Montana Department of Transportation December 2020
RESEARCH PROGRAMS

Project Summary Report: FHWA/MT-20-001/9596-617

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TESTING WILDLIFE FRIENDLY FENCE MODIFICATIONS TO MANAGE WILDLIFE AND LIVESTOCK MOVEMENTS

https://www.mdt.mt.gov/research/projects/env/wildlife_fence_mods.shtml

Introduction

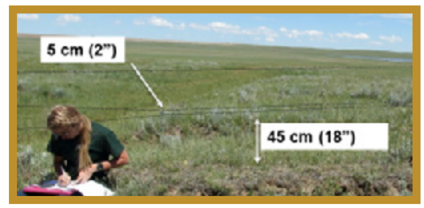
Fences are ubiquitous across the landscape, yet there is little understanding of their effects on wildlife. Fences can pose both indirect (i.e., access to habitat, energetic costs) and direct (i.e., mortality) consequences to wildlife, and so their effects are an important consideration. Wildlife managers, land managers, and Departments of Transportation must balance mitigation options that allow for wildlife connectivity, private property rights, and public safety, (i.e., keeping motorists safe).

Fences along roadways serve as safety measures to protect humans from vehicular collisions with wildlife and livestock (i.e., all cattle) by containing livestock in appropriate pastures. However, fencing can reduce overall landscape connectivity for wildlife and ecological processes. Historically, many in the ranching community have believed wildlife friendly fence designs to be ineffective in holding livestock.

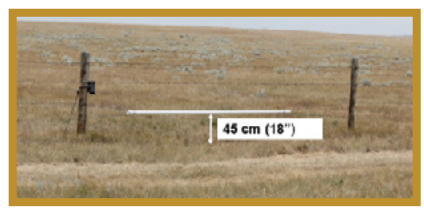
This research measures the effectiveness of wildlife friendly fence designs and fence modifications in allowing continued movement of wildlife while keeping livestock in appropriate pastures, thereby providing MDT opportunities to negotiate with adjoining property owners along the right-of-way of roadways.

What We Did

The first objective was to test the effectiveness of several wildlife friendly fences and fence modifications currently in use or promoted by MDT that allow for daily and seasonal wildlife movements, while simultaneously keeping livestock in desired pastures. During the first field trial from 2012-2016, three commonly-used wildlife friendly fences modifications were placed on barbed wire fences: smooth wire along the bottom strand and the use of either clips/carabiners or PVC pipe (i.e., 'goat-bar') to attach and raise the bottom wire to the second-to-bottom wire (Figure 1).



A: Bottom wire raised to wire above



B: Bottom wire with PVC pipe (goat-bar) raised to wire above

Figure 1: Bottom Barbed Wire Modifications

During the second field trial from 2016-2018, two additional fence modifications were tested and placed on barbed wire fences which are typically used as visual warnings to approaching wildlife: PVC pipe and sage-grouse reflectors placed on the top wire.

Wildlife responses to fence heights and modifications were quantified using remote cameras placed on pasture barbed wire fences across two study sites in southeast Alberta and north central Montana.

The second objective was to test the influence of various fence density scenarios on pronghorn migrations during the spring, fall, and winter periods to assess scenario effects on connectivity, specifically along transportation corridors in conjunction with road maintenance wildlife mortality data across the Hi-Line region of Montana.

Lastly, through local, regional and national presentations, challenges and opportunities through our analytically-driven results were communicated to wildlife and habitat managers, private landowners (i.e., the ranching community), and Departments of Transportation so as to consider cost effective and prudent approaches for on-the-ground implementation.

What We Found

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.

A bottom wire height of 18" proved to be the optimum bottom wire height above the ground for improving or accounting for passage by pronghorn while keeping livestock within the intended pasture (Figure 2). 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. In only one instance during the 3-year field trial was a domestic animal (a calf) documented crawling underneath at a modified fence. A strand of smooth wire set at 18", or the use of clips or carabiners to modify the bottom wire height of an existing fence up to 18" above the ground was proven to be the most effective. The present usage of a goat-bar, i.e., PVC pipe, on the bottom wire to improve passage was documented to be ineffective and created a negative behavioral response by pronghorn. The research found that increased bottom-wire heights 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., sage-grouse reflectors and PVC pipe on the top wire did not impede crossing success and had no substantial unintended consequences on the crossing behavior of pronghorn, mule deer, or white-tailed deer, ultimately leading to a plausible multi-species wildlife friendly fence design.

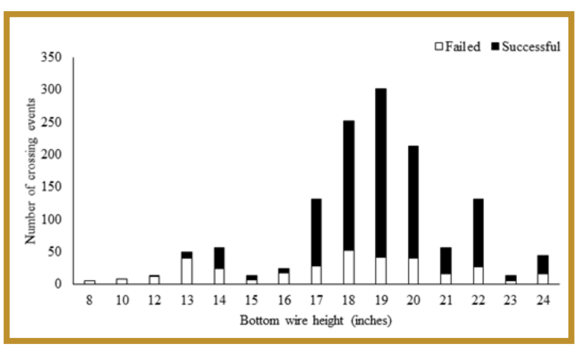


Figure 2: The effect of bottom wire height on pronghorn overall crossing attempts and successful crossing events at multi-strand barbed wire fences.

The large-scale fence density analysis coupled with connectivity modeling and highway mortality data show that, in general, fences East of Havre, MT are acting as barriers to fall and spring seasonal migrations for pronghorn and individuals are predicted to respond to greater fence densities by migrating to the West of Havre for crossing the transportation corridor during typical fall and spring migrations (Figure 3). For pronghorn specifically, regardless of season, they avoid areas of high fence densities and are reluctant to cross fences. This result holds true while migrating pronghorn navigate transportation corridors, in so much that individuals will select lower quality habitat that are coupled with lower fence densities to cross high traffic roadways. During winter facultative migrations specifically, pronghorn are responding to extreme conditions and move in a rapid and direct manner as a survival tactic. Consequently, pronghorn use behavioral responses to navigate the transportation corridor by utilizing learned areas to negotiate the multitude of linear features (i.e., roads, fences, railways). As a result, fence densities do not inform connectivity models during winter as much during seasonal fall and spring migrations. In addition, using the MDT road carcass data for HWY 2, we identified increased mortalities for mule deer in areas with higher fence densities, specifically during fall and winter.

What the Researchers Recommend

The researchers recommend a bottom wire height of 18-inches off the ground for improving or increasing the probability of wildlife crossing success through fences by pronghorn and deer species. 18-inches was found to be the minimum fence height that allowed wildlife the easiest opportunity to crawl underneath fencing, while successfully containing livestock in their intended pasture. Under proper grazing management and with site-specific monitoring, new fencing should be erected at this minimum bottom wire height. The findings support the use of smooth bottom wire, as well as the use of clips and/or carabiners as effective methods for modifying existing fences to attain the correct 18-inch height of the bottom wire.

Multiple wildlife species often interact with and navigate fences across the landscape. Consequently, it is prudent to design fences that allow for both the movement of various wildlife species found in that ecosystem/landscape while addressing landowner needs and keeping livestock in the appropriate pastures. Wildlife crossing decisions and ultimate successes depend on visualization, fence specifications, and animal behavior. Therefore, an update on multiple species fence design standards and the scale of the specification's impacts to wildlife and livestock should be considered.

The pronghorn connectivity results and associated varying fence density scenarios along U.S. Highway 2, are based on a very broad-scale assessment. From this assessment, the following areas have been identified for targeted mitigation efforts along roadways in the study area: 1) west of Havre in Hill County from approximately Burnham headed west to Gilford; 2) the Verona to Big Sandy section of HWY 287 in Choteau County as well as areas directly east of this highway stretch for approximately 15-18km; 3) on the Liberty/Hill County border, from approximately Inverness headed west to Chester and; 4) on the Liberty/Toole County border, from approximately Lothair headed west to Galata. These four areas have 1) fence densities that have a moderate to high influence on connectivity; 2) are areas considered optimal to moderate migratory habitat where the fencing parameter was accounted for in the modeling process and; 3) are areas with documented wildlife mortalities due to vehicular collisions. A repeatable process for prioritizing road and highway sections for future mitigation is key. The following set of factors could be considered for future processes: 1) wildlife telemetry data; 2) carcass collection data; 3) difference between connectivity modeling which do and do not include fence densities; 4) the amount of spatial overlap between spring and fall priority areas; 5) vehicle collision data; 6) seasonal range predictions to assess required habitats outside of a given transportation corridor; 7) and results from any previous modelling efforts. The scoring and weight for each of these parameters will need to be discussed and agreed to by future stakeholders.

The aforementioned analytically proven wildlife friendly fence types and modifications can be used along targeted roadsides where fencing is currently impeding wildlife connectivity. The researchers recommend that if fencing on one side of a highway or roadway is mitigated, that the fencing on the opposite side of the roadway must also allow wildlife passage to prevent wildlife from becoming inadvertently trapped between right-of-way fences. In addition, fencing modifications were tested only on interior pasture fencing in open native sagebrush/grassland landscapes. As a result, land managers and roadway professionals may need to consider the placement of new fencing and fence modifications through site-specific monitoring along highways based on the landcover types and the current grazing practices adjacent to a roadway. Overgrazed pastures adjacent to the right-of-

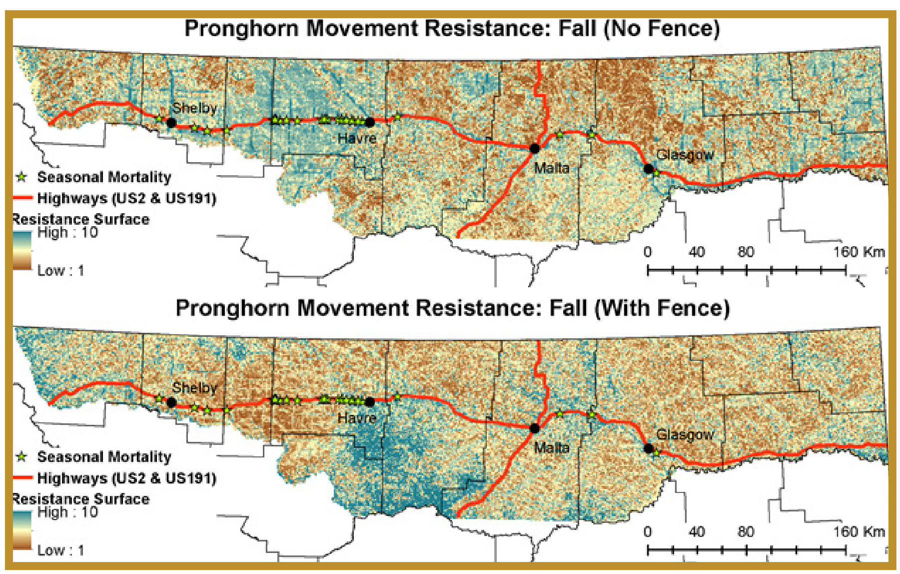


Figure 3: Movement resistance results for pronghorn spring migration across the Hi-Line of Montana. The top panel shows model results where pronghorn select to cross the landscape (brown areas) in the absence of fences, whereas the bottom panel indicates where pronghorn select to cross the landscape when fence densities are considered.

way of the roadway could place added pressure on wildlife friendly fences and/or fence modifications implemented along roadways. These added pressures were not modeled/evaluated during the research.

Moving forward, more studies are needed to address wildlife interactions with fences in differing ecosystems/landscapes and the fence specifications required to address the safety of private property, i.e., livestock, wildlife safety and passage, and the fiscal and social responsibilities of transportation agencies. In addition, 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. 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. The researchers believe the results and findings of this research can be implemented across Montana, and not just within the specified study area.

For More Details . . .

The research is documented in Report FHWA/MT-20-001/9596-617, https://www.mdt.mt.gov/research/projects/env/wildlife_fence_mods.shtml.

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MDT Implementation Status: December 2020

An implementation meeting was held, during which the Researchers and the Technical Panel discussed each of the former's recommendations. The Technical Panel responded with what MDT can reasonably implement. This discussion was documented in the implementation report, which can be found at the above URL. In addition, a detailed implementation plan will be developed and monitored until implementation is complete.