Reducing Wildlife Vehicle Collisions by Building Crossings:

General Information, Cost Effectiveness, and Case Studies from the U.S.

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Impacts of Wildlife-Vehicle Collisions (WVCs):

A 2008 Report to Congress found that WVCs "are a growing problem and represent an increasing percentage of accidents on our roads".[1] At the time of the report, over the most recently reported 15-year period, WVCs had increased by 50%, from less than 200,000 to 300,000, even though the overall number of collisions remained roughly steady over the same period.[1] These collisions pose a serious safety hazard for people and wildlife and are economically costly. WVCs often result in substantial damage to vehicles, injury to their occupants, and are almost always lethal to the animal. WVCs occur when a vehicle strikes an animal, but animals on roads may also be the secondary cause of additional crashes, such as when a vehicle swerves to avoid an animal in the roadway and instead drives off the road or into the oncoming lane.[2] Reported collisions between motorists and wildlife cause more than 200 human fatalities and over 26,000 injuries each year, at an annual cost to Americans of more than $8 billion.[1] In addition to the human toll, an estimated 1-2 million large animals are killed by motorists every year, and these numbers do not include smaller species that do not present a threat to human safety.[1]

Roads also fragment the landscape and create a barrier to wildlife moving to locate water, food, mates, shelter and to fulfill other needs. Roads that are barriers may reduce gene dispersal and undermine long-term population viability.[1] Road mortality is documented as one of the major threats to the survival of 21 federally-listed threatened or endangered species in the U.S; and, every one of the 11 states covered by the U.S. Department of Interior Secretarial Order 3362, *Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors*, concluded that roads were an impediment to the migration and movement of iconic western big game species such as elk, pronghorn, and mule deer.[1,3]

Researchers have conservatively estimated that the average cost of a deer-vehicle collision is $8,190, an elk-vehicle collision is $25,319 and a moose-vehicle collision is $44,546 in 2018 U.S. dollars.[4,5] These estimates are based solely on property damage, human injuries and fatalities, and the lost revenue from a hunting license for the species involved.[4] They do not factor in any other values such as those associated with biodiversity conservation or lost revenues from wildlife-related tourism and recreation. Thankfully, there are well-researched and effective solutions to mitigate WVCs.[1,6,7,8] The most effective method to reduce WVCs, while at the same time maintaining or improving habitat connectivity, is to construct wildlife crossing structures – overpasses and/or underpasses - that allow them to cross safely under or over roads.[1,2] When combined with wildlife fencing to keep animals off the road and funnel them towards the structures, wildlife crossings have consistently resulted in >80% reductions in WVCs.[1,6,7,8]

Although costly, properly sited wildlife crossings can pay for themselves where situated along highways that experience 1) an average of five or more collisions between motorists and deer per mile per year, 2) an average of two or more collisions with elk per mile per year, or 3) an average of one or more collisions with moose per mile per year.[4] In those cases, in which the total economic costs associated with wildlife-vehicle collisions along a given highway segment exceed the expense of building a structure that allows animals to safely cross the road, **it actually costs society less to solve the problem of WVCs than it costs to do nothing**.[4]

In addition to constructing new wildlife crossings, enlarging existing deficient culverts and bridges to allow for terrestrial safe passage along the riparian areas not only benefits wildlife, but also makes our infrastructure more resilient to climate change and extreme weather events, such as flooding. This protects our infrastructure investments in the long-term and ultimately saves taxpayers money. Dedicating federal funding to infrastructure projects that at the same time reduce wildlife-vehicle collisions and maintain or improve ecological connectivity provide benefits in the form of job creation, infrastructure resiliency, and sustainable natural resources.[9,10]

Costs of WVCs to States

Many states collect data on (large animal) WVC incidences. Some collect only the number of crashes reported by their state's law enforcement agencies (these are typically only crashes resulting in significant property damage or human injuries/fatalities), others also record carcass data collected by their transportation agency's maintenance personnel when they remove carcasses from the roadside. Another source of data used by some states is motor vehicle insurance claim records. A study of deer-vehicle collisions (DVCs) from Virginia found that, according to deer carcass removal records, the number of DVCs in the evaluated areas was up to 8.5 times greater than what was documented in police crash reports.[11] Most likely the total number of WVCs is actually much higher than carcass records indicate, since not all carcasses are retrieved, and by some estimates as many as 50 percent of animals struck by vehicles leave the road or right-of-way before dying and so are never recorded.[2,12]

There are two different values that states and others have used to determine the costs associated with WVCs:
1) the estimates produced in the analysis by Huijser et al. 2009 (as seen in the previous section), or,
2) United States Department of Transportation (USDOT) equivalency values for different types of crash severities (e.g., property damage only vs. major injury).

In the table below, we have compiled WVC cost information from several states using these methodologies. The values for Washington state and Montana were calculated by the authors of this report using the state's WVC records, while the values for Wyoming, Virginia, and California were calculated and documented in reports by researchers in the respective states.[16,11,17] In addition, State Farm Insurance publishes annually statistics on the likelihood of a licensed driver being involved in a collision with an animal by state – we also report this ranking as a reference (NOTE: this is the likelihood of hitting an animal, so it is influenced by the number of drivers in the state; for reference 1/50 is the state with the highest likelihood of hitting an animal).[13]

State	Records Used for Analysis	Species Included	Value of Incident Huijser et al. 2009* values -or- USDOT equivalency values by crash severity	State Farm Ranking 2019[13]	Total Cost Annual Cost Estimate
Washington[14]	Carcass Only	Deer, Elk	Huijser et al. 2009	44/50	$46 Million
Montana[15]	Carcass Only	Deer, Elk, Moose	Huijser et al. 2009	2/50	$42 Million
Wyoming[16]	Crash and Carcass (duplicates removed)	Deer	Wyoming DOT cost estimates	6/50	>$50 Million
Virginia[11]	Insurance claims	Deer	USDOT equivalency values	12/50	$533 Million
California[17]	Crash and Carcass (duplicates removed)	All large wildlife	USDOT equivalency values	47/50	$232 Million

*The values from this paper were adjusted to reflect their equivalency in 2018 dollars. They were originally reported in 2007 dollars.[5]

COST-EFFECTIVENESS OF WILDLIFE CROSSINGS: CASE STUDIES FROM THE U.S.

The following case studies are some recent examples of large-scale wildlife mitigation projects in the U.S. These are cases in which crossing structures are combined with fencing throughout the project area with other mitigation measures such as gates and/or cattle-guards to keep animals from entering the right-of-way at access roads. In order for wildlife crossings to be most effective they must be combined with fencing to keep animals from entering the right-of-way and coming into contact with traffic.

Case Study 1: State Highway 9, Grand County, Colorado

In 2015-2016 the Colorado Department of Transportation constructed seven large wildlife crossings with wildlife funnel fencing along over 10 miles of State Highway 9 in the Lower Blue Valley in Grand County, Colorado as part of a larger road improvement project. The wildlife mitigation measures consisted of 2 overpasses, five large arch underpasses, and 10.4 miles of wildlife fencing and other design features on both sides of the road at a cost of roughly $10M (Julia Kintsch/CDOT, personal communication). During the five winters previous to the start of construction in 2015, WVCs with mule deer and elk were the most common type of accident on this stretch of highway, accounting for 60% of all accidents reported to law enforcement. Four percent of the reported WVCs during this timeframe resulted in human injuries. During the same 5 years before construction, carcass counts conducted by Colorado Parks and Wildlife and the Blue Valley Ranch reported an average of 56.4 mule deer and elk carcasses each year, at a cost of over $500,000/year depending on the ratio of deer vs. elk. Since construction of the mitigation measures, the number of carcasses within the project area has decreased by 89%, and the project is projected to pay for itself in approximately 22 years, long before the end of the structures' projected 75-year lifespan.

<u>Case Study Sources</u>:

Kintsch, J., Cramer, P., Singer, P., Cowardin, M., & Phelan, J. (2019). *State Highway 9 Wildlife Crossings Monitoring–Year 3 Progress Report*. Colorado Department of Transportation Study Number 115.01.

Huijser, M. P., Duffield, J. W., Clevenger, A. P., Ament, R. J., & McGowen, P. T. (2009). Cost–benefit analyses of mitigation measures aimed at reducing collisions with large ungulates in the United States and Canada: a decision support tool. *Ecology and Society*, *14*(2).

Case Study 2: Highway 191, Trapper's Point, Wyoming

In 2012, the Wyoming Department of Transportation completed construction of wildlife crossing infrastructure on Highway 191 outside of Pinedale, WY. The project was built to address a wildlife-vehicle collision hotspot for pronghorn and mule deer, as well as to protect connectivity along the Path of the Pronghorn, a millennia-old pronghorn migration route and the first federally designated wildlife corridor. The project consisted of two overpasses, six underpasses, and wildlife funnel fencing along a 12-mile stretch of the highway at a cost of roughly $11M. By the third year following construction, the total number of wildlife-vehicle collisions dropped by 81%, and pronghorn-vehicle collisions were completely eliminated. In addition, habitat connectivity was improved, and back-and-forth movements increased by >60% for mule deer and >300% for pronghorn.

Before construction, Wyoming Department of Transportation estimated that wildlife-vehicle collisions at Trapper's Point were costing over $500,000 each year. Now, the crossing structures are used by over 5,000 pronghorn and mule deer as they move from winter to summer range, and the state estimates that the crossings will pay for themselves in about 17 years, 50+ years before their estimated 75-year lifespan concludes.

Photo: One of the Overpasses at Trapper's Point with Highway 191 running underneath.
Credit: Renee Callahan

<u>Case Study Sources</u>:

Sawyer, H., Rodgers, P. A., & Hart, T. (2016). Pronghorn and mule deer use of underpasses and overpasses along US Highway 191. *Wildlife Society Bulletin*, *40*(2), 211-216.

New Crossings Help Wildlife. (2012). WY Game and Fish Department, WY Dept. of Transportation. Available at: http://www.pinedaleonline.com/news/2012/11/Newcrossingshelpwild.htm

Case Study 3: US Highway 30, Nugget Canyon, Wyoming

US Highway 30 in Nugget Canyon, Wyoming bisects crucial winter range and an important migration route for mule deer, and had long been recognized as a problem for human and wildlife safety due to WVCs. In 2001, WY Department of Transportation constructed one underpass and seven miles of wildlife-exclusion fencing to address the issue, and in 2008 expanded the mitigation by constructing an additional six underpasses and an additional seven miles of wildlife exclusion fencing. The completed project now consists of seven large underpasses and over 13 miles of exclusion fencing at a cost of roughly $5M. Previous to any mitigation, an average of 9.75 deer carcasses were reported each month in the project area (117 DVCs/year). After mitigation was completed the number of deer carcasses dropped by 81% to an average of 1.82/month (~21DVCs/year). The cost savings resulting from the drop in DVCs amounts to over $500,000/year, meaning that the mitigation measures would pay for themselves in less than 10 years, long before the estimated 75-year lifespan of the crossing structures.

Photo: Mule deer using one of the underpasses on US 30 in Nugget Canyon.
Credit: Hall Sawyer

Case Study Sources:

Sawyer, H., Lebeau, C., & Hart, T. 2012. Mitigating roadway impacts to migratory mule deer—a case study with underpasses and continuous fencing. *Wildlife Society Bulletin, 36*(3), 492-498.

Huijser, M. P., Duffield, J. W., Clevenger, A. P., Ament, R. J., & McGowen, P. T. 2009. Cost–benefit analyses of mitigation measures aimed at reducing collisions with large ungulates in the United States and Canada: a decision support tool. *Ecology and Society, 14*(2).

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[6] Sawyer, H., Rodgers, P. A., & Hart, T. 2016. Pronghorn and mule deer use of underpasses and overpasses along US Highway 191. Wildlife Society Bulletin, 40(2), 211-216.

[7] Sawyer, H., Lebeau, C., & Hart, T. 2012. Mitigating roadway impacts to migratory mule deer—a case study with underpasses and continuous fencing. *Wildlife Society Bulletin*, *36*(3), 492-498.

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