Summary of Western States Analyses and Efforts for Crossings and Connectivity

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Please contact the author with any additional resources or examples that can be included in future iterations of this document.

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Introduction

In this document, we compile policies, analyses, and efforts related to connectivity and crossings issues, focusing on eleven states in the western conterminous United States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. These states reflect the Department of Interior's Secretarial Order 3362, which addresses conserving, enhancing, restoring, or improving the condition of priority big game winter range and migration corridor habitat in eleven Western states.[1]

Recent Efforts and Policies

While the science and practice of transportation ecology has been advancing steadily globally over the last decades, several actions have spurred the practice and related policies in the U.S. in recent years, particularly in the West. Several are highlighted here:

In 2008, the Western Governors' Association (WGA) formed a Wildlife Council to develop policies and tools to identify key wildlife corridors and crucial wildlife habitat. The Council considered how 16 western state wildlife agencies could be more innovative and collaborative in information-sharing. In 2013, WGA launched a west-wide Crucial Habitat Assessment Tool (CHAT), and many western states created their own similar tools. The CHAT initiative was phased out in 2023. WGA reaffirmed its commitment to wildlife corridors and habitat conservation through policy resolutions in 2019[2] and 2021.[3]

Several states have hosted multi-stakeholder summits (see Table 2, described below) bringing together state departments of transportation and fish and game agencies, along with partners. These summits have led to important next steps for transportation ecology, including working groups, analyses that combine transportation and wildlife concerns, and priority setting.

Department of Interior Secretarial Order 3362 catalyzed significant research[4] in big game migration with focus on habitat conservation and management. It also identified habitat fragmentation by roads as a priority to address. As a result of the Order, each western state identified its top five priority big game winter range and migration corridors in a required Action Plan.

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[1] U.S. Department of the Interior. 2018. Improving habitat quality in western big game winter range and migration corridors. Secretarial Order 3362. https://www.doi.gov/ sites/ doi.gov/ files/ uploads/ so 3362 migration.pdf

[2] https://www.trcp.org/wp-content/uploads/2019/06/WGA_Wildlife_Migration_Corridors_and_Habitat-Res-6-12-19.pdf

[3] https://westgov.org/images/files/WGA-PR-2021-04-Species-Conservation-and-the-ESA.pdf

[4] Kauffman, M., et al. 2022. Ungulate Migrations of the Western United States, Volume 3. Scientific Investigations Report 2022-5088. 114 pp. https://doi.org/10.3133/sir20225088

The federal Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL) (once enacted at the end of 2021), created unprecedented funding opportunities for projects that reduce wildlife-vehicle collisions and improve habitat connectivity. The Wildlife Crossings Pilot Program is aa $350 million-dollar competitive grant program that offers the first-ever dedicated federal funds for crossings projects.[5] In addition to the Pilot Program, projects that improve habitat connectivity and reduce wildlife-vehicle collisions are eligible for a wide range of federal transportation programs under the BIL. Expanded eligibility means billions of additional federal dollars are available.

Many state policies are catalyzing habitat connectivity and wildlife crossing projects, as well.[6] For example, the states of California, Colorado, New Mexico, Oregon, and Utah have enacted wildlife crossings and/or connectivity legislation. Further, the governors of Colorado, Nevada, Washington, and Wyoming have enacted executive orders protecting wildlife movement or migration.[7,8]

Statewide Analyses

Western state transportation and wildlife agencies have increasingly carried out analyses to identify priority areas and road segments for wildlife mitigation measures.

Table 1 includes each state's most recent studies and reports on wildlife-vehicle conflict and/or connectivity at a statewide scale. Some identify and prioritize mitigation locations based primarily on concerns for human safety by focusing on the locations of wildlife-vehicle collisions. Others include emphasis on wildlife conservation through examination of ecological connectivity and other factors. In addition, some states analyze connectivity more broadly without a direct focus on transportation concerns.

Additional studies focus on particular regions within a state; these are included as a list by state in the final section of this document.

[5] https://highways.dot.gov/federal-lands/programs/wildlife-crossings

[6] Breuer, A., B. Hance, R. Callahan, R. Ament, Z. Wurtzebach, and A. Wearn. 2022. Ecological connectivity policy compendium: U.S. policies to conserve ecological connectivity, 2007-2021. Center for Large Landscape Conservation: Bozeman, MT, U.S. doi.org/10.53847/KBWT3277

[7] https://largelandscapes.org/news/state-xing-legislation/

[8] https://www.ncelenviro.org/issue/wildlife-connectivity-and-crossings/

Table 1. Existing statewide wildlife-vehicle conflict and/or connectivity studies

State	Document name	Description
Arizona	Arizona Statewide Wildlife-Vehicle Conflict Study *Williams et al. 2021*	Identified and analyzed crash/collision hotspots. Other transportation and ecological factors were examined at those crash hotspots for a prioritization analysis using wildlife movement data, habitat maps, threatened species locations and habitat, and other factors and including wildlife linkages from Arizona's Wildlife Linkage Assessment (2006) and other efforts. Considered estimated costs of mitigation recommendations during prioritization.
	Arizona's Wildlife Linkages Assessment *Arizona Wildlife Linkages Workgroup 2006*	Identified potential linkage zones important to Arizona's wildlife and natural ecosystems. Identified large blocks of protected habitat, the potential wildlife movement corridors through and between them, the factors that could possibly disrupt these linkage zones and opportunities for conservation.
California	Large Mammal-Vehicle Collision Hot Spot Analyses *Huijser and Begley 2019*	Identified deer-vehicle crash and mule deer carcass hot spots based on a statewide analysis (crash data only) and analyses per Caltrans district (crash and carcass data). Hot spots were then prioritized based on parameters related to human safety, biological conservation, and economics. Includes economics analysis.
	California Wildlife Barriers 2020 *CDFW 2020*	First attempt to collate an initial suite of priority wildlife movement barriers across the state. CDFW staff identified linear segments of infrastructure that currently present barriers to wildlife populations. Each identified linear segment then evaluated using 10 criteria and the degree to which the criteria applied to the segment under review. Each Region identified and mapped their top ten priorities for mitigation. There was an updated version in 2022 but it is not available to the public.
	Statewide Terrestrial Connectivity Map *CDFW 2019*	Shows statewide overview of essential corridors and linkages that have been mapped in California across multiple studies across time.
	California Essential Habitat Connectivity Project *Spencer et al. 2010*	Statewide assessment of essential habitat connectivity using the best available science, data sets, spatial analyses and modeling techniques. The goal was to identify large remaining blocks of intact habitat or natural landscape and model linkages between them that need to be maintained, particularly as corridors for wildlife.
Colorado	Western Slope Colorado Wildlife Prioritization Study *Kintsch et al. 2019*	Created WVC risk model to estimate relationship between roadway and road-adjacent attributes (tree cover, traffic volume and speed, winter range herd density) and relative WVC risk based on accident and carcass locations. Prioritized model results by weighting prioritization criteria, largely influenced by

State	Document name	Description
	Eastern Slope and Plains Wildlife Prioritization Study *Kintsch et al. 2022*	WVC safety needs but also considers wildlife movement (mule deer, elk) needs during winter and migration periods. Included cost-benefit analysis.
Idaho	Methodology for Prioritizing Appropriate Mitigation Actions to Reduce Wildlife-Vehicle Collisions on Idaho Highways *Cramer et al. 2014*	Set up a prioritization process to identify priority WVC problem road segments and identify actions to reduce WVC in those locations. Was applied in a pilot test to identify high WVC hotspot areas in several Districts.
Montana	Montana Wildlife and Transportation Partnership (MWTP) Planning Tool Summary Report *MWTP Data and Information Working Group 2023*	MDT, FWP, and partners. Online planning tool evaluating highway segments of interest based on wildlife-vehicle conflicts and important areas for wildlife movement and conservation. Provides coarse scale information to assist stakeholders and the interested public in working collaboratively to identify potential conservation efforts for mitigation measures.
Nevada	Prioritization of Wildlife-Vehicle Conflict in Nevada *Cramer and McGinty 2018*	Identified areas of animal-vehicle conflict of highest priority where NDOT can create mitigation alternatives to reduce these collisions and make roads safer for travelers. Identified top hotspot locations using the crash data. Included livestock analyses. Also identified priority locations using GIS modeling of safety and ecological data to identify areas of potential animal-vehicle conflict, where wildlife and livestock presence near roads is predicted based on many factors including wildlife habitat and corridor maps.
	Wildlife Connectivity Plan *(in development as of 5/23*	From Executive Order 2021-18. Nevada Department of Wildlife will identify migratory corridors of ungulates and other key species, delineate migration corridors supported by existing and ongoing scientific research, accumulate and provide wildlife movement information, evaluate threats and needs across species and habitats, recommend conservation strategies, actions and policies, and establish actions for MOU with NDOT within 12 months of completion. Expected completion 12/23.
New Mexico	New Mexico Wildlife Corridors Action Plan *Cramer et al. 2022*	Identified statewide priority areas for wildlife mitigation based on WVC hotpots using crash data and prioritized them with additional transportation, ecological, and feasibility factors; and wildlife corridors via linkage modeling using GPS locational data, telemetry and other movement data, past habitat and corridor modeling, and input from agencies, stakeholders, and the public. Developed range of recommendations for each potential project area based on field visits. Included cost-benefit analysis.

State	Document name	Description
Oregon	Oregon Wildlife Connectivity Implementation Plan *ODFW 2023*	Plan outlines eight priority actions for wildlife habitat connectivity, including the Action Plan and OCAMP, described below.
	Oregon Wildlife Corridor Action Plan (in development as of 5/23) *ODFW and ODOT*	Connectivity legislation passed in Oregon (House Bill 2834 Signed by Governor Brown 2019) requires ODFW to create a Wildlife Corridor Action Plan. The bill also directed ODOT to establish a program to reduce wildlife-vehicle collisions in areas where wildlife corridors identified in the Wildlife Corridor Action Plan intersect with proposed or existing public roads. Not yet available to public as of 5/2023.
	Oregon Connectivity Assessment and Mapping Project (OCAMP) *ODFW 2022*	Analyzed and mapped statewide wildlife habitat connectivity at fine resolutions for 54 species, to link landscapes for wildlife by identifying current wildlife habitat connectivity throughout the state for a wide diversity of species, representing a variety of taxa, movement types, dispersal capabilities, and sensitivity to anthropogenic threats. Species' connectivity models compiled to highlight Priority Wildlife Connectivity Areas (PWCAs)– areas with the highest overall value for facilitating wildlife movement.
	Research Project Work Plan for Habitat Connectivity Assessment and Mapping for Prioritization of Wildlife Crossing Projects 2019 (in development as of 5/23) *de Rivera et al. 2019*	Describes efforts to further develop ODOT's wildlife passage program to reduce wildlife-vehicle collisions and to incorporate corridors into design options for road projects with potential to threaten connectivity. Aims to integrate collision mapping data together with wildlife corridor models, predicted traffic models, and climate resiliency mapping to identify wildlife-vehicle collision hotspots and ODOT priorities for wildlife crossing improvements. Technical report expected summer 2023.
Utah	Identification of wildlife-vehicle conflict priority hotspots in Utah *Cramer et al. 2019*	Identified top-ranked locations of WVCs, based on areas of the greatest number of reported wildlife-related crashes and carcasses reported along roads. Examined those locations in relation to available data on wildlife movements and use of habitat near and across Utah roads. Includes examination of costs.
	Wildlife connectivity across Utah's highways *West 2007*	Utah DOT held workshop in 2004 to identify highway sections that disrupt wildlife connectivity. 64 zones were identified and prioritized based on expert opinion. Possible mitigation solutions were included.

State	Document name	Description
Washington	*Washington Connected Landscapes Project: Statewide Analysis.* *Washington Wildlife Habitat Connectivity Working Group 2010*	WSDOT, WDFW, and other stakeholders. Nearly-statewide habitat connectivity assessment that identified areas where wildlife require movement across highways. Produced maps depicting linkage networks, including areas of suitable habitat and the best remaining linkages connecting them. Derived from two modeling approaches: focal species approach producing linkage networks for 16 representative species, and landscape integrity approach producing networks of lands exhibiting high degrees of landscape integrity and relatively intact natural areas with low levels of human modification.
Wyoming	Framework for Prioritizing Projects to Reduce Negative Road-Wildlife Interactions *Wyoming's Wildlife and Roadways Initiative Implementation Team 2019*	Wyoming Wildlife and Roadways Initiative. At 2017 Summit, 240 potential mitigation project locations were brainstormed. From those locations, priorities developed by each WYDOT District, then used these regional lists as a basis to develop statewide priorities based on human safety and biological considerations, and factors related to cost, effectiveness and feasibility.
	Planning-Support for Mitigation of Wildlife–Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming *Riginos et al. 2016*	WYDOT and FHWA commissioned consultants. Hotspot analysis of deer-vehicle collisions (DVC) using crash and carcass data from 2008-2013, statewide. Via model, examined overlap with traffic volume, deer winter-use areas, modeled migration habitat value, cropland, and migration corridors derived from GPS-collared mule deer. Identified 27 DVC hotspots that should be prioritized and made recommendations for specific mitigations at those locations.

State Efforts

In addition to the analyses listed in Table 1, states have developed other important measures to address wildlife crossing needs in collaboration with stakeholders.[9] These measures are summarized Table 2. Activities include wildlife and transportation summits, memoranda of understanding or agreement (MOU or MOA) between transportation and wildlife agencies to work together on wildlife and transportation issues, statewide stakeholder partnerships, and interactive websites for wildlife and transportation priority locations or roadkill reporting.

Table 2 is not an exhaustive list as it only includes statewide efforts. Some states have held regional meetings instead of statewide summits. In most states, local or regional partnerships exist, such as the Southern Oregon Wildlife Crossing Coalition.[10]

[9] Cramer, P., J. Kintsch, J. Gagnon, N. Dodd, T. Brennan, L. Loftus-Otway, K. Andrews, P. Basting, L. Frazier, and L. Sielecki. 2022. Strategic integration of wildlife mitigation into transportation procedures: A manual for agencies and partners. Transportation Pooled Fund Study, TPF-5(358). Nevada Department of Transportation, Carson City, NV. www.wildlifeconnectivity.org/s/700-18-803-Final-Report-Manual.pdf

[10] https://www.myowf.org/sowcc

Table 2. Other statewide transportation and wildlife-related efforts, including whether a state has: held a summit, developed an agreement or memorandum (MOA/MOU) between transportation and wildlife agencies on wildlife and transportation issues (not including fish/culverts), created a statewide partnership of agencies and others, and/or created an interactive website for wildlife and transportation priority locations.

State	Summit	MOA or MOU	Statewide group with agencies and others	Interactive public mapping or reporting website
Arizona	N/A	N/A	N/A	N/A
California	N/A	N/A	N/A	- Habitat Connectivity Viewer - Roadkill Observation System
Colorado	2017, *upcoming 2023*	2019	- CO Wildlife and Transportation Alliance	- Crossing structures
Idaho	N/A	2015	N/A	- Roadkill reported locations - Roadkill/Wildlife Salvage Report
Montana	2018	*2019*	- MT Wildlife and Transportation Partnership - Montana Migration Coalition	- Areas of greatest need
Nevada	2019	*upcoming*	N/A	N/A
New Mexico	2022	N/A	N/A	N/A
Oregon	N/A	N/A	N/A	
Utah	N/A	2020[11]	- Utah Wildlife Migration Initiative - Utah Wildlife Connectivity Working Group	- Existing crossing structures - Utah Roadkill Reporter
Washington	N/A	N/A	- WA Wildlife Habitat Connectivity Working Group	- Existing crossing structures
Wyoming	2017,[12] 2021	N/A	- Wyoming Wildlife and Roadways Initiative	- Priority projects - Migration corridors

[11] Cramer, P., J. Kintsch, J. Gagnon, N. Dodd, T. Brennan, L. Loftus-Otway, K. Andrews, P. Basting, L. Frazier, and L. Sielecki. 2022. Strategic integration of wildlife mitigation into transportation procedures: A manual for agencies and partners. Transportation Pooled Fund Study, TPF-5(358). Nevada Department of Transportation, Carson City, NV. www.wildlifeconnectivity.org/s/700-18-803-Final-Report-Manual.pdf

[12] Lutz, D., K. Keel, C. Riginos, H. Copeland, B. Rudd, and A. Withroder. 2017. Wyoming's Wildlife and Roadways Initiative – A Roadmap Forward. Wyoming Game and Fish Department and Wyoming Department of Transportation. Cheyenne, WY

Local, Regional, and State Crossing and Connectivity Identification Studies

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