Conservation Effects Assessment Project–Grazing Lands: An Introduction to the Special Issue

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On the Ground

- Knowledge derived from grazing lands assessment programs provides the foundation for the development of conservation policy and informs local, regional, and national entities on benefits associated with investments in conservation and land management.
- Conservation Effects Assessment Project – Grazing Lands provides a baseline for informing decision-makers at all levels of the impacts and potential values of conservation practice application.
- Comprehensive assessment at multiple scales provides opportunities for understanding the impacts of land management and conservation programs on approximately 600 million acres of grazing lands in the United States.

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Grazing lands in the United States contribute a significant and vital foundation to the food and natural fiber industries of the country and also provide a basis for many of the goods and services citizens depend upon for maintaining quality of life, industry, and biodiversity among other benefits. Appropriate management and conservation of these critical ecosystems contributes to the sustainability of the nation and the security of its population. To understand their innate value and the contributions to society as a whole, the United States Department of Agriculture (USDA), under the direction of the Natural Resources Conservation Service (NRCS), initiated the Conservation Effects Assessment Project (CEAP)–Grazing Lands to assess the contributions of conservation efforts to maintain resilient, productive, and desirable privately held "grazing land" ecosystems in the United States.[1,2] This effort is designed to inform landowners, stakeholders, decision-makers, and the general public of the value of conservation on these ecosystems and to account for the impact of investments made to maintain or improve grazing lands.

Of the roughly 1.9 billion acres that make up the 48 contiguous states, the Natural Resources Conservation Service-Natural Resources Inventory estimates there are 525 million acres of nonfederal range and pasture lands.[3] Finding effective ways to improve conservation investments in this approximately 30% of terrestrial land cover of the United States could have a significant impact on the way the materials and services that support our way of life are managed. The Federal Government, through continued efforts supported by Title II (Conservation) of the Farm Bill, authorizes expenditure of the federal treasury for the "conservation" of agricultural and other working lands across the country. The Congressional Budget Office (CBO) estimated that the Agriculture Act of 2014 would have an approximately 489 billion cost to be spent over the 5-year period between 2014 and 2018. Of this, the CBO estimated that 6% of the total would be spent on "conservation." Although only 6% of the total "Farm Bill" expenditures, Title II-Conservation represents a significant investment in the stewardship and management of agricultural working lands across the country. Accounting for and verifying the returns on these investments provides a means for landowners and managers, action agencies, and lawmakers to justify the benefits of these activities and the value of their actions. The CEAP-Grazing Lands component is a key to assessing the impacts of investments on the grazing land portion of agricultural landscapes. Through CEAP-Grazing Lands, transparency and accountability is increased in the effort to maintain a vibrant, resilient, and sustainable agricultural industry in the United States while also supporting the many other benefits of "healthy" functioning grazing lands (Fig. 1).

Rangeland Management Meets Rangeland Science

The science and management paradigms of the rangeland discipline in US grazing lands grew in the late 19th century

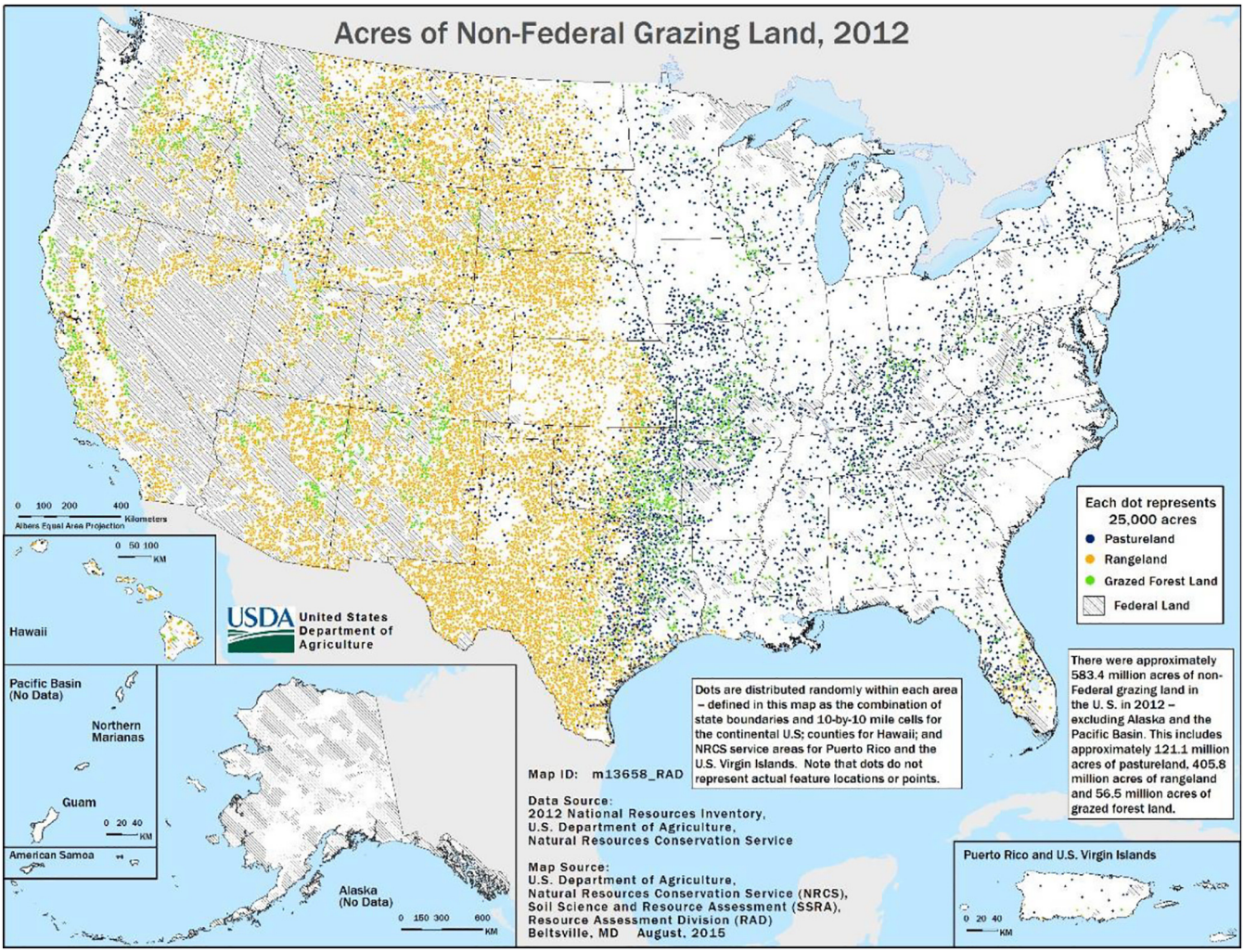

Figure 1. Non-federal grazing lands in the contiguous United States. Each dot represents 25,000 acres.

when the combination of overgrazing and severe drought drastically affected range landscapes.[4] The degradation resulting from the combined impact of overgrazing and drought led E.O. Wooton to describe the issue as the "Range Problem."[5] The response to these drivers and the development of science, management, and policy resulted in an emphasis on the production[4] or utilitarian[5] approaches toward addressing the problems.

Conservation of natural resources has been described as developing through three sequential paradigms.[6–8] The first paradigm can be viewed as utilitarian, which is largely based on conserving long-term sustainable production that provides benefits for the many and maintains economic stability.[9] Conversely, the protectionist paradigm is motivated more by spirituality and emotional drivers illustrated by the ideas of Ralph Waldo Emerson, Henry David Thoreau, and John Muir. The protectionist paradigm aims to protect nature from humans by setting aside or reserving lands, national parks, and wilderness areas from human influence.[6] The utilitarian and protectionist paradigms were often viewed as dichotomous or competing perspectives. Based on concepts from these two paradigms, there arose a third paradigm of ecosystem management, which focuses on the conservation of functions and interrelatedness of ecosystem components by maintaining processes (e.g., grazing, fire, water cycling, nutrient cycling) with the objective of sustaining the full suite of biodiversity[10] and function. As ecosystem management has matured, conservation and management of "grazing" landscapes has evolved.

As we look forward within the ever-evolving aspects of conservation efforts and their effects and influence upon grazing lands, one must start to take into account common perceptions of "management" and the assumptions that are made related to the actions taken. C.S. Holling[11] posed the questions "What Barriers?" "What Bridges?" in regard to concepts focused on the renewal of ecosystems and institutions. In his considerations, Holling suggests that over the recent past, Page 3 "regional resource and environmental policy and management have been in and out of decision gridlock in many regions of North America, Europe and Australia."[11] During these times when factions solidified their camps within the utilitarian or preservation paradigms, ecosystem management has struggled to find a common ground and many conflicts prevail and suspicions dominate (i.e., grazing public lands, forest management for fire concerns, utilization of water resources, etc.). Each camp

Figure 2. Land management impacts and assessing value of conservation: 1) grazing plans and conservation in the Rolling Plains of Texas (photo courtesy of Jay Angerer); 2) pristine tallgrass prairie of north central Texas managed with prescribed fire (photo courtesy of William Fox); and 3) proper stocking rates and rotational grazing in the Blackland Prairie region of Texas (photo courtesy of Jason McAlister).

envisioning their policy as preferred has led to continued ecosystem deterioration, economic challenges, and a general mistrust by the public. The results generated through efforts to minimize the variables used for policy and decision-making and control of certain aspects of the processes within ecosystems (based upon the factions desired outcomes: utilitarian vs. preservation) has led to the paradox that Holling and Meffe labeled as "Command & Control and The Pathology of Natural Resource Management."[12] Through efforts within the CEAP-Grazing Lands Project and the assessment of conservation impacts, the pathology can begin to be discussed and refined to further benefit the overall resilience of the ecosystems monitored (Fig. 2).

With the expanding applications of ecosystem management and the policies in place that guide land management agencies, the application of conservation practices seeking to recapture or build capacities of grazing lands throughout the United States has increased substantially through the last half of the 20th century and into the 21st century. As efforts continue related to land management and the application of practices for conservation and sustainability of grazing lands and the economies they support, defining success and measuring outcomes will be critical to accounting for return on investments, both government and private. The verification and accounting responsibilities for private lands (and some public land ecosystems) have been directed to the USDA-NRCS. This directive has led to the development of the CEAP and is currently underway for croplands, grazing lands, and wetlands within the United States.

A Brief History of CEAP-Grazing Lands

The "Grazing Lands" CEAP Project officially began in 2006 to assess the effects of conservation programs on the approximately 525 million acres[3] of nonfederally owned rangelands and pasturelands (including grazed forests). The program was initiated to evaluate the benefits of conservation practices traditionally applied on these ecosystems to affect the status of vegetation communities, water quality and quantity, and reduced soil erosion, and to promote the economic viability of the agricultural communities where grazing lands occur.[1] Grazing lands is a term utilized by the USDA-NRCS to include rangelands, pastureland, grazed forestland, native and naturalized hayland, and grazed cropland.[13] The term does not designate that actual grazing takes place upon the land; however, it is commonly accepted that the primary use centers on production of forage plants maintained through grazing management (domestic and wildlife).

Grazing lands provide a wide array of societal benefits well beyond the actual utilization of vegetation for grazing of domestic livestock. These landscapes, often sparsely populated, provide resources to wildlife, provide water resources (quantity/quality), clean air, and open space. Services generated by grazing lands are both extractable and *in situ* and are commonly the connections between the biophysical and socio-economic components that make up an ecosystem.[14–16] Traditionally, these landscapes were viewed as marginal in the capacity of production (not conducive to crop production), but more recently they are being valued for their vital contribution to society and their management and conservation has increased considerably from the turn of the 20th century until today. With that said, there have been limited efforts in quantifying the value of grazing lands and the effects of their conservation until recent times.[13] With the implementation of the CEAP-Grazing Lands Project, efforts are underway to analyze their contributions to society at national and watershed scales.

In 2006, the "Rangeland CEAP" was officially initiated. Professionals from the rangeland discipline embarked on an effort to conduct a synthesis of the literature currently available related to common land management practices utilized for the conservation of grazing land ecosystems.[1] These common land management practices included the following:

- An Evidence-Based Assessment of Prescribed Grazing Practices
- Assessment of Prescribed Fire as a Conservation Practice
- Brush Management as a Rangeland Conservation Strategy: A Critical Evaluation
- Assessment of Range Planting as a Conservation Practice
- A Scientific Assessment of the Effectiveness of Riparian Management Practices
- An Assessment of Rangeland Activities on Wildlife Populations and Habitats
- Invasive Plant Management on Anticipated Conservation Benefits: A Scientific Assessment

- A Landscape Approach to Rangeland Conservation Practices
- A Social and Economic Assessment of Rangeland Conservation Practices

Concurrent to the "rangeland" efforts, a CEAP "pastureland" process similar to that for rangelands was being conducted for landscapes primarily in the eastern and central United States. C.J. Nelson coordinated an effort entitled "Conservation Outcomes from Pastureland and Hayland Practices: Assessment, Recommendations, and Knowledge Gaps."[2] The effort reviewed topics central to the management of pasture and haylands. Topics included the following:

- Pastureland and Hayland in the USA
- Forage and Biomass Planting
- Prescribed Grazing on Pasturelands
- Forage Harvest Management
- Nutrient Management on Pastures and Haylands
- Synthesis and Perspectives

Key findings within the pastureland synthesis suggest that environmental studies are often conducted on short time scales with the processes being evaluated often requiring decades to equilibrate and with little regard to landscape position or location within the watershed.[17] Other findings included the need for tools to assess risk and probability of success of conservation practices in place and time, monitoring and assessment tools, process-based and biogeochemical models, and protocols to address goods and services over a wide range of disciplines.[17] These comprehensive efforts (rangeland and pasture syntheses) sought to provide a basis for the CEAP-Grazing Lands Project and a point from which programs could be developed to ascertain the value of, and return on, conservation investment for private grazing land systems.

Challenges and Future Perspectives

It is key to understand that the CEAP-Grazing Land effort focuses primarily on ecosystems that are held in a private capacity and that all management, stewardship, and conservation decisions generally rely upon voluntary participation of landowners, managers, and stewards. Because of the emphasis on voluntary participation and focus on private lands, CEAP efforts require an understanding of the drivers and values of individuals as they consider their land management goals. Development of processes and protocols for determining participation, implementation, and maintenance of conservation efforts on private grazing lands is critical to the accurate implementation and assessment of the services provided by these programs.

Greiner et al.[18] suggested that society's expectations of "farmers" are increasingly related to the environmental performance in both general terms and to regional challenges. Pannell et al.[19] illustrated that the adoption of innovation in terms of conservation practices is primarily influenced by current circumstances and characteristics of the "farmer." In principal, most land managers adopt innovation if they believe the practices will provide benefits in meeting ownership or management goals (i.e., economic, social, environmental). The decision to implement conservation practices injects aspects of risk and reward in the decision-making process and requires some sort of assurance (probability) of success. Raymond and Brown endeavored to assess conservation opportunities on private lands in Australia from a socioeconomic, behavioral, and spatial perspective.[20] One of their results (impacts on economic markets) is interesting and quite relevant to the benefits of a CEAP-Grazing Land assessment because it is centered on the challenges of encouraging "moderately engaged landowners" to become more engaged in the studied conservation practice. As CEAP-Grazing Lands starts to deliver a more complete understanding of the benefits of conservation practices in the United States, the drivers and market devices within the economy will provide incentive for conservation activities. These drivers and market devices can be seen at a relatively small scale in some locations within the United States where corporations and private funders are engaging and supporting landowners and managers in the implementation of conservation efforts. Knight et al. have suggested that, Page 208 "we need to know, not only where the most valued nature is located, but also where willing and capacitated people and institutions are located."[21] Unlike the concept of conservation priorities, which locates where areas should be conserved, "conservation opportunity" can examine factors that contribute to effective actions.[22]

As efforts continue in the conservation arena to expand the application of and funding for practices, CEAP-Grazing Lands has the potential to inform landowners, managers, and investors as to the benefits to both local and societal goods and services. Greiner and Gregg suggested, based upon economic theory, that private investment in conservation would occur at a level below what is considered "socially optimal" because investment in public goods are of value only up to their "marginal private costs."[23] However, we have seen that in many cases, investment in conservation far outweighs the marginal private benefits and costs, with industry, corporations, and private donations being dedicated to conservation efforts for various reasons. These "altruistic" sources can be and are of great benefit to the conservation effort and are consistent with economic models.[24] CEAP-Grazing Lands, through the development of analytics and data supporting the ecological value of the conservation practices, has the ability to inform the economic model in such a way that expansion of investment into the long-term conservation of natural capital can be achieved across a broad spectrum of the financial horizon.

As was mentioned earlier, under private landownership models, conservation implementation and long-term success relies on the personal goals as the driver for land management decisions.[19] It has been suggested that the design of conservation policy and programs at larger scales should include a better understanding of the landowner and manager motivations across the spectrum of decision-making drivers. Understanding these motivations and their importance to the

decision-making process and adoption of conservation practices is critical to the implementation of such efforts.[25] Greiner et al.[18] indicated that landowners and managers with a high conservation or lifestyle motivation have higher rates of adoption of conservation practices compared with those who hold a strong economic or financial motivation. The conservation/lifestyle landowner/manager provides the early adoption avenue for conservation practices that can feed off outputs from the CEAP-Grazing Lands informing practice benefits, whereas the economically or financially motivated landowner or manager can utilize outputs in determining economic benefits and integrating incentive programs into the decision-making process. The potential for CEAP-Grazing Lands to provide regional inputs into these decision-making processes of private landowners and managers is one of the highest benefits, while also informing lawmakers and administrators as to the value of the public trust/treasury invested in the conservation effort. Inclusion of CEAP-Grazing Lands results as inputs in a collaborative manner to guide policy and incentive programs and support of conservation practices is critical and can be informed by the efforts within the CEAP-Grazing Lands Project.

Bestelmeyer and Briske et al.[26] set forth concepts related to resilience-based ecosystem management and proposed five grand challenges: 1) develop knowledge systems to support adaptation and transformation; 2) improve models of ecological systems; 3) assess and manage tradeoffs among ecosystem services; 4) develop social-ecological system perspectives; and 5) build organizations to promote resilience-based management. These challenges provide a basis from which next-generation conservation efforts can be built upon and for which current and future efforts of the CEAP-Grazing Lands Project can inform and support. Connecting conservation policy (regulatory decisions) and conservation practice (on-the-ground decisions) with sound scientific support can be vital for effectively addressing natural resource management problems.[27,28] However, producing the science that both informs policy and guides practice is an ongoing challenge that is currently being addressed through efforts such as CEAP, the NRCS National Resources Inventory, the USDI-BLM (United States Department of Interior - Bureau of Land Management) Assessment, Inventory and Monitoring program, and the USDA-ARS (United States Department of Agriculture - Agricultural Research Service) Long Term Agroecosystem Research network.[29,30] CEAP-Grazing Lands can provide one effort in meeting this challenge in the ongoing efforts to conserve and produce goods and services from the nation's range and pasture lands.

Conservation Effects Assessment Project–Grazing Lands

The CEAP-Grazing Lands series of papers in this issue are developed to present some outputs of the overall effort in the realm of applications for wildlife, forest, and grazing, as well as a challenge to the future for the interactions between science and management. The series concludes with a summary of current activities within the CEAP-Grazing Lands Project and a view into future efforts. Overall, CEAP-Grazing Lands is developing capacity to address the initial questions posed by the Office of Management and Budget and providing foundations to address the grand challenges proposed by Bestelmeyer and Briske[26] and Briske et al.[31] in an effort to expand the application of conservation practices across a broad landscape in the effort to move toward a resilience-based approach to land management that meets the needs and desires of private landowners and managers while maintaining and improving the ability of these landscapes to provide for the general good of society.

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