



PRIORITIZATION STUDY – SUMMARY REPORT

Roaring Fork Safe Passages

December 2023



Photo: EcoFlight

Background and Objectives

Wildlife is an essential element of the Roaring Fork Watershed, contributing both to the ecological health of this landscape and to our quality of life. Yet wildlife populations in the watershed – elk herds in particular¹ – are facing increasing pressure from development, recreation activities, and transportation. Specifically, vehicle-induced mortality and transportation-related habitat fragmentation are major stressors affecting wildlife and population resilience. According to Colorado Parks and Wildlife (CPW), two percent of collared doe mule deer are killed each year in vehicle collisions² – this suggests that the roadkill rate is higher than the annual hunter harvest but without the economic and social benefits that hunting provides.

WILDLIFE-VEHICLE CONFLICT IN THE ROARING FORK WATERSHED STUDY AREA

Wildlife-vehicle collisions were the leading cause of crashes reported to law enforcement, accounting for 30% of all crashes.³

The annual cost of reported wildlife-vehicle collisions, including the value of the wildlife killed, is estimated at \$5.2M.⁴

As many as 2-4 times more collisions with wildlife are never recorded, for example when an animal is hit but dies away from the road.⁵

The objective of the Roaring Fork Safe Passages Prioritization Study was to undertake a systematic and inclusive process to support informed decision-making about wildlife-highway mitigation priorities in the Roaring Fork Watershed. The study involved a comprehensive analysis of wildlife-highway interactions on Highways 82 and 133, building on existing data and analyses. The study also engaged key agencies and stakeholders in the development of the prioritization process and decision-making framework. The resulting prioritization identifies highway segments where mitigation investments combined with habitat protection will bring the greatest benefits for reconnecting wildlife corridors and reducing wildlife-vehicle collisions.

Prioritization Process

The analysis of highway segments for mitigation investments focused on State Highway 82 between Glenwood Springs and Aspen and State Highway 133 between Carbondale and McClure Pass. Two recently completed studies provided the foundation for the prioritization analysis: 1) the Roaring Fork Watershed Biodiversity and Connectivity Study⁶ 2) the Western Slope Wildlife Prioritization Study,⁷ a joint initiative by the Colorado Department of Transportation (CDOT) and CPW. The prioritization also integrated mapped elk and mule deer migration corridors data from CPW.



Combined, these analyses resulted in a primary prioritization score highlighting sections of highway with the greatest risk of wildlife-vehicle conflict and with the greatest potential for restoring wildlife corridors that are bisected by a highway. Figure 1 provides a flowchart of the prioritization process including inputs and analyses for conducting the primary prioritization and the supplementary secondary considerations that comprise this decision support framework.

A complete description of the analysis methods may be found in the *Roaring Fork Safe Passages Prioritization Methods and Results Report* accompanying this summary report.

Secondary Prioritization Considerations

Restoring wildlife corridors and reducing wildlife-vehicle conflict was the primary driver of the prioritization. However, other factors may also influence the likelihood of mitigation in each highway segment, including factors that affect the feasibility of mitigation. These secondary considerations were not scored as a part of the primary prioritization process but, instead, included as part of the decision-support framework for determining which of the prioritized highway segments offer the greatest opportunity for implementing wildlife crossing systems or other types of mitigation strategies.

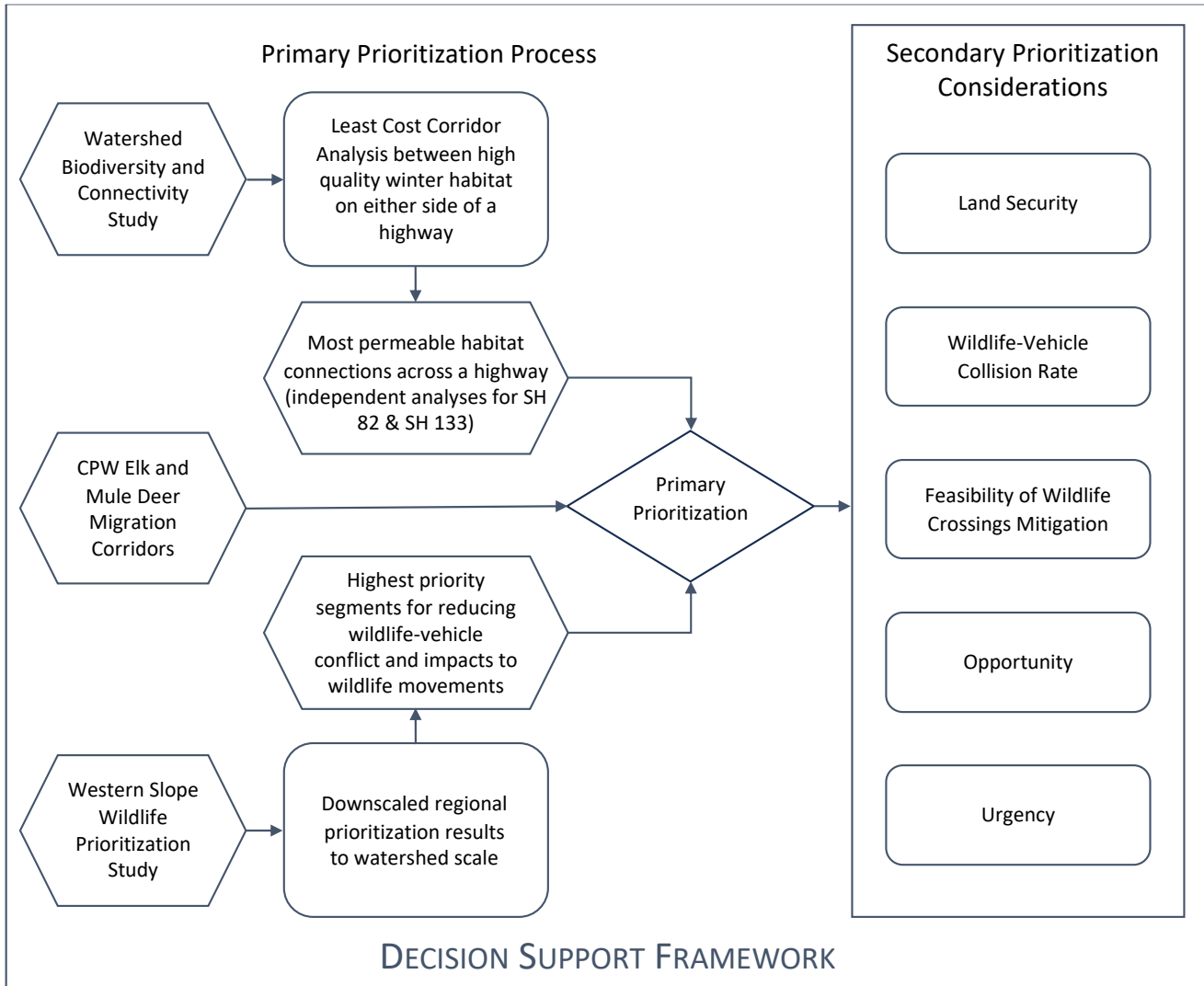
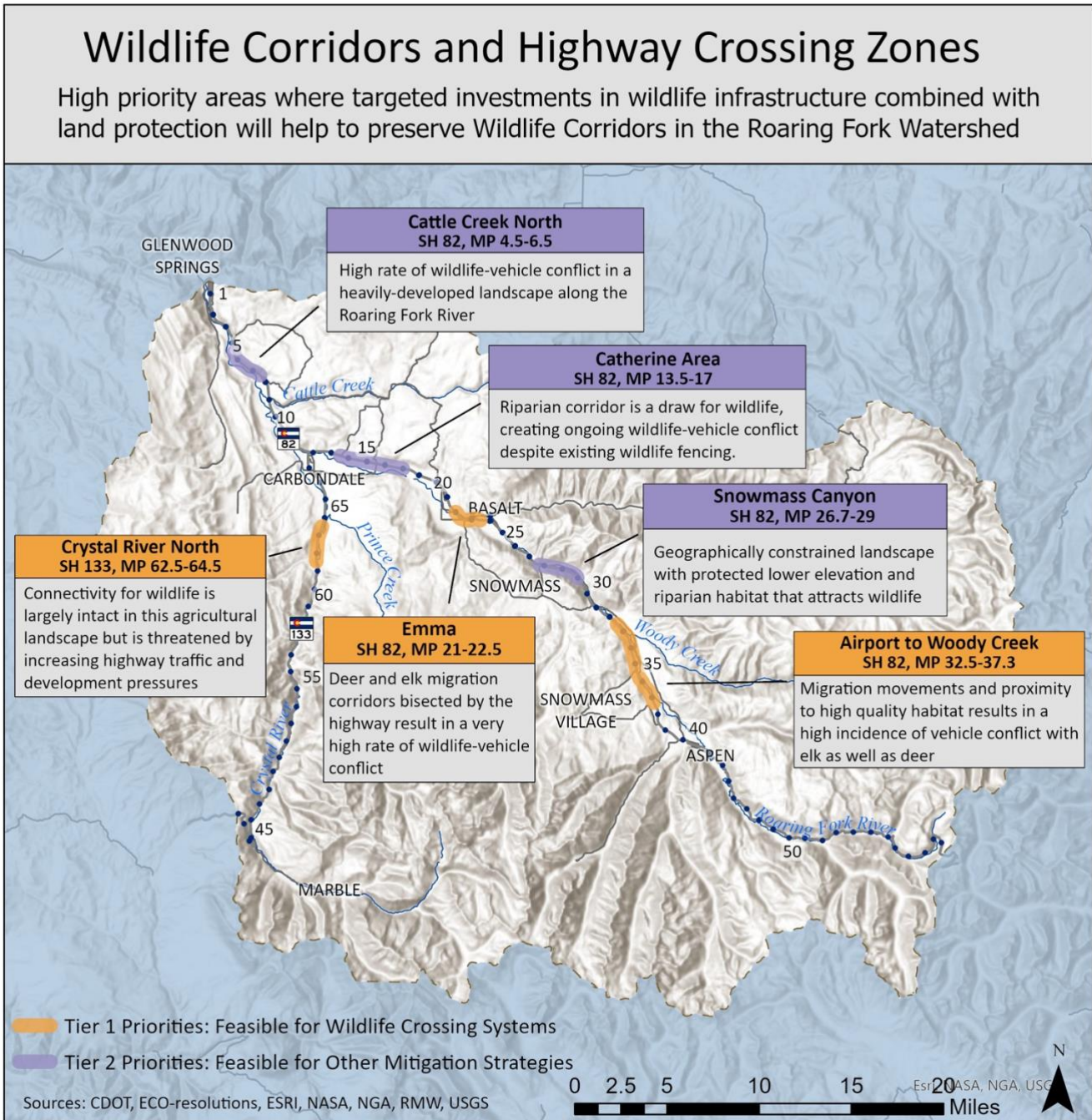


Figure 1. Decision support framework, including the primary prioritization process and secondary prioritization considerations.

Prioritized Highway Segments

The prioritization process identified six wildlife corridors and highway crossing zones, which are described below. These six segments represent the best opportunities in the watershed for reducing wildlife-vehicle conflict and lessening the impacts of highway infrastructure and traffic on wildlife movements and mortality. Although other sections of these two highways also see wildlife-vehicle conflict and the entire reach of both highways contribute to habitat fragmentation, a prioritization process such as this inevitably creates cutoffs to focus mitigation and coordinated land protection efforts in the areas with the greatest opportunity and need. Notably, all six of these prioritized wildlife corridors and highway crossing zones have been identified as areas with high driver safety concerns due to wildlife-vehicle collisions by CDOT⁸.

These prioritized wildlife corridors and highway crossing zones were then separated into Tier 1 and Tier 2 priorities based on the secondary prioritization considerations. Tier 1 priorities are where wildlife crossing systems may be feasible, based on terrain and existing or potential land security. Tier 2 priorities are areas where other types of mitigation strategies are most feasible, such as improving or extending existing wildlife fencing; removing or replacing barriers along the highway; roadside vegetation management; or other strategies.



Tier 1 and Tier 2 priority wildlife corridors and highway crossing zones in the Roaring Fork Watershed.

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The table below provides a summary of the primary prioritization scores and secondary considerations for each Tier 1 & Tier 2 priority highway segment.

		PRIMARY PRIORITIZATION				SECONDARY CONSIDERATIONS	
		Least Cost Corridor Score	Western Slope Study Score	CPW Migration Corridor	Total Prioritization Score [†]	Percent Secured Land [‡]	Wildlife Crossings Feasibility [§]
TIER 1 PRIORITIES	Hwy 82 – Emma	1	4	Deer & Elk	9	61%	High
	Hwy 82 – Airport to Woody Creek	4	4	Elk	9	31%	Moderate
	Hwy 133 – Crystal River North*	5	4	-	9	66%	Moderate
TIER 2 PRIORITIES	Hwy 82 – North Cattle Creek	2	5	-	7	14%	Low
	Hwy 82 – Catherine	3	5	-	8	10%	Low
	Hwy 82 – Snowmass	5	3	Deer	9	60%	Low

*Prioritization scores for Hwy 133 not directly comparable to Hwy 82 because separates analyses conducted

[†]Maximum possible score is 15

[‡]Percent public and private conservation lands within a half-mile buffer

[§]Preliminary assessment. Feasibility may depend on opportunities for land protection and/or landowner support



Photo: John Fielder

Tier 1 Wildlife Corridors and Highway Crossing Zones

Hwy 82, Emma (mp 21-22.5)

The Emma wildlife corridor is situated between El Jebel and Basalt. This wildlife corridor has become constricted by high levels of residential and commercial development and the habitat quality is impacted by human activities and land uses. Still, herds of elk and mule deer continue to move across the highway through the adjacent fields to access protected public and private, lower elevation winter range habitat.



This segment averages 6.1 wildlife-vehicle collisions per mile per year – the highest rates of any of the segments. There is a medium-sized box culvert in this segment (mp 22.1) that provides limited passage for deer. Existing wildlife fencing is not continuous through the segment on both sides of the highway, which exacerbates wildlife-vehicle conflict when animals become trapped inside of the fenced highway right-of-way. The Watershed Biodiversity Study identifies significant restoration opportunities within this wildlife corridor.⁶

This segment was also identified as a priority in the Eagle County Safe Passage Plan.⁹

Hwy 82, Airport to Woody Creek (mp 32.5 -37.3)

The Airport to Wood Creek wildlife corridor extends from the Aspen Airport to the Pitkin County Landfill north of Woody Creek. This segment averages 5.2 wildlife-vehicle collisions per mile per year – including 95 reported collisions with elk over 10 years.

Pitkin County Open Space and the City of Aspen have protected portions of this landscape adjacent to the highway and along the river corridor, although much of the greater landscape is in private ownership. Both lower elevation agricultural lands along the river and the adjacent mesas and hillsides are under increasing pressure from residential development, which would limit habitat restoration opportunities in the wildlife corridor.

The far southern end of the segment has wildlife fencing on both sides of the highway, extending from the bridge at the south end of the bluffs (mp 35.8) and tying into the airport fencing at milepost 36.4. A wildlife crossing culvert built in 2000 (mp 36.2) offers a safe passage opportunity primarily for deer and carnivores, and wildlife-vehicle collisions are lower in this area than north of Brush Creek Road.

Hwy 133, Crystal River North (mp 62-64.5)

This wildlife corridor extends through the lower elevation agricultural landscape along the Crystal River south of Carbondale. Under current conditions, wildlife continues to be able to cross the highway and wildlife-vehicle conflict is low (0.9 wildlife-vehicle collisions per mile per year). However, with increasing traffic volumes and development pressures, wildlife movements are expected to become more constrained and cross-highway movements riskier, likely resulting in increased in wildlife-vehicle conflict.

While some of these lands have habitat protections in place, landowner coordination is an essential component for ensuring the long-term connectivity and habitat values of this landscape. The Watershed Biodiversity Study identifies significant restoration opportunities within this wildlife corridor.⁶

Tier 2 Wildlife Corridors and Highway Crossing Zones

Hwy 82, Cattle Creek North (mp 4.5-6.5)

The Cattle Creek North wildlife corridor south of Glenwood Springs is sandwiched between the steep slopes coming off the mesa to the north and the Roaring Fork River to the south. Many of the lands along this stretch of the Roaring Fork River are developed. Yet wildlife continues to attempt accessing the remaining undeveloped areas along the riparian corridor. The high threat of additional development limits potential restoration opportunities. There is no wildlife fencing in this segment, which averages 5.7 wildlife-vehicle collisions per mile per year – the second highest rate among the priority segments.

Hwy 82, Catherine Area (mp 13.5-17)

This stretch of Highway 82 between Carbondale and El Jebel runs along the north side of the Roaring Fork River and associated floodplain. Beyond the riparian corridor, agricultural lands are increasingly being converted to residential development. The Watershed Biodiversity Study identifies this portion of the Roaring Fork riparian corridor as having most significant restoration opportunities.⁶ Despite the presence of wildlife fencing on both sides of the highway throughout this segment, there are gaps in the fencing and wildlife-vehicle collisions continue to occur at a rate of 3.3 per mile per year.

Hwy 82, Snowmass Canyon (mp 26.7-29)

This Snowmass wildlife corridor extends from Snowmass Creek Road (mp 26.7) south into Snowmass Canyon. Highway 82 through this segment has grade-separated eastbound and westbound lanes hugging the south side of the canyon. While wildlife fencing is present through much of this segment – including paired bridges suitable for wildlife passage at milepost 28.5 – wildlife-vehicle collisions



continue to occur at a rate of 2.6 reported collisions per mile per year, indicating that wildlife is still able to access the highway through gaps in the fencing or at the fence ends.

Much of the landscape within and around this wildlife corridor is protected. Steep terrain and the river running immediately adjacent to the highway limit the opportunity to construct safe passages for wildlife.

Next Steps

The next phase of this work will focus on developing and evaluating the benefits and costs of strategies for improving safe passages for wildlife and reducing wildlife-vehicle conflict within these sections of roadway. Wildlife crossing structures combined with wildlife diversion fencing are known to be an effective mitigation strategy, resulting in 80-90% reductions of collisions with wildlife while allowing deer, elk, and other species to move safely under or over a roadway.¹⁰ Where wildlife crossings are not feasible due to terrain constraints, cost, land use and land management considerations, other types of mitigation strategies may be warranted, alone, or in combination. The development of mitigation strategies for prioritized highway segments will include a complete evaluation of the full range of wildlife-highway mitigation methods.

Compatible land use and land management to maintain or restore high quality wildlife habitat is integral to the long-term success of wildlife crossings system in providing same passages and reducing conflict. Accordingly, the next phase of this work will also seek to work in tandem with partners to pursue habitat protections within wildlife corridors. The results of this prioritization study may be used in conjunction with the Conservation and Restoration Priorities Map produced by the Biodiversity Study to align conservation and restoration actions with highway mitigation investments.

Authors and Acknowledgements

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Endnotes

- ¹ Colorado Parks and Wildlife 2023, in [Summit Daily](#) 11/27/2023
- ² A. Holland, Colorado Parks and Wildlife, personal communication.
- ³ Colorado Department of Transportation (CDOT). 2023. *Wildlife-vehicle Collision Crash and Carcass Datasets, 2012-2021*. Traffic and Safety Engineering Branch (crash data), Environmental Programs Branch (carcass data), Denver, Colorado.
- ⁴ Cost calculations based on per animal costs of a wildlife-vehicle collision (WVC) with deer, elk, moose, and grizzly bear (Huijser et al. 2022). As many WVCs go unreported and collisions costs or conservation values have not been calculated for other species involved in WVCs (eg, smaller fauna and birds), these calculations underestimate the actual cost of WVCs to society. Reference: Huijser, M.P., J.W. Duffield, C. Neher, A.P. Clevenger, and T. McGuire. 2022. *Cost-Benefit Analysis of Mitigation Measures Along Highways for Large Animal Species: An Update and Expansions of the 2009 Model*. Report No. 701-18-803 TO1 Part 3. Nevada Department of Transportation, Carson City, Nevada.
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- ⁶ Rondeau, R., M. Fink, A. Schuhmann, and L. Grunau. 2022. Roaring Fork Watershed Biodiversity and Connectivity Study. Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado, and Watershed Biodiversity Initiative, Basalt, Colorado.
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