Plovers, prairie dogs, and fire: Managing semi-arid rangelands for wildlife and livestock

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INTRODUCTION

The mountain plover (*Charadrius montanus*) is a bird species with very specific habitat needs when it breeds in the shortgrass and mixed grass regions of the western Great Plains. Plovers are a ground-nesting bird with cryptic coloring that allows them to blend in well with the short vegetation and bare soil typical of prairie dog (*Cynomys ludovicianus*) colonies, their most preferred habitat. Prairie dog colonies are increasingly rare and seen as undesirable by ranchers as prairie dogs compete with livestock for forage and pock the ground with holes and mounds.

Providing additional desirable plover habitat compatible with livestock production can be challenging. Better understanding how plover, prairie dogs, fire, and livestock interact may provide possible solutions.

METHODS

This paper summarizes the results of several experiments in which methodology differed based on the research objectives. All sites were grazed by cattle at a moderate stocking rate from approximately May 15 to October 15 unless noted. Prescribed burns were conducted during the dormant season and prior to plover arrival. Study locations are listed in Table 1 and at other sites as noted. The Pawnee National Grassland and USDA Agricultural Research Service Central Plains Experimental Range are contiguous.

Figure 1. Plovers are a near-threatened species of grassland bird endemic to the Western Great Plains.

Table 1. Study locations were distributed north to south in the Western Great Plains.

Study Site	Location	Ecosystem	Precipitation	Vegetation
Thunder Basin National Grassland	Northeast Wyoming	Mixed grass prairie	10.8”	western wheatgrass big sagebrush blue grama
Pawnee National Grassland + Central Plains Experimental Range	Northeast Colorado	Shortgrass steppe	13.4”	blue grama buffalograss prickly pear
Comanche National Grassland	Southeast Colorado	Stortgrass steppe	12-17”	sideoats grama blue grama

RESULTS

Late winter prescribed burns (February-March) on the Pawnee National Grassland did not affect aboveground net herbaceous production. The only exception was a reduction on one burn during the second growing season post-drought. Fire intensity was moderate (flame lengths typically <1 meter) due to grazing during the prior growing season. Nitrogen content of grasses was increased post-fire. Prescribed burns conducted for reasons other than livestock production, such as to create plover habitat, can be neutral or positive for livestock production.

Figure 2. Grazing prior to burning reduces fire intensity by reducing fuel load.

Burn prescriptions include numerous components that will affect the results of the burn. At the Central Plains Experimental Range, variations in fuel loads and weather conditions resulted in fire temperature and duration differences. Fuel loads less than 300 pounds per acre often had insufficient fuel to carry the fire across the site. With a fuel load of more than 300 pounds/acre, 80-100% of the site burned.

Heat and duration increased as fuel load increased. At 300 pounds per acre, temperatures near ground level ranged from 230-300 degrees F and heat duration was 40-77 seconds. When fuel loads were 600-900 pounds/acre, temperatures ranged from 275-371 degrees F and heat duration was 68-116 seconds. In the relatively low fuel conditions commonly found in shortgrass prairie, 10-20% humidity, air temperatures >60 degrees F, and wind speeds of 18-22 miles/hour resulted in more effective burns. Fuel load was more than 3 times as important in increasing peak temperature as any weather factor. To reduce vegetation height and expose more bare soil for mountain plover habitat with prescribed burning, a fuel load of 450 pounds/acre or more is preferable.

Patch burn grazing is a burning-grazing strategy in which only part of a pasture is burned in any one year, resulting in heavier grazing on the burned part of the pasture. When 25% of a pasture was burned, vegetation height (visual obstruction) was 50% lower on the burned area of the pasture compared to both the unburned area of the pasture and adjacent unburned pastures, which had similar vegetation heights. The primary reason for the difference in vegetation height between burned and unburned areas was the removal of standing dead vegetation by the fire.

Patch burn grazing had minimal effect on plant community composition and did not impact cover of blue grama or scarlet globemallow, the dominant grass and forb, respectively, in the pastures, but cactus and other shrub cover was reduced by about 2.5%. Three years after burning, burn patches had similar vegetation height and cover as unburned pastures. Plovers were detected only on the most recently burned patches. Increased intensity of grazing on burn patches was less than commonly seen in tallgrass prairie. The patch burns increased cattle weight gain in 1 of 4 years, and had no negative effect in the other 3 years.

Figure 3. Patch burn grazing is compatible with creating plover habitat and livestock grazing.

Livestock grazing alone, even at double the normal stocking rate, did not create mountain plover nesting habitat on the Pawnee National Grasslands and Central Plains Experimental Range, but prescribed burning and prairie dogs did create suitable habitat. Prairie dog grazing is different from cattle grazing in that it occurs year round, and plants are defoliated more often and closer (<0.5 inch) to the ground. Large areas with a fine-scale mosaic of bare soil and prostrate vegetation (where both are intermingled in any given square yard)

were selected by plovers for nesting. Prescribed burning may be especially useful for creating habitat after high rainfall years with abundant plant growth. Burning only part of a pasture can be useful in co-managing for plovers and livestock without damaging the rangeland.

Plover habitat created by prairie dogs generally persists longer than habitat created by prescribed burning. Incentives for preserving prairie dog towns on private lands could increase their acceptance by ranchers.

Figure 4. Livestock production is prevalent on shortgrass steppe rangelands.

Plover density was comparable on prairie dog colonies and prescribed burn sites on the Pawnee National Grassland and Central Plains Experimental Range. Despite additional sampling effort in undisturbed grasslands, plovers were found only on the 3% of the area that contained burn patches or prairie dog colonies.

Figure 5. Prairie dogs drastically alter vegetative cover near their colonies.

Plover densities trended lower on inactive prairie dog colonies as compared to active colonies. In previous studies, plover chicks on prairie dog colonies survived at three times the rate of those on non-prairie dog colony sites. Survival on burn sites is not known.

Figure 6 a,b. Plover nests and eggs blend well with surrounding bare ground and sparse vegetation.

Figure 7. Prairie dog colonies vary widely in size and density.

Plovers tend not to use prairie dog colonies for 1-2 years post plague. Plague is most frequent in wet years, when prescribed burning fuel loads are greatest. Implementing prescribed burns near plague-affected prairie dog colonies may be a useful strategy for maintaining plover density until colonies recover.

Plover densities were similar on recent burns (both prescribed and wildfire) and active prairie dog colonies on the Central Plains Experimental Range and the Pawnee National Grasslands. Nest survival was greater on prairie dog colony sites as compared to burned sites. Plover densities on plague-affected colonies declined 70% compared to active colonies, and plovers continued to minimally use colonies for the following 2-3 years.

Figure 8. A plover chick is nearly indistinguishable from cacti in a recently burned pasture.

Figure 9 a,b. Special burning techniques can be used to create a patchy vegetation-bare soil vegetation pattern at a scale preferred by plovers.

Similar rates of decline were observed on burned sites between first and second year post-burn, but plovers were completely absent after the second year post-fire. Plover density did not differ between various burn sizes or time of burn (fall or late winter).

Prairie dog colony extent did affect plovers, with larger colonies (>200 acres) having higher plover density than smaller colonies (<135 acres). Higher ambient temperatures were associated with lower plover nest survival.

Both prairie dog towns and burns are transient across the landscape, although prairie dog colonies can persist for years between plague outbreaks. Prairie dog sites may offer plover nesting survival advantages due to known conditions (plovers often return to the same site each year) and if plovers take evasive action from predators in response to prairie dog alarm calls. Both prairie dog conservation and prescribed burning are important in providing plover habitat.

In studies conducted on the Thunder Basin National Grassland of Wyoming, prairie dog colonies sampled were as large as 9800 acres in extent, which is substantially larger than colonies studied in Colorado. Colonies were sampled for vegetative structure and use by plovers.

Grass and sagebrush cover were lower within colonies, and forbs and cactus were more abundant. Plovers were found almost exclusively within prairie dog colonies, and not in grasslands which were undisturbed or had a past history (multiple years earlier) of wildfire.

Figure 10 a,b. Edge and center vegetation on large prairie dog colonies can be very different.

Plover abundance was greatest between about 1000 feet to a little less than half a mile (2100 ft) from the outside edge of the colony, with greatest density at around 1600 feet. On large colonies (>800 acres) plover abundance was less near the center than closer to the edges, with density declining rapidly beyond 2600 ft (half mile). Vegetation at the edge of the colony was distinctly different from vegetation at the core of large colonies. Very sparse vegetation available for cover and fewer insects for food in the center of large colonies may impact plover use.

Managing for a suite of bird species must take into consideration not only varying habitat preferences but also sudden changes in habitat availability due to plague or wildfire. The configuration and scale of disturbed and undisturbed patches, as created by both fire and prairie dogs, is as critical as having both types of patches available. Very large prairie dog colonies are not maximally beneficial from either a mountain plover or livestock production standpoint.

Plague outbreaks are common in prairie dog colonies, and the associated reduction in the prairie dog population results in rapid changes in vegetative structure. A study of prairie dog colonies on the Comanche National Grasslands, Pawnee National Grassland, Central Plains Experimental Range, and BLM and private lands in Montana (mixed prairie), found that mountain plovers similarly utilized all ages of prairie dog colonies (1-7+ years old), indicating that very young colonies, when grazed, provide suitable habitat.

After plague events, mountain plovers rapidly (within 1-2 years) decreased their use of inactive colonies. The availability of nearby alternative, high-quality habitat, such as that created by prescribed burning, may be needed to sustain local mountain plover populations following large plague events.

Figure 11 a,b. Trail camera images taken at Thunder Basin National Grassland capture prairie dog colony vegetation changes before and after plague. Top photo was taken in 2017, and the bottom photo of the same site was taken in 2018 after a plague event and during a wet year.

IMPLICATIONS

Prairie dog colonies provide a key habitat for breeding mountain plovers in the western Great Plains. While previous studies found greater plover densities on colonies greater than about 200 acres in extent, plover densities decline towards the center of colonies greater than 800 acres. Both fine scale and large scale vegetative/bare soil matrices are important in habitat creation and selection. From a plover conservation standpoint, there is little benefit in managing for very large prairie dog colonies.

Prescribed burns conducted during the dormant season after grazing produced acceptable plover habitat and did not reduce forage production the following growing season. Previous wildfire studies suggest that without grazing, biomass accumulation and related high fuel load, particularly after wet years, can result in fire intensity great enough to cause reductions in forage production the following growing season.

Using a patch burn grazing strategy did not harm rangelands, provided plover habitat, and had a positive or neutral effect on cattle weight gains.

Moderate grazing the season prior to burning is beneficial for both plovers and livestock. A minimum of 450 pounds/acre is generally needed for a burn to create plover habitat, but burning conditions also depend on wind speeds and relative humidity. Effects of dormant season prescribed burning on plover habitat rarely last more than one year.

Livestock grazing by itself is insufficient to create desirable plover habitat, even at high stocking rates. Prescribed burning might best be used near colonies where plague results in localized extirpation and following years with above average precipitation when fuel loads are greater and plant growth outpaces herbivore consumption.

Figure 12. Fire, prairie dogs, and plovers can co-exist with livestock production on the shortgrass steppe.

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