

Implementation Report**TESTING 'WILDLIFE FRIENDLY'
FENCE MODIFICATIONS TO
MANAGE WILDLIFE AND LIVESTOCK MOVEMENTS**
https://www.mdt.mt.gov/research/projects/env/wildlife_fence_mods.shtml**Introduction and Purpose**

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.

Fences along roadways serve as safety measures to protect humans from vehicular collisions with wildlife and livestock by keeping wildlife off the roadway and 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. Thus, 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.

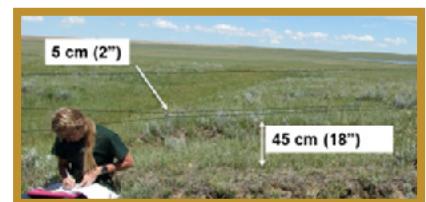
During the first field trial from 2012-2016, three commonly-used wildlife friendly fences and fence modifications placed on barbed wire fences were tested: 1) smooth wire along the bottom strand, 2) using either clips or carabiners to attach and raise the bottom wire to the second-to-bottom wire and 3) the placement of PVC pipe (i.e., 'goat-bar') on the bottom wire (Figure 1).

During the second field trial from 2016-2018, two additional fence modifications on barbed wire fences, which are typically used as visual warnings to approaching wildlife, were tested: 1) PVC pipe and 2) sage-grouse reflectors placed on the top wire (Figure 2, page 2).

The second objective was to test the influence of various fence density scenarios on

pronghorn migrations during the spring, fall, and winter periods. This was done 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.

Finally, through local, regional and national presentations, the challenges and opportunities of this research were communicated to wildlife managers, private



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

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A: Top wire with PVC pipe



B: Top wire with Sage Grouse reflectors

Figure 2: Top Barbed Wire Modifications

landowners (i.e., the ranching community), and Departments of Transportation to consider cost effective and prudent approaches for on-the-ground implementation through analytically-driven results.

The following scientifically defensible results support the recommendations and can help steer subsequent actions.

Implementation Summary

- A bottom wire height of 18" proved to be the optimum bottom wire height for improving or accounting for passage by pronghorn, while keeping livestock (i.e., all cattle) within their intended pastures. A strand of smooth wire set at this height, or the use of clips or carabiners

to modify the bottom wire height of existing barbed wire fences up to 18" above the ground were proven to be the most effective.

- The present use of a goat-bar (i.e., PVC pipe, on the bottom wire) was documented to be ineffective and created a negative behavioral response by pronghorn.
- The use of a PVC pipe on the top wire to prevent snagging 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.
- The connectivity modeling with highway mortality data show that, in general, for typical fall and spring migrations, fences east of Havre, MT are acting as barriers to seasonal migration for pronghorn. It also shows that individuals are predicted to respond to greater fence densities by migrating to the west of Havre. These results indicate that increased fence densities may act as an ecological trap on individuals forced to move through sub-optimal habitat during migration periods. During winter facultative migrations, 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 as during seasonal fall and spring
- 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, and fence modifications with area ranchers and those who graze livestock on BLM allotments. Their work on state, federal, and private lands outside of road rights-of-way will act as a force multiplier for the Benefit Cost (B/C) and Return on Investment (ROI) for work completed by Departments of Transportation along roadways. These recommendations are also being deployed and promoted by members of The Ranchers Stewardship Alliance and the Winnett Aces.

migrations. In addition, using the MDT road carcass data for HWY 2, there was increased mortality for mule deer in areas with higher fence densities during fall and winter.

- The benefits of a public outreach program have been documented. Sharing the findings and recommendations of this project during the early public outreach efforts have proven to be very effective at educating the public, as well as local, state, federal, and tribal personnel about the importance of these findings. This has resulted in local and regional champions for this work within multiple agencies and among private landowners. These results have been presented to and discussed with personnel across Montana, including along the Hi-Line region, through nine presentations, webinars, and podcasts.

- This work is envisioned as a springboard for stakeholders as they promote wildlife friendly fencing and the successful fence modifications identified as cost-effective alternatives. These alternatives have been proven to be effective for protecting private property and providing for human safety, while increasing and/or maintaining habitat connectivity.
- The findings of this research can be used to: 1) update and/or modernize right-of-way manuals that guide right-of-way professionals at Departments of Transportation when negotiating for new roadway right-of-ways; 2) inform replacement of right-of-way fencing and/or fence modifications; and 3) promote collaborative partnerships between government agencies, non-government organizations, and private landowners. These updates to manuals will help explain the effects of fencing on habitat connectivity both along transportation corridors and throughout adjacent lands.
- Based on MDT 2019 average bid prices, the cost of wildlife friendly fences has been found to be comparable to and sometimes cheaper than typical farm style fence designs per linear foot.

Implementation Recommendations

Recommendation 1:

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 Chouteau County as well as areas directly east of this highway stretch; 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: 1) have fence densities with a moderate to high influence on connectivity, 2) are areas considered optimal to moderate migratory habitat where the fencing parameter was accounted for during 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, and 7) 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.

MDT Response:

MDT supports an easily repeatable, data driven methodology for evaluating and prioritizing roadway segments for future mitigation efforts that are cost effective and will improve the safety of travelers.

The four roadway segments recommended for future mitigation by the researchers above have been noted.

Recommendation 2:

It is recommended that MDT's current "Wildlife Friendly Fence" brochure, and Right-of-Way and public involvement manuals and/or procedures be updated to reflect the new, scientifically defensible findings of this project. FHWA has expressed an interest in assisting MDT with this effort. It is further recommended that MDT Right-of-Way personnel and public involvement officials share the results of this research with private landowners and land management agencies when negotiating for new right-of-way, the replacement of existing right-of-way fences, and any needed fence modifications.

MDT Response:

MDT agrees with this recommendation.

Recommendation 3:

It's recommended that under proper grazing management and with site-specific monitoring, the bottom wire height of farm fences be 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 (i.e., all cattle) in their intended pastures. The findings also support the use of clips and/or carabiners as an effective method for modifying existing fences to attain the correct 18-inch height of

the bottom wire. A smooth bottom wire is also beneficial.

In only one instance during the 3-year field trial was a domestic animal (a calf) documented crawling underneath a modified fence. This single instance occurred where a PVC pipe (i.e., ‘goat bar’) was installed, which is recommended for discontinuance as an appropriate wildlife friendly fencing practice.

MDT Response:

MDT agrees with this recommendation.

Recommendation 4:

It is recommended 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.

MDT Response:

MDT agrees with this recommendation.

Recommendation 5:

It is recommended to work cooperatively with private landowners and/or the respective land and wildlife management agencies during the environmental review of future MDT projects. This will allow for a more comprehensive analysis of the landscape connectivity possibilities and the human-made features (i.e., fence densities) that may be hindering the connectivity potential of the surrounding landscape. MDT is encouraged to consider how and why wildlife are moving across the landscape to help focus their efforts and limited funding to specific areas where

wildlife interactions occur along roadways, to yield the greatest return on their investment. The factors and methodology discussed and used in Recommendation 1 can help to prioritize and identify the best locales for fence replacement and/or modifications to improve human and wildlife safety and passage along roadways. This project’s scientifically defensible information can also be used to create a collaborative/cost sharing effort, by partnering with other public and private entities such as federal, state, and tribal land and wildlife management agencies, private landowners (i.e., the ranching community), and NGO’s.

MDT Response:

MDT agrees that collaborating with other researchers and land management entities is needed to generate additional data.

Recommendation 6:

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 keeping livestock in their appropriate pastures. Wildlife crossing decisions and ultimate successes depend on visualization, fence specifications, and animal behavior. Therefore, designs must include modifications that allow for both wildlife visualization from further distances and increase crossing opportunities when they reach fences. An update on multiple species fence design standards and the scale of the specification’s impacts should be considered.

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. As an example, additional studies should be conducted on fence top wire heights, types, and modifications using similar experimental designs as outlined in this research.

Finally, the naming convention of these standard fence designs should be vetted and agreed to by all stakeholders to select a more appropriate title that will have a less polarizing effect when used during negotiations.

MDT Response:

MDT will update fence standard drawings and will investigate rebranding ‘wildlife friendly fence’ to make it less polarizing during negotiations.

Limitations of Research

The 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-way could place added pressure on wildlife friendly fences and/or fence modifications implemented along roadways. This added pressure was not modeled/evaluated during this research.



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