

Effects of Bison on Bird Communities in Northern New Mexico

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One of the most iconic species of North America, bison (or buffalo) are a commanding presence on the Great Plains and other habitats where they occur. They also strongly affect their environments, modifying habitats to the extent that conservationists and ecologists refer to these powerful beasts as “ecosystem engineers.” A type of “keystone species”, ecosystem engineers modify the places they live, creating habitat for a wide variety of other species (think beavers and the dams they build or elephants that maintain open grasslands by knocking over trees). Bison do the same. In northern New Mexico, we’ve found that bison damage and eliminate intrusive piñon pine and juniper trees as well as yucca plants and cholla cacti. They also “smooth out” cut banks along streams channels, using the physical action of their hooves and horns to transform drainages and thereby slow water flow and erosion. Other studies have documented the importance of bison wallowing to other species and have shown bison use grasslands differently than cattle, leading to a greater diversity of vegetation and vegetation height.



What does this mean for birds?

Some conservationists, ourselves included, suggest that the switch from bison to cattle grazing adversely affected some native species of flora and fauna on the Great Plains. For example, grassland birds have declined more than any other group of birds in North America. Could that decline be linked to the change from wild bison grazing to commercial domestic livestock ranching across the plains? We do know that cattle grazing has simplified and degraded much of America’s grasslands. So, might returning bison to the Great Plains range help restore native wildlife and habitats? We set out to try to find out the answers to these questions with support from the Denver Field Ornithologists.

American bison once numbered around 30 million animals. Before European settlers eradicated bison from the Great Plains in the late 1800s, huge herds roamed the open grasslands seeking

out the best pastures. Plains' settlers replaced native ungulates with exotic livestock, primarily cattle. Cattle graze the land differently than bison and have significantly altered vegetative communities that evolved with bison. Bison disturbance (grazing, trampling, and wallowing) no longer influences native vegetation and species composition as it once did.

Yet, bison numbers are increasing across North America. Most of that increase has resulted from commercial bison producers, as more and more people look for healthier, less fatty sources of meat. More recently conservationists have begun working to restore "wilder" herds of bison that they refer to as "conservation herds" on both public and private lands. Conservation herds strive to maintain more natural age and sex ratios (usually meaning more males and older animals), use less fencing, and use little to no supplement feed. Although animals still get harvested from conservation herds, managers work to cull a broader range of ages and an equal number of males and females. Such conservation herds provide us with an opportunity to compare how bison and cattle differ in their impacts to other species.



In late 2012, Denver Zoo assumed management of the newest unit in U.S. Fish & Wildlife Service's (FWS) National Wildlife Refuge (NWR) System, the Rio Mora NWR in northern New Mexico. In an innovative and novel partnership, Denver Zoo became the first non-governmental organization to manage a NWR, working in partnership with the FWS, New Mexico Highlands University, and the Pueblo of Pojoaque. Prior to becoming a refuge, Rio

Mora operated as a private refuge operated by the Wind River Ranch Foundation. In another innovative partnership, Wind River reintroduced bison to the ranch in partnership with tribes from northern NM. Just prior to creation of Rio Mora NWR, the Pueblo of Pojoaque assumed ownership of all bison on the property.

Pojoaque's strong connection to nature made them the perfect partners in research we initiated to try to better understand the role of bison in the ecosystems they inhabit and how that role differs from cattle grazing. The Pojoaque hope to increase their bison herd to conserve both their cultural and ecological heritage. They use bison meat to provide food for the poor and as a low fat alternative to beef to help them battle the high rates of diabetes that afflict their people. Further, they use the head and coats of the bison to make costumes for their bison dancers. Bison promise to restore the ecology of the land and culture of their tribe.

To compare how bison and cattle might differently affect the bird community, or avifauna, of the shortgrass prairie, we initiated a pilot study of birds occurring on Rio Mora NWR and an adjacent, commercial cattle ranch. We studied bird communities using what scientists refer to as “variable circular plot” surveys on randomly located survey points on both the refuge and a cattle ranch. During these surveys, researchers stand quietly at random points for 5 minutes soon after sunrise or just before sunset and let the birds settle down to their normal routines. Surveying simply consists of counting birds and determining the distance of each bird from the researcher using a range finder. With enough data, a software package can analyze those data



to provide population estimates. Sadly, we never collected enough data (at least 40 observations of a species per sampling effort) to allow us to estimate populations sizes, but we did get enough data to begin to look at the number of species (called “species richness” by scientists), the diversity of species (the number of species, but also the relatively abundance of those species) and the evenness of the species (another measure of diversity).

Our findings are admittedly preliminary and we hope to find a graduate student to increase the sample sizes and obtain more data to help us better assess the differences between bison and cattle. So what did we find? As the figures and tables demonstrate, the differences in number of species (one measure of diversity) were relatively small and favored pastures with bison in all seasons, except spring, when we found more species of birds on cattle pastures. However, better measures of diversity, such as the Shannon-Weiner and Evenness Indices, take into account the abundance of different species, not simply the number of species. Most people, ourselves included, would argue that at pasture with 100 individuals equally divided among 10 different species is more diverse than a pasture with 10 species in which one species accounted for 91 individuals and the other nine species accounted for just 1 individual each. The Shannon-Wiener, Evenness, and other indices, permit us to make such comparisons when differences are less dramatic and the number of species is much greater. In our study, we found relatively small differences in the Shannon-



Wiener and Evenness Indices, but slightly higher diversity and evenness on pastures with cattle for all seasons, except winter. So, while bison pastures supported more species and more total individuals, fewer species tended to dominate the number of individuals observed.

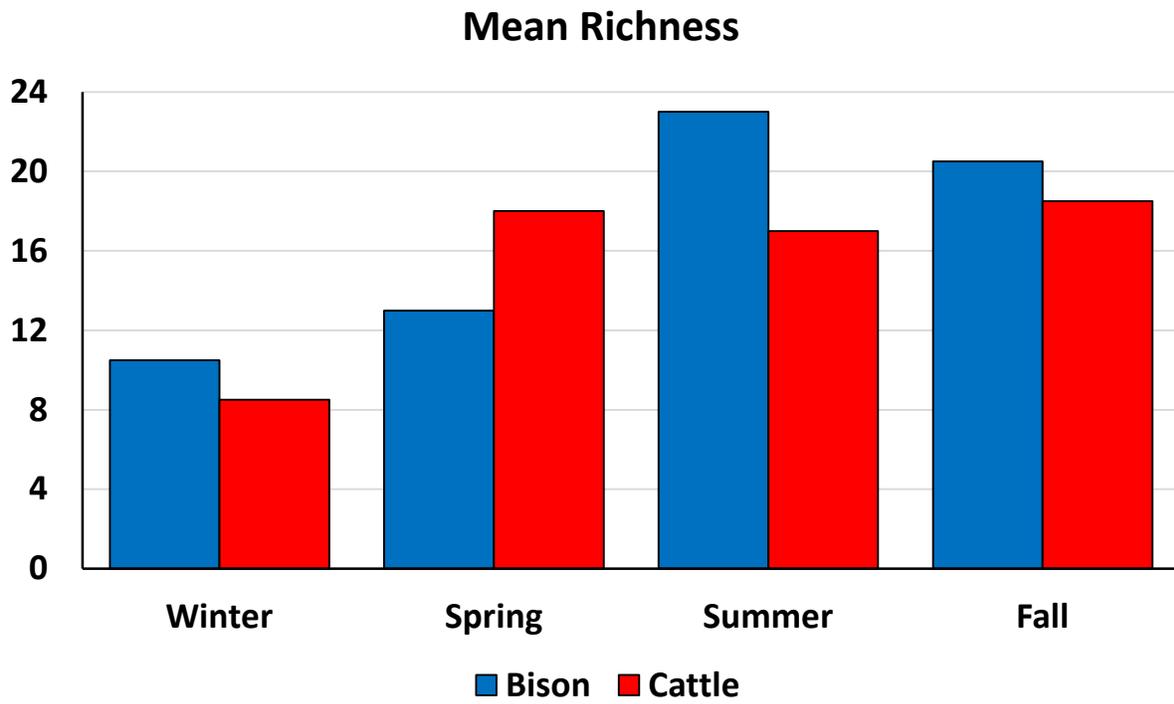
To make more definitive statements about how bison and cattle influence avifaunal diversity, we require more data and additional sites where we could replicate the work conducted on Rio Mora. We intend to do just that and are working with universities in the region to find a suitable student to take over and expand our work. As we write this paper, a graduate student at Colorado State University appears interested in doing just that and using replicates at sites in Colorado to expand our work. Stay tuned for those exciting results over the next few years!

Further Reading

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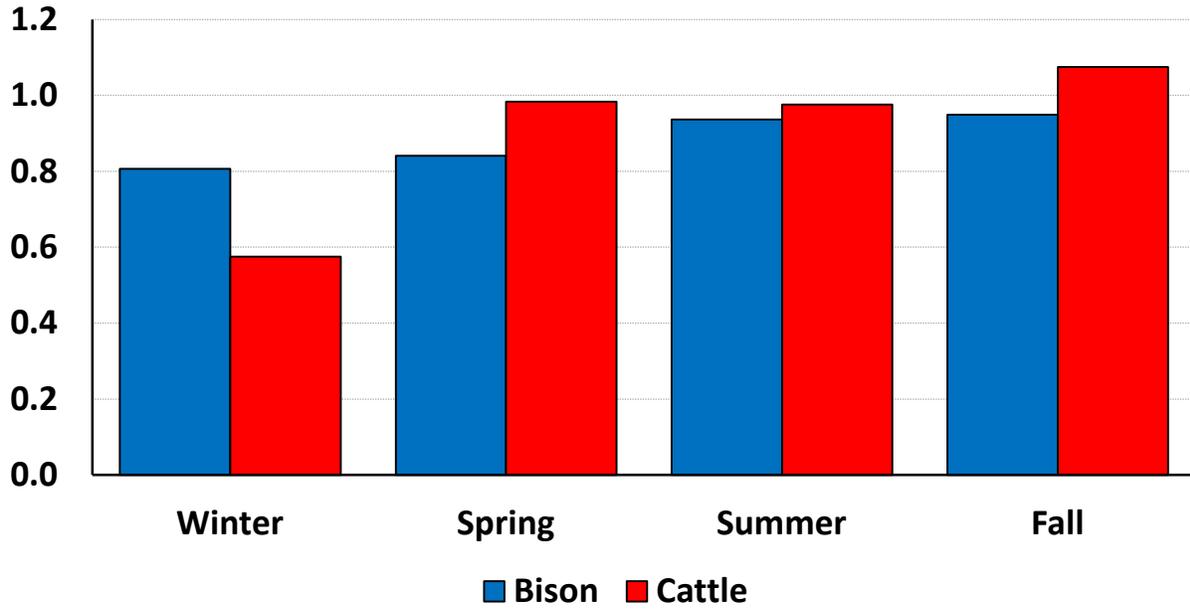
Figure 1. Indices of avifauna diversity on pastures grazed by cattle and bison in northern New Mexico.

A.



B.

Mean Shannon-Wiener Diversity



c.

Mean Evenness

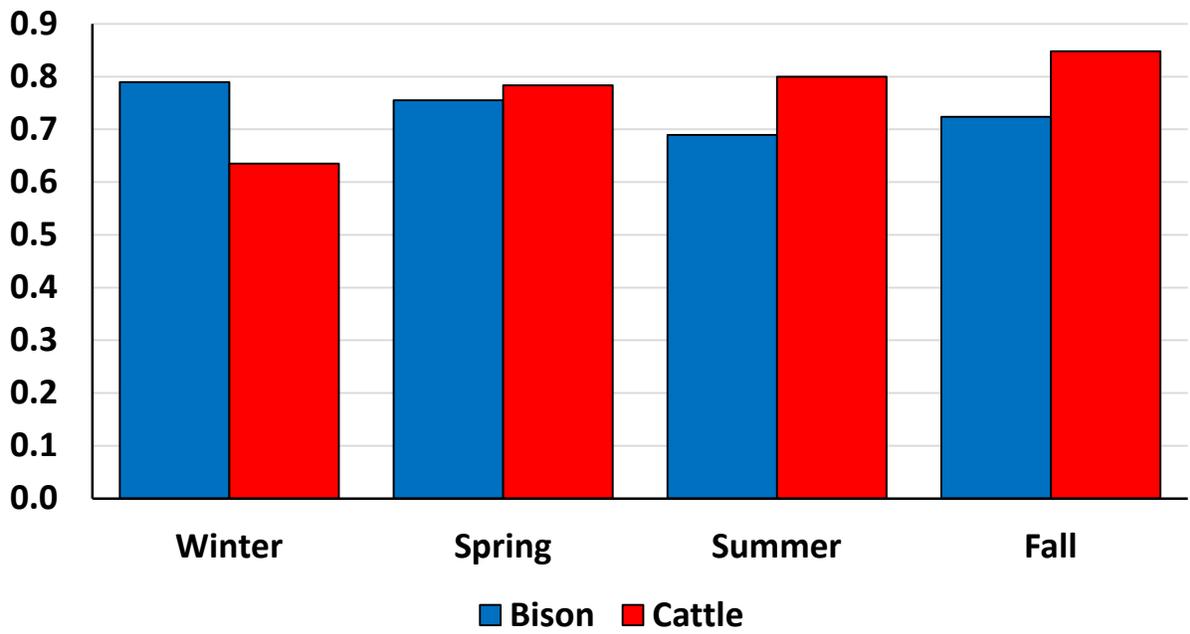


Table 1. Number of birds observed on bison and cattle pastures in Northern New Mexico, 2013-2014.

Bison pastures	# individuals	Cattle pastures	# individuals
Pinon Jay	111	American Crow	78
Sparrow sp.	110	Canada Goose	62
Mountain Bluebird	94	Northern Raven	40
Cliff Swallow	52	Turkey Vulture	40
American Crow	40	Horned Lark	36
American Robin	34	American Robin	28
Western Meadowlark	34	Swallow sp.	27
Turkey Vulture	33	Northern Flicker	26
Northern Raven	30	Red Crossbill	25
American Kestrel	25	American Kestrel	24
Spotted Towhee	25	Mourning Dove	22
Black-billed Magpie	20	Mountain Bluebird	21
Swallow sp.	17	Townsend's Solitaire	13
Horned Lark	15	Long-billed Curlew	12
Mourning Dove	13	Pinon Jay	12
Western Kingbird	13	Black-billed Magpie	10
Western Scrubjay	11	Spotted Towhee	10
Barn Swallow	10	Western Kingbird	10
Northern Flicker	9	Western Meadowlark	9
Western Bluebird	8	Sparrow sp.	8
Hawk sp.	7	Common Nighthawk	7
Say's Phoebe	6	Western Scrubjay	6
Lesser Goldfinch	5	Cliff Swallow	5
Vesper Sparrow	5	Great Blue Heron	5
Bluebird sp.	4	Bluebird sp.	4
Jay sp.	4	Dark-eyed Junco	4
Thrush sp.	4	Gadwall	4
Townsend's Solitaire	4	Hawk sp.	3
Woodpecker sp.	4	Mountain Chickadee	3
Black-capped Chickadee	3	Red-tailed Hawk	3
Dark-eyed Junco	3	Say's phoebe	3
Eastern Bluebird	3	Common Grackle	2
Lark Sparrow	3	Eurasian Collared Dove	2

Table 1. Continued.

Bison pastures	# individuals	Cattle pastures	# individuals
Red-winged Blackbird	3	Mallard	2
Sandhill Crane	3	Rough-legged Hawk	2
Savannah Sparrow	3	Vesper Sparrow	2
Bluejay	2	Western Bluebird	2
Common Nighthawk	2	Barn Swallow	1
Eastern Meadowlark	2	Cassin's Kingbird	1
Great Blue Heron	2	Clay-colored Sparrow	1
Grey Vireo	2	Eastern Kingbird	1
Hairy Woodpecker	2	Falcon sp.	1
Red-tailed Hawk	2	Flycatcher sp.	1
Blackbird sp.	1	Hairy Woodpecker	1
Downy Woodpecker	1	Jay sp.	1
Falcon sp.	1	Lark Sparrow	1
Flycatcher sp.	1	Loggerhead Shrike	1
Hepatic Tanager	1	McCown's Longspur	1
Hummingbird sp.	1	Pine Siskin	1
Rock Dove	1	Roadrunner	1
Sage Thrasher	1	Sandhill Crane	1
Swainson's Hawk	1	Thrasher sp.	1
Swift sp.	1		
Vermillion Flycatcher	1		
Western Wood Peewee	1		
TOTAL	794		587

Table 2. Number of species observed each year on bison and cattle pastures in northern New Mexico, 2013-2014.

Pastures	# species	Year
Bison	44	2013
Cattle	26	2013
Bison	35	2014
Cattle	43	2014
Bison	55	Both
Cattle	52	Both
Both	72	Both
