Written Testimony
Submitted to
U.S. House Committee on Science, Space, and Technology
June 4, 2019 Hearing

Nature in Crisis: Biodiversity Loss and its Causes

Jeff Goodwin
Conservation Stewardship Lead
Noble Research Institute, LLC

Chairwoman Johnson, Ranking Member Lucas, Members of the Committee, thank you for this opportunity to submit a written statement on behalf of the Noble Research Institute, LLC.

Lloyd Noble, an oilman and philanthropist, founded the Noble Research Institute in 1945 to help revitalize agriculture following the Dust Bowl. Mr. Noble was a visionary in land stewardship and conservation, recognizing that "… the land must continue to provide for our food, clothing and shelter long after the oil is gone," and that "no civilization has outlived the usefulness of its soil. When the soil is destroyed, the nation is gone." Today, the Noble Research Institute is the largest independent agricultural research organization in the United States. Among our other efforts in agriculture consultation and education, we conduct agricultural research to connect the five soil health management principles referenced herein to definable outcomes across the U.S. in an effort to enhance a sustainable beef cattle industry.

The recently published “Global Assessment of the Intergovernmental Panel for Biodiversity and Ecosystem Services” discusses in depth the estimated projections of global biodiversity loss and the perceived negative impacts imposed by the agriculture industry. To the contrary, for more than a decade, a movement has been taking place in the agricultural industry that is *returning* biodiversity to the land. A significant number of farmers and ranchers (“producers”) across the country and around the world are part of an agricultural revolution, a regenerative revolution, focused specifically on biological diversity and a healthy, biologically active soil. This movement, however, was not born in a laboratory nor was it born out of legislation or regulatory requirements. It was born out of the recognition by innovative producers who understood the need to adopt ecologically and economically sustainable principles to enable them to remain on the land, producing food, feed, fiber needed for an ever-expanding population.

Sixty years ago, 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, 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 techniques that limited the use of inorganic fertilizer, fuel and feed. They began to see that limiting or eliminating tillage reduced their fuel bill, and 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). In essence, they built a foundation of principles that many producers follow today to manage healthy 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 rangeland 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 structure. These principles have proven the path forward for many innovative producers and substantiated that the conventional farming practices of the last six decades are not the only way. The following soil health management principles were developed by producers for producers:

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 140º F soil bacteria die. The soil must be covered to minimize bare ground, this is largely accomplished by forage and crop residue.

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.

3) **Increase diversity:** Increasing plant diversity above ground allows for a more diverse communities 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.

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.

5) **Properly integrate livestock:** Grasslands 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 the plant to recover before being grazed again.

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 six decades, the agriculture industry admittedly focused on treating symptoms with practices and inputs rather that addressing the problem with science-based, systems-focused principles. Dating back as far as the early 1900s, producers tended to focus more on plowing the prairie with industrial technology and machinery rather than understanding the soil's ecology. To most, soils were largely viewed as a medium to grow crops.

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.

Soil health is often defined as “the continued capacity of the soil to function as a vital, living ecosystem that sustains plants, animals and humans.” While many people today think of “soil health management” as a new strategy, it’s actually not. In 1949, Aldo Leopold stated in *A Sand County Almanac*, “Land, then, is not merely soil; it is a fountain of energy flowing through a circuit of soils, plants and animals”.

Mr. Leopold is widely considered to be the father of modern conservation theory and wildlife management. He taught that land stewardship was not only rooted in conservation but also involved an ethic of stewardship. He wrote that all ethics rest upon the single premise "... that the individual is a member of a community of interdependent parts. The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, animals, or collectively: the land." Stated another way, once we understand that humans are not separate from, but are part of and depend on the natural community, we will develop an ethic to care for the community as a whole.

Fast forward to today: a lot has changed in how many “view” the soil and those entrusted with the stewardship thereof. For years, our soil, and specifically the health of our soil, has been taken for granted. And those who oversee the use and protection of our soil—the producers, the stewards of our land—have been disparaged and in many cases demonized for the practices in which they engage. However, the reality is that those entrusted with the mantle of responsibility as land stewards embrace the same ethic taught by Mr. Leopold. This is land stewardship, and land stewardship does not happen without land stewards.

Defining the Steward

Most of the time you can’t see them from the road, but if you take the time to look across rural America, you’ll find producers working tirelessly in an effort to ecologically steward their lands, raise their families, and earn a living wage. Many of these stewards are using the same tools that others claim are degrading the environment to effectively regenerate it.

In a 1933 article published by Mr. Leopold in *Game Management*, he states, "...game (wildlife) can be restored by the creative use of the same tools which have heretofore destroyed it- axe, cow, plow, fire and gun." He goes on to state "...management is their purposeful and continuing alignment,” emphasizing how these tools can be implemented or managed to drive their potential ecological outcome.

The management of the “axe” represents the management and sculpting of habitat, specifically woody species encroachment. The “cow” represents grazing management, including stocking rate along with the timing, frequency, intensity and duration of the grazing event. The “plow” represents soil management, optimizing habitat disturbance, managing for specific plant communities, even planting them. “Fire” represents the planned application of prescribed fire. Fire molded many of our rangeland systems and many have degraded due to its absence. Finally, the “gun” represents managing wildlife populations with science-based data in an effort to conserve and eliminate declining wildlife populations and declining biodiversity.

Applying the Principles Today

No-till and Cover Crops - Producers today are actively and independently beginning to re-implement these principles into their operating plans, all the while looking for new (and old) tools to help achieve environmental and production goals. With the primary soil health management principle being “armor the soil”, keeping the soil covered is paramount. Conventional tillage practices are extremely damaging to soil biological processes and increase the susceptibility of the soil to erode. Many innovative producers have embraced no-till agriculture and many are out-producing their conventional county cohorts. The use of cover crops has increase exponentially over the past several years. Cover crops are one commonly utilized tool in agronomic systems to meet several management goals, such as keeping the ground covered, adding biological diversity and increasing pollinator habitat. Cover crops are an incredible tool that can be utilized to directly or indirectly meet any and/or all of the five soil health management principles in cropland and pasture systems. Many producers have been utilizing mixed species cover crops in cropland and pasture systems to increase diversity, increase organic matter, increase soil microbiological function and more. Simply planting cover crops is not one of the principles. Cover crops are but one of the facilitators that enhance the farmer’s ability to follow the five soil health management principles.

Fire - The Great Plains, once stood as one of the most biologically diverse prairie ecosystems in the country. The two primary tools that molded this system over eons were herbivory (grazing) and fire. There are multiple reasons these rangelands are not in the condition they once were, including overgrazing (due to poor management and not the mere presence of the animals themselves), land fragmentation and woody encroachment. However, the most impactful is the suppression of fire. Limiting or completely removing fire from the landscape reduced nutrient and energy cycling and more importantly allows woody species to encroach and recruit, eventually creating a woodland. Fire in this ecological region is a core ecological process often overlooked, more often, completely removed. Historically, every square inch of land in the Great Plains evolved under a fire dependent ecology, meaning the proper function of that ecosystem and its habitat for wildlife species depended on fire and an integral component. Today, producers are increasing the use of prescribed fire to tailor its application and meet specific ecological outcomes and management objectives.

As with the use of cover crops to keep the ground covered thereby building healthy soil, timely and well-planned application of prescribed fire can actually limit the duration the soil is bare following fire. Given adequate soil moisture, cover can return quickly during the growing season. Prescribed fire can additionally aid in soil nutrient cycling and availability, often providing legacy effects for additional years.

Prescribed fire also aids in managing diverse plant communities, thus supporting habitat requirements of many game and non-game grassland bird species. Producers applying prescribed fire are actively enhancing the plant community structure for improved habitat, improving forage quality and quantity, and effectively addressing brush management. Studies have indicated that forage quality is increased and year end forage quantity is not reduced following prescribed fire. A primary driver of this result is controlling woody encroachment in prairie ecosystems. Consequently, brush management is the most common purpose for applying prescribed fire.

Air quality is often the scapegoat for most dissenters of prescribed fire. The primary air concern regarding prescribed fire is smoke management. Numerous environmental factors can have positive and negative effects on smoke dispersion during a prescribed fire, including mixing

height, transport wind speed and wind direction. Today's producers are using precise weather forecasting, proper planning and appropriate application of prescribed fire to mitigate air quality issues. Moreover, an oft-overlooked benefit of prescribed fire is that for some plant species, smoke actually increases seed germination.

Grazing - Grazing management is another tool that has defined agricultural production in the Great Plains region and beyond. Plant communities that make up the majority of ecologically diverse prairie systems evolved over time under some type of grazing influence. Largely the timing, duration, frequency and intensity of the grazing event over time has a tremendous impact on the composition and production of these rangeland plant communities. The art of applying proper grazing management is found in, among other things, the ability to be flexible with forage utilization and return intervals.

Beneficial grazing systems have been developed, tested, well published in the scientific literature and implemented across the country for decades. Producers are implementing grazing systems with an intentionality toward a given environmental climate, balancing the timing, duration, frequency and intensity of the grazing event.

Grazing systems are a valuable part of the overall grazing plan; however, no grazing system will be effective if stocking rate is not addressed. Stocking rate is the single most important grazing management decision a producer can make. Stocking rate influences forage utilization, grazing distribution, and over time can influence either positively or negatively the productive capability and diversity of rangeland plant communities and wildlife habitat. Grazing management is a complex part of managing a ranch, but today's producers are focusing not only on stewarding an ecological system and an animal production cycle that is constantly changing, but also on doing so in a manner that allows them to sustainably deliver their products cost-effectively into fluctuating markets.

Conclusion

Market forces on the inputs and outputs of farmers and ranchers across the United State have combined with the land stewardship ethic of those same individuals to create a movement in the agricultural industry focused on the application of fundamental principles of land stewardship, principles that can be applied across all aspects of the agricultural sector. Despite the growing theme in our public discourse laying the blame for global biodiversity loss at the feet of the agriculture sector, over the past decade, the movement is demonstrating that, in fact, many agricultural producers, as well as the sector as a whole, are actually helping return biodiversity to the land.

As the movement continues to grow, unimpeded by the burden of restrictive legislation and regulations, so too will the biodiversity beneficial to the production food, feed and fiber and ecosystem services necessary to support an ever-expanding population.