PERFORMANCE MEASURES REPORT

TESTING 'WILDLIFE FRIENDLY' FENCE MODIFICATIONS TO MANAGE WILDLIFE AND LIVESTOCK MOVEMENTS

Fences are ubiquitous across the landscape, yet there is a poor understanding of their effects on wildlife. Fences can pose both indirect (i.e., access to habitat, energetic costs) and direct consequences (i.e., mortality) to wildlife, requiring that their effects and usage need to be considered more carefully. Historically, many in the ranching community have believed wildlife friendly fence designs to be ineffective in holding livestock. This Research measures the effectiveness of wildlife friendly fence designs and fence modifications that MDT is presently attempting to negotiate with adjoining property owners. MDT has a vested interest in being "sensitive to the environment" via their current Mission Statement. This Research will help MDT attain this goal, while being fiscally responsible with their available funding by properly selecting and siting effective fences and other mitigation techniques that are hereby proven to be effective.

Wildlife and land managers must continually explore mitigation options that promote wildlife connectivity, while concurrently addressing human and property safety (i.e., keeping motorists safe, keeping cattle in desired pastures). The results of this research provide scientifically defensible recommendations that can be used to inform State and Federal Wildlife and Land Management Agencies, Departments' of Transportation, and the public at large of the effectiveness of more holistic multi-species 'wildlife friendly' fence designs, and mitigation techniques.

The fence designs and mitigation techniques described were scientifically tested to determine their effectiveness for promoting habitat connectivity and keeping livestock (i.e., all cattle) in their respective pastures over a 7-year period from 2012-2018. Specific to pronghorn, the Research found that for every centimeter of height the bottom wire is above the ground surface, the odds of an individual successfully crossing a fence increases (unstandardized odds ratio = 1.08, 95% CI = 1.07–1.10), with little to no corresponding risk of livestock escaping from their pastures (Jones et al. 2018). This 18-inch bottom wire height above the ground was found to be the minimum height that allowed the greatest passage of pronghorn while maintaining livestock in preferred pastures. If possible, the use of a smooth bottom wire at 18" is recommended during fence construction as this modification creates a permeable fence line for wildlife but not livestock. The use of smooth wire increased average pronghorn crossing success by approximately 1 additional cross every 3 days. In addition, the use of metal clips or carabiners as a post construction mitigation technique to maintain the preferred bottom wire height at specific fence panels is proven to be an effective strategy at allowing wildlife passage. The use of clips/carabiners increased average crossing success by approximately 1 additional cross every 7 days. Burkholder et al. 2018 found that increased bottom-wire heights also allowed deer species to crawl underneath fence and was the preferred crossing decision by does, and in particular, does with fawns. Finally, the Research found that modifications which increased fence visibility (i.e., greater sage-grouse reflectors and PVC pipe on top wires) did not impede crossing success by pronghorn and deer species and that an increase in bottom wire height increased the probability of crossing success by all three ungulate species (Jones et al. 2020).

The Research critically tested the effects of various fence modifications on the crossing success of pronghorn and crossing success and decisions by deer species. Deer species (i.e., both mule deer and white-tailed deer) were shown to both jump over fencing as well as crawl under fencing in roughly equal ratios while pronghorn almost exclusively crawled under fencing. As such, the Research focused on bottom height requirements to allow for safe passage of ungulates. Further analytical testing will be required to determine preferred top wire heights on crossing success and decisions made by deer species and elk. Fortunately, fence sage-grouse reflector and PVC pipe modifications that were used on top wires to deter wildlife crashes and decrease mortality do not affect the crossing ability of ungulates. In general, fence testing occurred on either 3-strand barbed wire fence (interior pastures) or 4-strand barbed wire fence, which served as boundary fences between landowners. In addition, some woven wire fence was identified as either boundary or right-of-way fencing but was not tested as wildlife crawling underneath was prohibited by this fence type.

The large-scale fence density analysis was a critical part of this Research. Fence density analysis' will allow State and Federal Wildlife and Land Management Agencies, Departments' of Transportation, and the public at large, to target specific areas along both roadways and adjacent lands with their limited funding for mitigation. Pairing the fence density analysis with range maps, migration data, carcass collection, and accident reports will help identify specific problem areas for fence replacement or mitigation to improve human and wildlife safety by allowing wildlife to move more quickly across roadways; rather than inadvertently trapping them between right-of-way fences. For pronghorn specifically, regardless of season, they avoid areas of high fence densities and are reluctant to cross fences (Jones et al. 2019). This result holds true while navigating transportation corridors, in so much that individuals will select lower quality habitat that are coupled with lower fence densities to cross high traffic roadways. With careful planning, the fence designs and mitigation techniques presented here can be implemented for multiple species at targeted locations, within seasonal ranges, and throughout migratory pathways with success. We believe the results and findings of this Research can be implemented across Montana, and not just within the specified study area.

The funding provided for this research can be returned to MDT and their stakeholders through the targeted application of the scientifically defensible findings of this Research's findings. For every recommended wildlife friendly fence design agreed to and constructed, MDT could see a substantial per linear foot cost savings over other commonly used right of way fence designs. The result of which could be a potential cost savings to MDT of hundreds of thousands of dollars annually, based on MDT average bid prices from fiscal year 2019.

In Montana, the final type of right of way fencing is negotiated with the landowner. As a result, it is difficult to calculate a benefit cost (B/C) and a return on investment (ROI) by not knowing which fence type would have been preferred by a landowner before a wildlife friendly fence design is successfully negotiated. The most common fence type along Montana roadways today is the traditional, 4-strand farm fence on metal posts (Table 1). Using this common fence type to start, replacing this fence type with a 4-strand, wildlife friendly fence on metal posts would save MDT 0.44/ft ($2323.20/mi.) based on the average bid prices.

An even greater cost savings would occur whenever a woven wire fence type could be successfully negotiated out of a Project's design. By example, replacing a 32" woven wire farm fence on metal posts, with 2-strands of barbed wire on top would save $1.44/ft ($7603.20/mi.) if replaced with a 4-strand, wildlife friendly fence on metal posts (2019 bid prices); cost savings that will add up annually over time. Wildlife friendly fences are hereby proven to be cost effective, and more sensitive to the surrounding environment; which is in keeping with MDT Mission Statement.

Constructing right-of-way fencing with a wildlife friendly fence design can allow for daily and seasonal movements by a variety of wildlife species reduce instances of direct wildlife mortality that can occur while navigating common fence types, and decrease the amount of time wildlife spends navigating fences; which reduces the amount of time that wildlife spend in the right of way of roadways trying to find an exit and improving the overall safety of the traveling public.

Table 1: Cost comparison of fence type per linear foot and mile

Fence Type	FY2019 Cost/Linear Foot	FY2019 Cost/Mile
Wildlife Friendly Farm Fence, Wooden Post	$2.31	$12,196.80
Wildlife Friendly Farm Fence, Metal Post	$1.82	$9,609.60
Traditional Farm Fence, 3-Strand, Metal Post	$2.47	$13,041.60
Traditional Farm Fence, 4-Strand, Wooden Post	$2.75	$14,520.00
Traditional Farm Fence, 4-Strand, Metal Post	$2.26	$11,932.80
Farm Fence - 2-Strand Top, 39" Woven-wire, Wooden Post	$2.85	$15,048.00
Farm Fence - 2-Strand Top, 32" Woven-wire, Metal Post	$3.26	$17,212.80
Farm Fence - 2-Strand Top, 32" Woven-wire, Wooden Post	$3.34	$17,635.20
Farm Fence - 3-Strand Top, 32" Woven-wire, Wooden Post	$4.07	$21,489.60

Finally, personnel from the USFWS Partners for Wildlife Program, the U.S. Bureau of Land Management, Montana Fish, Wildlife & Parks and The Nature Conservancy are already using this information and these recommendations when discussing the application of wildlife friendly fences with area ranchers, and with those who graze livestock on BLM allotments to benefit landowners and wildlife alike. Their work will act as a force multiplier when combined with similar efforts conducted by State Transportation agencies along the roadways under their jurisdiction.

References

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