

Biodiversity of Rangelands

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Rangelands span a variety of ecosystems including grasslands, savannas, sagebrush steppe, shrublands, tundra, mountain meadows and deserts. The variety of life and its processes on them (biodiversity) is important for moral, aesthetic and economic reasons, as well as for the services biodiversity provides to society. Rangeland biodiversity is constantly changing by reduction in habitat, land use changes, loss of species, global environmental change and invasion of non-native species. Range scientists and managers, in partnership with the livestock industry and environmental groups, are working to improve the understanding of biodiversity so that the knowledge will be used to protect the vast rangelands of the world.

What is Biodiversity?



Biological diversity (biodiversity) includes all living organisms (plants, animals, microbes, etc.) and the genetic differences among them. It exists at species, community, ecosystem and landscape scales.

Genetic Diversity is the variation in the genes of rangeland plants, animals and other organisms. Genetic diversity within species contributes to biodiversity at higher levels. With the exception of plants used in cultivation, there is not much known about the genetic diversity of most rangeland species. Fortunately, new techniques are becoming available to accelerate the understanding of rangeland genetic diversity.

Species Diversity is the variety of species (plants, animals and other organisms) on Earth. The perception that rangelands have low biodiversity is false. A wide variety of plants, animals and other organisms can be found on rangelands. The problem is, there is not an accurate accounting of many of the components of diversity except for select plants, birds and mammals.

Community Diversity is the variety found in groupings of species (communities). This diversity includes how many species and which ones are in a community (richness), as well as how many individuals of each species are present relative to other species (dominance). Management actions, including protection, on rangeland communities involve positive and negative trade-offs between species that benefit from those actions and those that do not. Rangeland managers can alter what species and how many individuals of each are present by using management tools such as changes to livestock grazing or fire regimes.

Ecosystem Diversity is the variety of ecosystems (biological communities plus the physical environments with which they interact). The diversity of species, life forms, lifecycles and strategies for growing and reproducing, affects the micro-environment energy flow and nutrient cycles for each ecosystem.

Landscape Diversity is the variety and patterns of ecosystems and communities across a hillside, watershed or region. Changes in landscape patterns influence a variety of features including patterns of use by animals, water and nutrient cycles, and physical surface disturbances and soil erosion.

Why is Biodiversity Important?

Biodiversity is important for four basic reasons: morality, aesthetics, economics and the services that it provides to society. Many people believe there is a moral or spiritual obligation to protect their fellow creatures. People like to see and appreciate the living parts of nature as it often adds to the interest, value and quality of their lives. There are many direct benefits to people and our economy from biodiversity such as foods, fibers, forage for grazing animals, medicines, fuel, building materials and industrial products, as well as recreation and hunting. The least understood, but most important, value of biodiversity is the array of environmental benefits provided by natural ecosystems. Essential ecosystem benefits provided by rangelands include maintaining the composition of the atmosphere; mitigating climate and moderating weather; creating, fertilizing and stabilizing soils; disposing of wastes; cycling nutrients; storing and purifying water; and providing natural control of diseases and pests to name only a few. Loss of biodiversity can negatively influence the quality and quantity of these benefits.

What is the State of Biodiversity on Rangelands?

A major threat to biodiversity is the reduced size of contiguous habitats. Most of the world's rangelands with sufficient rainfall for growing crops have been converted to agricultural land. In other areas, irrigation using imported water or groundwater has been implemented on traditional rangeland areas. In the U.S., more than 50% of the ecosystems determined to be critically endangered are grasslands and almost 25% are shrublands. Rangeland that is marginal for agricultural, urban and industrial development remain less fragmented than many other ecosystems but even low levels of fragmentation may negatively impact some species and the function of some rangeland communities. Maintaining sufficient area in each type of rangeland is necessary to sustain biodiversity on all levels.

Rangeland professionals have long been interested in the complex relationship between grazing and rangeland biodiversity. Grazing is an important process in many rangeland ecosystems. Grazing can have both a positive and negative impact on biodiversity on all levels. Continuous heavy livestock and/or large animal grazing and trampling can adversely impact some rare plant species' population. The indirect effects of heavy



grazing can be significant for some groups of animals. Wide-ranging vertebrates, particularly predators and carrion-eaters, have been the most visibly impacted animals on rangelands. Several species are jeopardized by activities related to livestock grazing management including the grizzly bear, Mexican wolf and black-footed ferret.

On the other hand, some rare species are favored by grazing. For example, the mountain plover nests only in heavily grazed short-grass steppe ecosystems. This bird probably evolved with bison influences that only cattle can now widely replace. Livestock can be used to actually enhance conservation of particular species or plant communities and structures.

Grazers influence community diversity by eating select plant species and trampling plant species with different abilities to respond. Moderate grazing and trampling usually increase the diversity of plants by decreasing the ability of any one plant species to become dominant and exclude other species. Grazing can create gaps in the plant community, making light, moisture and nutrients more available. The effects of grazing on plant community diversity depend on the grazing intensity, evolutionary history of the site and climate. If grazing is excluded, the number of species may increase in the short-term, but may decline in the long-term because the system itself changes. It may develop into a system that is less able to withstand other disturbances such as drought and fire. Rangeland professionals use a combination of management actions, such as grazing and prescribed burning to enhance landscape diversity by creating patterns of different communities across the landscape. In addition, large tracts of land owned or managed by livestock operators can assist in protecting biodiversity by maintaining contiguous habitat.

An increasing threat to rangeland biodiversity is invasion by non-native species, which can cause many facets of biodiversity to change. For example, as cheatgrass from Eurasia became a more common component of sagebrush steppe ecosystem, the nutritional quality of available forage was reduced, the intensity and frequency of fires changed, and water cycles of these ecosystems were altered. Several native animals, the sage grouse in particular, have declined because of these changes. Simply removing livestock will not reverse these trends, so rangeland scientists and managers are working on techniques to restore these invasive-dominated ecosystems to a more diverse and durable state.



What is the Future of Biodiversity on Rangelands?

The ability to sustain biodiversity will depend on how successful the efforts are to maintain and restore variation and revitalize ecosystem functioning. Genetic resources will become more valuable for restoration in the future. Plants adapted for revegetating areas following disturbances such as mining and fire will need to be identified and developed. To guarantee the availability of potentially genetically valuable rangeland resources, there



is a need to develop management techniques to protect isolated and declining populations of rangeland species.

Information is available on many rare vascular plant and vertebrate species and where they are located, but there is a lack of similar data on invertebrate animals, non-vascular plants and microbes. An inventory of these species is needed. These less noticeable species may be more important for maintaining ecosystem function or affecting ecosystem recovery than the more visible ones.

The task of quantifying biodiversity of rangelands and planning management to accommodate these values has just begun. Differing and expanding views of biodiversity are requiring inventories, monitoring efforts and research beyond the livestock grazing focus. To find ways that natural resources can be both used and maintained, rangeland professionals are working to improve the understanding of the role species and life forms play in ecosystem functioning. Biodiversity conservation efforts are being focused on using the collective knowledge of rangeland science and management.

The best way to minimize species loss is to maintain ecosystem integrity across landscapes by placing a priority on maintaining soils and ecosystem functions. Without these features, overall potential for all biodiversity will be seriously diminished. The basic guideline is to prevent the loss of the inherent capacity of the land to produce life and maintain options for the future.



Resource List

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For More Information:

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