 1) **Keep down the shoot, kill the root:** In essence, if plants are grazed too short for too long of a duration, the plant will die. Roots of plants form essential functions: anchor the plant to soil, take up water and nutrients, and if healthy, the roots help the plant mitigate stresses of drought, temperature extremes, and grazing. The top growth of grass plants is directly proportional to root growth. Roots naturally die and are replaced by new roots. However, when excessive amounts of top growth are removed, roots are unable to regrow and replace themselves as they die. The plant becomes weaker and eventually dies. When actively growing leaves are left at an optimum amount, the root system is maintained and supports plant growth. Grassland managers have learned that managing plants and root systems are the keys to a healthy and productive grassland. These managers have adopted a planned grazing approach to their management, which defines a proper degree of grazing use for the key species. Planned grazing prescribes rest and recovery following grazing events to maintain or enhance grasslands.
- 2) **Nature abhors a vacuum:** Nature does not like bare ground. Bare ground is soil that is not protected by plants, plant residues, plant litter, gravel or rocks. Bare ground is subject to erosion, rain runoff instead of infiltration, intense temperatures and exposure to the sun.

When grazing lands are disturbed, overly grazed, and managed poorly for extended periods, bare soil is exposed. Grazing lands with extensive bare soil are more susceptible to droughts and are much less productive. Managing grazing lands so that the soils remain covered provides protection from erosion, allows for water infiltration, and builds organic matter, which in turns builds biological activity and soil health. Together these elements improve soil stability and productivity.

- 3) **Bare soils decrease moisture availability:** When grazing lands have significant amounts of bare soil or are in the early stages of recovery, they have little organic matter and are prone to erosion, weeds and the effects of drought mentioned above. Rains that fall on bare soil is less effective because less moisture soaks into the soil whether it can be absorbed by organic matter. More water runs off the soil making the affected area more prone to drought. With the direct exposure to the sun, soil surface temperatures of bare soil are elevated creating an environment that reduces or eliminates biological activity in the top layers of the soil. In this condition, soils are less likely to support productive grasses

and forages. As a result, less productive, less desirable plants, such as weeds, appear rapidly.

Conversely, rain that falls on grazing lands covered with productive grasses and forages readily infiltrates the soil and is absorbed by soil organic matter. This provides an environment more conducive to the continued recruitment and maintenance of the desired grasses and forages. Healthy grazing lands remain more resilient to drought over time.

- 4) **If given a chance, the best-adapted plants will dominate:** In general, nature will bring back the best-adapted vegetation on grazing lands if the producer works *with* nature by following a good grazing plan. These best-adapted vegetation species are more productive, more resilient to drought, and are more profitable than less desirable species. This concept also holds true with introduced pastures. A well-managed, properly grazed grazing land provides nature the opportunity for the grasses and forages that best fit the environment to survive and thrive.

Implementation of Principles and Natural Laws on Grazing Lands

Grazing Plans – To provide an effective mechanism for implementing the soil health principles and the natural laws of grazing management, producers must develop and follow a grazing plan. A grazing plan allows producers to intentionally manage the grazing lands to achieve desired outcomes for a livestock operation. A good grazing plan considers two essential components – the nutritional needs of the livestock and the health of the key plants being grazed and managed, which is impacted by health of the supporting soil.

Grazing plans are, in essence, conservation plans for grazing lands. They include decisions for manipulating the plant community to manage the soil, water, air, plant and animal resources. A well-designed and well-managed grazing plan results in healthy soils and grasses, proper nutrition for grazing animals, and greater livestock production at a lower cost.

There are also four keys to proper grazing management: stocking rate, livestock rotation, utilization rate and plant rest and recovery. All of these elements must be managed in unison to be effective.

Stocking Rate – Stocking rate is arguably the most critical variable in proper grazing management. Stocking rate is the number of animals on a given area of land over a certain period. If intake is not limited, livestock consume about three percent of their body weight of grass and/or forage per day. For all practical purposes, stocking rate is a measure of the grass demanded by the livestock over a period of time.

The amount of grass and forage produced on a given area is a function of many factors, including soil types, forage types (e.g., grasses, legumes), pasture condition, and previous management. However, moisture and temperatures during the growing season also drive production. Forage production is dynamic, and the entirety of the forage produced should not be grazed. As provided above, with proper grazing management, only a portion is grazed and the rest is used to maintain the health and productivity of the grazing land. The portion of the forage that is allocated for grazing is called the *available* production. It is important that the stocking rate match the available production and be used optimally. Improper stocking of grazing lands leads to over-grazing or under-grazing, neither of which provides favorable outcomes. Over-grazing for extended periods of time leads to the degradation of the grazing land and an overall reduction in pasture

productivity, soil health and livestock production. Determining a proper stocking rate is essential for proper grazing management and requires balancing the animal numbers with available grass and forage production.

Grazing Rotation – Once a proper stocking rate is established, implementing a suitable grazing rotation is the next variable in proper grazing management. A grazing rotation considers where to graze, when to graze, how long to graze, and how long to allow a grazed area to rest and recover. The purpose of a grazing rotation is to manage the impact of grazing on the grazing land while maintaining or improving livestock production.

Livestock are selective grazers, and left unmanaged they tend to disproportionately graze more-productive plants over less-productive plants. Livestock also prefer the fresh regrowth over mature leaves. In a continuously grazed pasture, plants that are grazed early in the growing season are grazed repeatedly without adequate time to recover. Since these plants are not allowed to regrow leaves and supply needed energy to the roots through the process of photosynthesis, roots do not regrow adequately to support the plant. Roots of these plants become weakened, depleted, and eventually die. Over time, the more-productive plants are grazed out leaving less desirable, less productive plants, which can lead to deterioration of the grazing land and the health of the soil.

Grazing Intensity – Grazing intensity is the amount of grass and forage removed before livestock are rotated to a new area. Stated another way, it is how short the pasture is grazed before removing the grazing animals. A good grazing management practice is “take half and leave half.” Conceptually, this means graze the top half of the leaves and leave the rest to allow for rapid recovery and regrowth. Ideally, every plant in the pasture would be grazed evenly at this level. Taking more than 50% of the leaf production stops root growth and extends the recovery time. Grazing 50% or less of the leaf area of plants has little or no effect on root growth and plant regrowth. This expedites recovery and increases the productivity of grazing lands. Other benefits of grazing less intensely include increased root production, rooting depth, and plant residue, which increases soil organic matter, water holding capacity, pasture production, and soil health. When properly stocked with a good grazing rotation, grazing intensity can be managed such that the majority of the plants in a pasture are grazed at 50% or less during each grazing rotation throughout most of the growing season allowing for optimum growth and production of the grazing land.

Rest and Recovery – The final aspect to consider in grazing management is the rest and recovery period. After being grazed, plants need an adequate recovery period. The more severe the grazing intensity, the longer it takes for the plants to fully recover. Soil moisture and seasonal temperatures also affect the rest and recovery period. In favorable moisture conditions, the recovery period is shorter than in low moisture conditions. As moisture becomes more limiting, longer rest and recovery periods are required. It is important to determine the recovery period based on the key species in the grazing land being managed. In a native grass pasture, the key species are those more productive, more palatable species that have a longer recovery period than the less desirable species. Introduced pastures usually have a shorter recovery period than the native prairies and have to be managed differently for optimum results. Well-managed rest and recovery periods increase pasture production and offer greater potential for livestock production.

Conclusion

Management of grazing lands is a dynamic process with a complex set of variables that must be taken into account. However, as the science of grazing management has evolved, innovative producers have mastered the understanding of the natural laws of grazing management. Many have seen dramatic improvements in the productivity and resilience of their grazing lands. They have also observed great improvements in soil health and ecosystem function because they have embraced and are managing for the soil health principles; many even before the soil health principles were specifically identified. It is the challenge of organizations, such as the National Grazing Lands Coalition and the Noble Research Institute, to continue to education land managers, farmers and ranchers to ensure proper management of grazing lands becomes the norm for producers focused on the long-term economic viability and ecological sustainability.