Wildlife Highway Mortality and Linkage Assessment: A Prioritization and Planning Tool for Western Montana

An American Wildlands Report

NOVEMBER 2009

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Suggested citation:

[Former report title (pre-November 2009):
*Wildlife Linkage and Highway Safety Assessment:*
A Prioritization and Planning Tool for Western Montana]

Photo credits:
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Back cover—top (l): Wyoming Department of Transportation; top (r): Amanda Hardy, Western Transportation Institute; bottom: Bruce Sterling, MT Fish, Wildlife and Parks.
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I. EXECUTIVE SUMMARY

PURPOSE OF REPORT

Human transportation systems pose a major threat to wildlife connectivity — a critical conservation goal for wildlife managers and conservationists. Ensuring habitat connections across roadways is important to maintaining successful wildlife movement (Forman et al. 2003). Unfortunately, recent research indicates a rise in wildlife-vehicle collisions along United States transportation routes (Huisjer et al. 2007). This trend poses a risk, not only for wildlife, but for human safety. Identifying locations where elevated levels of wildlife-vehicle collisions coincide with wildlife linkage areas is an important first step in reducing these collisions; protecting wildlife movement across transportation routes and increasing human safety.

To help identify and prioritize potential wildlife mitigation project areas along roadways in western Montana, American Wildlands initiated a rapid wildlife highway mortality and linkage assessment. The assessment is a planning tool that incorporates the best available wildlife collision and linkage data, as well as collaborative expertise, to build common ground and predictability on where to focus wildlife mitigation projects along highways over the next five to 20 years.

To guide the process, American Wildlands established a multi-agency and organizational advisory group in June 2008. The advisory group’s role was to: 1) guide methodology and report, 2) help American Wildlands better understand the obstacles and opportunities for wildlife conservation efforts along transportation routes, 3) identify on-the-ground sites for potential collaboration and 4) devise actions to improve collaboration ability.

METHODOLOGY

With input from the advisory group, we developed a three-step methodology to target potential areas for wildlife mitigation. First, we used kernel density estimation and percent volume contours to identify elevated concentration areas (ECA) of road kill (Chapter 1). Second, by overlaying elevated road kill concentration areas with data on high priority wildlife linkages, we identified Potential Project Areas (PPA). We placed these Potential Project Areas into three initial priority classes based on road kill species group and linkage value (Chapter 2). Third, we used two additional datasets to further rank the Potential Project Areas: State Transportation Improvement Program project areas and a Land Ownership Conservation Potential index (Chapter 3).

For the purposes of American Wildlands’ own efforts, we sorted the Potential Project Areas into three additional action categories: Immediate, Requires More Research and Possible for the Future (Chapter 4). This categorization will help guide which transportation routes and wildlife linkages American Wildlands’ targets through its Safe Passages Program initiatives.

We provide the advisory group’s response to the analysis (Chapter 5). Included in the response are the appropriate uses for this report, advisory group commitments and possible next steps. We also include a summary of recommendations for inter-agency prioritization of potential wildlife mitigation areas, improving inter-agency collaboration in wildlife mitigation areas and developing a inter-agency statewide wildlife-vehicle collision database (Chapter 6).

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1 As discussed further in this document, this report is a tool for targeting high priority wildlife mitigation sites and needs. All areas require a fine scale evaluation of wildlife movement before on-the-ground mitigation solutions are identified.
**Highlights**

- A density analysis identified 110 elevated concentration areas (ECA) of road kill in western Montana. Data came from the Montana Department of Transportation animal carcass database. Map I shows locations of elevated concentration areas by species subgroup.
- Overlap of ungulate and focal species elevated concentration areas with very high and high ranked wildlife linkages identified 29 Potential Project Areas (PPA) for wildlife mitigation along transportation routes. Based on species subgroup and linkage rank, these 29 areas were placed into one of three class categories. Map II shows the Potential Project Areas and their subsequent classes.
- An added opportunity analysis based on a state transportation improvement projects identified nine Potential Project Areas as having best and moderate added opportunities based on ease of incorporating mitigation along the transportation route. Map III identifies these transportation project added opportunities (AO-S I & AO-S II).
- An added opportunity analysis based on land ownership patterns identified ten Potential Project Areas as having best and moderate added opportunities due to land ownership conservation potential. Map IV identifies these land ownership added opportunities (AO-L I & AO-L II).
- Overlap of added opportunities from transportation improvement projects and land ownership patterns occurred in three Potential Project Areas. Map V shows these Potential Project Areas.

**Future Steps: Advisory Group**

In May 2009, following the preliminary results of this analysis, the advisory group agreed on a series of commitments designed to: 1) improve road kill data collection, 2) increase cooperation between agencies and organizations on wildlife transportation issues and 3) identify possible action sites for improving cooperation (Chapter 5). These commitments will likely take the following form:

- Creation of an inter-agency centralized road kill database (building off other state database models, such as Idaho’s);
- Establishment of an inter-agency wildlife and highway committee;
- Establishment of a set of wildlife and highway priorities based on advisory group capacity and report findings (slated for Fall 2009)

**Report Use**

This report is a planning document designed to help identify and prioritize areas for wildlife-highway mitigation activities. It also serves as a resource for data analysis methods. It is relevant to any individual, agency or organization who wishes to better understand techniques for identifying important wildlife-transportation project areas, as well as those wishing to obtain information to help them plan, prioritize and collaborate on wildlife and highway mitigation efforts in western Montana. Logical users of this report include state and federal wildlife and transportation agencies; federal, state and local area planners; wildlife conservation organizations and rural development organizations.

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2. We expect this report to be relevant for the next five years. At that time, the analysis should be repeated using updated and improved datasets. See Chapter 6: Overarching Recommendations for a list of recommended data set improvements.
The following provides references to different portions of this report in order to facilitate use of this document:

- For detailed methodology used in identifying and ranking Potential Project Areas, reference Chapters 1 through 3.
- To access the data used in the analysis or results, reference Appendices A–C (Appendix A: GIS data products (available for download from NRIS or American Wildlands web sites); Appendices B–C: Detailed maps and tables).
- To review priorities and commitments specific to American Wildlands and the Advisory Group, see Chapters 4 and 5.
- For overarching recommendations on reducing wildlife mortality, improving highway safety and maintaining habitat linkages in Montana see Chapter 6.
MAP I

All Elevated Concentration Areas (ECA)

- Ungulate Species ECA
- Focal Species ECA
- Focal Carnivore Species ECA

Focal Carnivore ECA should be considered as anecdotal information only, due to low sample size.
Map III

Added Opportunities
STIP Project influence within one mile of potential project areas (PPA)

Added Opportunity Ranking (STIPS)
- AO-S I
- AO-S II
- AO-S III
- MT Routes

STIP Project (2008-2012)
Scope Value
- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- No Data

Locator Map

November 2009
Map V

Added Opportunities
Overlap between high potential STIP projects and high Land Ownership Conservation Potential

PPA ID #
MT Routes

Locator Map

November 2009
II. ACKNOWLEDGEMENTS

Thank you, American Wildlands staff and volunteers for assistance with technical editing and guidance:
April Johnston, Executive Director, Programs
Josh Gage, GIS Lab Manager
Laura Code, Office Operations Director
Kristen Wimberg, Wimberg Productions
Eric Tietze & Bridget Belliveau, GIS volunteers

A special thank you to the following organizations and foundations for funding the assessment:
Turner Foundation
TransWild Alliance
Winslow Foundation
Bullitt Foundation
New Land Foundation
Henry J. Niles Foundation
MT Department of Fish, Wildlife & Parks
U.S. Forest Service
U.S. Fish & Wildlife Service
Western Federal Lands

Thank you to the project advisory group members for feedback and support of the project:
Bonnie Gundrum, Tom Martin, Deb Wambach and Jim Skinner, MT Department of Transportation
Doris Fischer, Paul Siher and T.O. Smith, MT Department of Fish, Wildlife and Parks
James Claar, Kristi Swisher and Fred Bower, U.S. Forest Service
Scott Jackson, U.S. Fish and Wildlife Service
Rob Ament, Western Transportation Institute
Carl James, Craig Genzlinger, Lloyd Rue and Marc Zitzka, U.S. Federal Highways
Whisper Camel, Confederation of Salish-Kootenai Tribes
Erin Chipps and George Fekaris, U.S. Federal Highways-Western Lands Division
Keith Aune and Jeff Burrell, Wildlife Conservation Society
Tim Davis, Sonoran Institute

We’d also like to thank additional contributors and comments made by the following:
Gerry Daumiller, Natural Resource Information Service at Montana State Library
Pat Basting, Pierre Jomini, Jonathan Swartz, Ed Ereth and Jean Riley, Montana Department of Transportation
Gary Tabor, Center for Large Landscape Conservation
Kari Gunson, University of Calgary
Marcel Huisjer, Western Transportation Institute
Maurizio Gibin, University College London
John Waller, National Park Service
III. Contact List

For information regarding various aspects of the report, please contact the following:

General questions regarding the report and its use, details on the advisory group and on-the-ground wildlife and transportation projects in the High Divide or Hub Conservation Areas:

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On-the-ground wildlife and transportation projects in the Crown of the Continent or Cabinet Purcell Conservation Areas:

- Katie Meiklejohn, American Wildlands, Conservation Director — North: 
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Regarding the analysis or GIS data products:

- American Wildlands GIS Lab Manager: gis@wildlands.org; 406-586-8175 ext. 103
IV. Diagram Illustrating the Process and Structure of the Wildlife Highway Mortality and Linkage Assessment

The diagram below outlines the goals, structure and potential outcomes of the project, as well as the roles of American Wildlands and the project advisory group.

1Key to abbreviations: CSKT- Confederation of Salish-Kootenai Tribes, FHWA- Federal Highways Administration, MDFWP- MT Department of Fish, Wildlife & Parks, MDT- MT Department of Transportation, USFS- US Forest Service, USFWS- US Fish & Wildlife Service, WCS- Wildlife Conservation Society, WTI- Western Transportation Institute, WFL- Western Federal Lands
V. ADVISORY GROUP STATEMENTS OF INTEREST

We asked advisory group members to write a statement indicating why the Western Montana Wildlife Highway Mortality and Linkage Assessment and its results are important to them and the organization or agency they represent. Below are their responses.

American Wildlands
(submitted/approved by Elizabeth R. Williamson and Kim Davitt)

From a wildlife conservation perspective, the purpose of the Safe Passages Assessment is to identify areas most in need of highway mitigation for wildlife thereby creating a tool to assist American Wildlands with internal project planning as well as help improve our ability to cooperate and work effectively with other agencies and organizations.

Confederation of Salish-Kootenai Tribes
(submitted/approved by Whisper Camel)

Interested in priority areas of American Wildlands and the advisory group which overlap with Salish-Kootenai lands.

Federal Highways Administration — Montana
(submitted/approved by Craig Genzlunger)

Identify locations of wildlife linkage and transportation safety concerns so that wildlife crossing considerations can be considered early on in the planning process and opportunities can be explored with other groups and agencies.

Federal Highways — Western Lands Division
(submitted/approved by Brian Allen)

Identify locations of wildlife linkage and transportation safety concerns so that wildlife crossing considerations can be considered early on in the planning process and opportunities can be explored with other groups and agencies.

Montana Department of Fish Wildlife and Parks
(submitted/approved by Doris Fischer)

Develop a credible planning and information tool that will: (1) identify locations where transportation safety hotspots intersect with priority wildlife linkage areas and highly valued hunting and fishing areas; (2) promote the integration of wildlife conservation goals into the early stages of transportation project planning; and (3) foster inter-agency planning and collaborative wildlife habitat conservation efforts.

Montana Department of Transportation
(submitted/approved by Bonnie Gundrum)

Utilize the results of the assessment as a tool to assist MDT in integrating ecological considerations into the early planning process of potential projects and collaborating with partners during design.

Sonoran Institute
(submitted/approved by Dennis Glick)

Representing private land interests, we are most interested in primary target areas for American Wildlands and the advisory group. Sonoran is very interested in land-patterns within selected areas.
U.S. Fish and Wildlife Service
(submitted/approved by Scott Jackson)
Most interested in determining linkage areas and problem areas of highest priority for facilitating recovery of federally-listed species, thus helping to focus inter-agency planning and habitat protection efforts.

U.S. Forest Service
(submitted/approved by Kristi Swisher)
Similar interests to USFWS (above), in addition to what public lands are located within prioritized areas. The USFS is also interested in the movements of non-threatened and endangered species such as moose, deer and elk, as well as wildlife that is under Forest Service designation as Management Indicator Species or sensitive or of special concern to the public.

Western Transportation Institute
(submitted/approved by Rob Ament)
Review and encourage best practices for wildlife and highway planning and evaluation. WTI is interested in working on a similar assessment at statewide level and incorporating methods and/or lessons learned from projects in other states.

Wildlife Conservation Society
(submitted/approved by Keith Aune)
Learn where other organizations and agencies priorities are for protecting wildlife habitat connectivity. Participate in the areas where we can and where needed. Participate in advancement of the science and best management practices around ecological connectivity to support agency conservation actions and planning.
VI. INTRODUCTION

We initiated this project in order to develop a planning tool to prioritize and direct American Wildlands’ wildlife and highway conservation work in western Montana. Based on the high level of agency interest in the process and results, we expanded the project to act as a pilot for the development of a multi-agency endorsed wildlife and highway planning effort. Through a 14-member advisory group, American Wildlands developed a prioritization framework that ranks wildlife movement areas along transportation routes in need of mitigation.

Due to the high quality wildlife habitat present in western Montana, there are a large number of areas where wildlife mitigation is both needed and warranted. Agency wildlife and transportation personnel alike are already aware of many of these areas. This assessment aims to identify priority areas through a systematic and transparent process in order to help agencies and organizations target their efforts to those areas most in need of wildlife mitigation. With input from an expert advisory group, we prioritized Potential Project Areas based on four criteria: road kill concentrations, wildlife linkage data, existing transportation projects and land ownership patterns.

This report details the prioritization process, as well as the potential uses for the report itself. For planning and prioritizing, use the appendices provided at the end of this document. For those with GIS capabilities, use the analysis and results data products. Download the data from the American Wildlands or Natural Resources Information Services web site, or request a CD. The GIS data products and results will be available by December 2009.

For this assessment, American Wildlands relied heavily on the multi-agency and organization advisory group as a guiding force for goal setting and methodology. Their inputs are reflected in the criteria and analyses (Chs. 1-3), as well as the commitments outlined in Chapter 5. This chapter identifies the advisory group’s perspective on setting priorities, their respective agency and organizational efforts to using the results, and agency/organizational commitments to improve cooperation.

Advisory group members will review the final report in the Fall of 2009. The group will then determine whether additional, broader scope analyses should be applied to the entire state.
CHAPTER 1: ELEVATED CONCENTRATION AREA ROAD KILL ANALYSIS

1.1 Introduction

The first step to mitigating wildlife-vehicle collisions along transportation routes is to identify where best to focus mitigation efforts. In this chapter, we use road kill incidence data from the Montana Department of Transportation to identify areas where elevated concentrations of road kill occur. In Chapter 2, we compare the elevated concentration areas of road kill against locations of known priority wildlife linkages. In Chapter 3, we identify added opportunities based on transportation improvement projects and land ownership patterns.

We evaluated studies in Colorado (Crooks et al., 2008), Florida (Smith et. al., 1998), and Montana (Huijser et al., 2006) to determine the best methodology for identifying road kill concentrations. These projects evaluated road kill patterns to assist in targeting management areas. A variety of geo-analytical methods were considered, including Ripley's K, Nearest Neighbor Indices, Getis Ord and Kernel Density (Crooks et al., 2008; Clevenger et al. 2006, 2003 and 2001; Mountraki and Gunson, accepted for publication; and Ramp et al. 2005). These analysis tools are available through standard GIS software, such as ESRI ArcGIS, but are also available through customized software, such as Sanet and Crimestat (Okabe et al. 2006; Levine 2004). Using guidelines from these sources, as well as road ecology literature, we chose a standard kernel density estimate (KDE) and percent volume contour (PVC) technique using ESRI's ArcGIS software for our analysis (Gibin et al. 2007; Ramp et al. 2005).

1.2 Study Area

The boundaries of the study area are the Canadian border (north), Idaho border (west and southwest), Wyoming border and Yellowstone National Park (southeast) and the Rocky Mountain Front and eastern slope of the Crazy, Castle, Beartooth and Little Belt mountain ranges (east) (Fig. 1.1).

Fig. 1.1. Map of Wildlife Highway Mortality and Linkage Assessment study area; includes the federal and state roads comprising the target road network.

Rugged mountain ranges divided by river valleys characterize the landscape of western Montana. Elevations range from 555 meters (1820 ft) at the Kootenai River to over 3810 meters (12,500 ft) in the Beartooth range. Lower elevation habitats, below 1829 meters (6000 ft), vary greatly in composition and include mountain foothills, short-grass/sagebrush...
prairie, intensively cultivated areas, natural wetlands/lakes, riparian plant communities, man-made reservoirs, small communities, large towns and cities. Coniferous forest and rocky sub-alpine/alpine communities dominate the mountainous habitats.

We considered road kill events which occurred in this study area on 7947 kilometers (4914 mi) of Montana Department of Transportation managed roads. This route network is comprised of 282 interstate, state primary, state secondary, state urban and “state highway” routes.

1.3 Data

Montana Department of Transportation (MDT) provided a road kill database representing all animal carcasses removed and reported by its maintenance division from January 2003 through December 2007 (44,969 records). Maintenance personnel received annual training in carcass removal and data recording. However, no mandate for road kill data collection existed at the time of collection, causing collection efforts to vary across the state (pers. comm. Deb Wambach 2008). Data for each road kill record includes the date the data was collected, the light conditions at time of record, the highway system, base route, roadbed direction, milepost where the carcass was observed (to the tenth of a mile), the direction of vehicle travel, the species and sex of animal and any additional comments.

1.4 Methods

We derived a Geographic Information System (GIS) point dataset from the MDT 2003-2007 tabular animal carcass data in ArcGIS 9.3 (ESRI 2008) using MDT system mileposts as reference points. We refined the dataset to points within the western Montana study area. Next, we grouped the data into three species sub-groups: ungulate, focal species and focal carnivores. Species overlap between sub-groups occurred, causing some road kill events to be included in more than one analysis (see Table 1.1). Species in the ungulate group are all non-domestic, hoofed animals killed on western MT roadways. This group contained the highest total number of road kill concentrations. The ungulate species group includes white tail and mule deer, elk, bison, bighorn sheep, moose, mountain goat and pronghorn. The focal species sub-group contained more sensitive Montana wildlife species; including all ungulates except for deer, as well as carnivores, such as bobcat, black bear, grey wolf, grizzly bear, mountain lion and red fox. The focal carnivore sub-group is a subset of the focal species. The focal carnivore sub-group identified road kill concentrations based on Montana wildlife species killed at lower rates than other sensitive species. Species included in the focal carnivore group are black bear, bobcat, grey wolf, grizzly bear, mountain lion and red fox.1

For each species sub-group, we created a density surface using a kernel density estimation (KDE) in ArcGIS, Spatial Analyst© extension (ESRI 2008). The grid layer generated by the KDE identifies where road kill point locations are concentrated by calculating a density value for each cell. We completed the analysis using an 800 m² cell size.2

Using the percent volume contours (PVC) function and an ArcGIS extension (Hawth’s Tools 2009), we identified elevated concentration areas (ECA) of road kill from the continuous density surface. Contour lines represent the top fifteen percent of the volume of the density distribution from the KDE output grid. The PVC routine generated polygons based on the value at the center of the density grid cells (Beyer 2004). Using this technique, it is possible to obtain PVC polygons that are smaller than the output grid cells. To guarantee that the spatial resolution of our product was consistent with the data on which we based it, we added a 500 m buffer to the PVC polygons.

1 Wolverine and lynx were included in both the focal species and focal carnivore sub-groups. However, no records of either species were present in the MDT database.
2 A 800 m² cell size provided a sufficient resolution of elevated concentration areas of road kill, while taking into account the approximated spatial accuracy of the underlying data.
1.5 Results

Road kill data
There were 27,979 species-of-interest road kill records located in the western Montana study area (Table 1.1). Ninety-nine percent of the records were included in the ungulate analysis, 4% in the focal species analysis and less than 1% in the focal carnivore analysis.

<table>
<thead>
<tr>
<th>Common Name</th>
<th># of Records in Database</th>
<th>Species Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ungulate</td>
</tr>
<tr>
<td>Bighorn sheep</td>
<td>50</td>
<td>✗</td>
</tr>
<tr>
<td>Bison</td>
<td>4</td>
<td>✗</td>
</tr>
<tr>
<td>Black bear</td>
<td>97</td>
<td>✗</td>
</tr>
<tr>
<td>Bobcat</td>
<td>7</td>
<td>✗</td>
</tr>
<tr>
<td>Elk</td>
<td>738</td>
<td>✗</td>
</tr>
<tr>
<td>Gray wolf</td>
<td>5</td>
<td>✗</td>
</tr>
<tr>
<td>Grizzly bear</td>
<td>2</td>
<td>✗</td>
</tr>
<tr>
<td>Moose</td>
<td>172</td>
<td>✗</td>
</tr>
<tr>
<td>Mountain goat</td>
<td>4</td>
<td>✗</td>
</tr>
<tr>
<td>Mountain lion</td>
<td>22</td>
<td>✗</td>
</tr>
<tr>
<td>Mule deer</td>
<td>6,271</td>
<td>✗</td>
</tr>
<tr>
<td>Pronghorn antelope</td>
<td>115</td>
<td>✗</td>
</tr>
<tr>
<td>Red fox</td>
<td>33</td>
<td>✗</td>
</tr>
<tr>
<td>White-tail deer</td>
<td>20,345</td>
<td>✗</td>
</tr>
<tr>
<td>Unknown deer spp.</td>
<td>114</td>
<td>✗</td>
</tr>
<tr>
<td>Total Records in Database</td>
<td>27,979</td>
<td></td>
</tr>
<tr>
<td>Total Records by Group</td>
<td>27,813</td>
<td>1,249</td>
</tr>
</tbody>
</table>

Table 1.1. Road kill analysis species sub-groups.

Ungulates
The total number of ungulate road kill recorded in the study area was 27,813. Of these records, 26,730 were either mule, whitetail or unknown deer species (approximately 96% of the ungulate subset, 93% of all road kill reported in western Montana). Sixty-six areas had an elevated concentration of ungulate road kill events (Fig. 1.2). The number of road kill records contained in these areas ranged from 17 to 808. These elevated road kill concentration areas cover 303 km of roads or 3.8% of the total length of transportation routes in western Montana.

Focal species
There were 1,249 road kill events reported for focal species. An annual average of 250 collisions occurred for focal species with a range of 203 to 302 records per year. We identified 25 areas where a high concentration of focal species road kill occurred (Fig. 1.3). Within these areas, records ranged from a minimum of 3 to a maximum of 75. The total length of the road within areas is 95.5 km or 1.2% of the total length of the transportation routes in western Montana.
mitigation projects in an efficient manner. For this study, kernel density estimations and percent volume contours provided an effective tool for assessing road kill concentration patterns on a regional scale. The combination of KDE and PVC identified relative differences in road kill density and targeted the highest road kill concentration areas. Analyzing the MDT dataset by species groups allowed us to isolate elevated road kill concentration areas for species of particular interest or value that might have been overlooked with a less targeted approach. Chapters 2 and 3 of this report outline our continued methodology for prioritizing potential wildlife mitigation sites. In these chapters, elevated concentration areas of road kill are evaluated in terms of wildlife linkage, transportation projects and land ownership.

Focal carnivores

There were 166 road kill events reported for focal carnivores. The analysis identified 19 elevated road kill concentration areas (Fig. 1.4). These areas ranged from 2 to 5 records each. The total length of the road contained in these areas equaled 75 km or less than 1% of the road network.

1.6 Discussion

Identifying where elevated concentration areas of road kill occur is an important step in mitigation planning to improve human safety and facilitate the safe passage of wildlife across transportation routes (Kassar and Bissonette 2005; Ramp et al. 2005). Using this information, managers will be able to target mitigation projects in an efficient manner. For this study, kernel density estimations and percent volume contours provided an effective tool for assessing road kill concentration patterns on a regional scale. The combination of KDE and PVC identified relative differences in road kill density and targeted the highest road kill concentration areas. Analyzing the MDT dataset by species groups allowed us to isolate elevated road kill concentration areas for species of particular interest or value that might have been overlooked with a less targeted approach. Chapters 2 and 3 of this report outline our continued methodology for prioritizing potential wildlife mitigation sites. In these chapters, elevated concentration areas of road kill are evaluated in terms of wildlife linkage, transportation projects and land ownership.
Data Caveats

Two major data considerations are worth discussing due to their potential influence over our results: 1) gaps in road kill data collection and 2) low representation in the data set of focal carnivore species.

In addition to detecting areas of high road kill concentration, our analysis revealed a few roadway segments where no road kill events appear to occur. While it is possible that these road segments experience low volumes of wildlife crossing, it is more likely that road kill events in these areas were simply not recorded. We identified two possible reasons for missing carcass data in the MDT records. First, MDT shares the responsibility of road kill removal with other agencies, notably MTFWP (for big game species) and USFWS (for threatened and endangered species). In these cases the other agency, not MDT, will often take responsibility for documenting the road kill incident. Second, although MDT maintenance personnel are trained in data collection, keeping record of carcasses is not mandated. Therefore, collection efforts may vary from no data collection to frequent and targeted efforts. This suggests that the results of this analysis are useful in identifying some areas with elevated road kill concentration, but may not identify all problem areas.

The second issue for consideration involves the focal carnivore species sub-group. The MDT database contains a relatively low number of focal carnivore-vehicle collisions. This effectively creates a small sample size and limits confidence in the focal carnivore ECA results. Since carnivores naturally occur at lower densities than most ungulate species, we would expect to find fewer carnivore mortalities on Montana highways compared to ungulates. It is likely, however, that carnivores are underrepresented in the MDT dataset.3 Possible reasons for the underrepresentation of focal carnivores by the database are two-fold. First, MDT protocol requires maintenance personnel to report road kill of sensitive species to game wardens of the MTFWP for subsequent disposal without additionally recording them in the MDT road kill database. Second, some carnivore species of interest are small-bodied and pose little threat to the traveling public making them easy for MDT maintenance crews to overlook (personal comm. Pat Basting). In an attempt to augment the MDT data set (during the data collection period), we inquired at MTFWP. They were, however, unable to locate a central database of road kill incidence within their agency. Although the USFWS also keeps records of threatened and endangered species kills along transportation routes, we were also unable to obtain this data for inclusion in our analysis.

Despite its limitations and based on requests by advisory group members, we included the elevated road kill concentration results for focal carnivores in this report. We advise, however, that use of the focal carnivore data be limited and strong consideration of the data limitations given when interpreting these results. Furthermore, the limitations in this sub-group led us to omit the focal carnivore results from subsequent analysis in Chapters 2 and 3. The focal carnivore results are reintroduced, however, as anecdotal information in Chapter 4 and in Appendix D - Potential Project Area Summaries.

Analysis considerations

By spreading density values over newly created surfaces, kernel density analysis aids the user in visualizing where a high concentration of underlying points occurs, but may not be precisely spatially coincident with the underlying points. As a result, the utility of KDE is limited at finer resolutions. For example, where there are many road kill events along a curve in the road, the highest density illustrated will be inside the area defined by the curve. For this reason, elevated concentration areas may appear to be off the road. A similar problem arises when road kill events occur near intersecting roads or on roads that are adjacent to one another. Finally, the KDE outputs

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3 Problems with the focal carnivore results were reinforced by MDT and USFWS biologists. They noted multiple sites in western Montana where known carnivore road kill concentration areas exist which the analysis did not identify.
a relative density value for each cell. Therefore, the user cannot read the density surface such that one color represents an absolute number of underlying road kill events, only that a color represents a density category (e.g., high to low). Of the areas that are displayed as belonging to the same category, it is not possible to determine which has a higher value.

In contrast to the KDE, percent volume contours calculate the desired percent of overall density volume using the center of the grid cells rather than the whole grid cell. As a result, the polygon products can be smaller than the input grid cells, suggesting a finer resolution than is attainable given the underlying grid. To address this issue, we therefore added a 500 meter buffer around each area defined by the PVC. Buffering the PVC to some extent generalizes the resulting elevated concentration areas. This reduces the potential for product users to misinterpret areas identified in this section as point locations necessitating mitigation as well as encourages users to consider more of the surrounding landscape when investigating the need for mitigation.

1.7 Chapter Summary and Recommendations

Recommendations on interpreting the elevated road kill concentration area results:

1. Road kill concentration areas identified in this study are zones/locations of elevated human safety concerns due to vehicle-wildlife collisions.

2. Areas not identified as road kill concentration areas may or may not have a human safety concern due to wildlife collision.

3. For each road kill concentration area, additional fine scale research must be conducted to identify exact locations where mitigation may be warranted.

4. Road kill concentration based on the focal carnivore sub-group can not be assessed with the existing MDT road kill dataset; more data is needed.

5. Road kill concentration areas should not and can not be used as the sole source of information identifying important wildlife movement areas.

6. Consider CrimeStat tools for alternative analysis techniques. The developers of CrimeStat have indicated that the next version of the program may enable efficient processing on a network (such as a system of highways). Upon planned improvements to the program, the CrimeStat routines may provide a superior alternative to the kernel density estimations and percent volume contour techniques used in this analysis.

1.8 GIS Data Products

Below are the GIS data products available from Chapter 1. Datasets are accompanied by metadata and can be used by organizations and agencies for wildlife and transportation planning:

Road kill point events: The 27,979 records from the Montana Department of Transportation road kill database from January 2003 through December 2007. See Appendix B- GIS Data Products for more details.

Elevated Concentration Areas: The 110 elevated concentration areas of road kill based on three species sub-groups from the MDT database. See Appendix B: GIS Data Products for more details.
CHAPTER 2: IDENTIFYING AND CLASSIFYING POTENTIAL PROJECT AREAS FROM ELEVATED CONCENTRATION AREAS OF ROAD KILL USING WILDLIFE LINKAGES

2.1 Introduction

In the first chapter of this report, we identified elevated concentration areas (ECA) of road kill where a dual concern for wildlife and human safety exists based on road kill volumes. While road kill data indicates locations where wildlife are killed, it does not necessarily target the most important and likely wildlife movement areas. In this chapter, we refine our existing list of ECA to those areas that also function as critical wildlife linkages by incorporating a wildlife linkage-specific data layer: American Wildlands’ 2007-2008 Priority Linkage Assessment.

2.2 Methods

Data

Elevated Concentration Areas: Elevated concentration areas of road kill, identified in Chapter 1, represent the top 15% percent of the density distribution of road kill point events, plus a 500-m buffer. In Chapter 2, we examine two of the three road kill ECA datasets developed in Chapter 1: ungulate ECA and focal species ECA. We removed the focal carnivore ECA from this stage of the analysis due to its low sample size and our resulting lack of confidence in the results. These ungulate and focal species ECA datasets include the route number and mileposts between which each ECA occurred, the length of roadbed within the area and the number of road kill events underlying the density surface (Appendix C-1.4).

Priority Linkage Assessment: In 2007 and 2008, American Wildlands used an expert-based model to identify the most important wildlife linkage areas in the U.S. Northern Rockies. As part of the Priority Linkage Assessment (PLA), American Wildlands interviewed 86 federal, state, tribal and independent biologists asking them to identify important areas for wildlife movement between core habitats. This assessment focused on the movement needs of eight species: elk, lynx, moose, wolverine, gray wolf, grizzly bear, bighorn sheep and pronghorn. The participating biologists scored each identified linkage in three categories: ecological quality, conservation threats and conservation opportunities.

Using a Bayesian averaging algorithm and Jenks Natural Breaks, each linkage received a final score. Linkages were sorted into one of five hierarchical groups: very high, high, intermediate, low and very low. American Wildlands conducted this process in each of our four conservation areas: 1) Cabinet-Purcells, 2) Crown of the Continent, 3) Hub and 4) High Divide (Fig. 2.1). One hundred and forty-seven of the 157 linkages occur within the study area. Of these, 20 are considered very high priority, 33 high, 58 intermediate, 24 low, and 12 very low (Fig. 2.2).

1 Of the three categories in the PLA (ecological quality, threat and opportunity), final linkages scores are driven primarily by ecological quality.

2 It is important to note that the linkages are ranked in comparison to other linkages within their conservation area, not across all of the linkages between conservation areas. We used the data from the four PLA conservation areas in this analysis on the assumption that any existing variance between assessment methodologies has negligible influence on the results. In cases where linkages overlap at conservation area boundaries, we assigned the overlapping area the highest linkage value of the coincident linkages in this analysis.
Overlay Analysis

We converted the three input datasets (ungulate ECA, focal species ECA and PLA data) to grid layers with a resolution cell size of 800 meters.\(^3\) Using a grid overlay, we combined the attributes from these three layers. The resulting Potential Project Areas represent overlap of an ungulate and/or focal species elevated concentration area with a high or very high priority linkage area. We then categorized the results into three Potential Project Area classes prioritized by their value as linkage habitat (Fig. 2.4).

Class A (top priority) Potential Project Areas are ungulate and focal species ECA that overlap with linkages ranked very high in the PLA. Class B projects (middle priority) are either a) ungulate and focal species ECA that overlap with linkages ranked high, b) ungulate-only ECA that overlap with linkages ranked very high, or c) focal species-only ECA that overlap with linkages ranked very high. Class C projects

\(^3\) Consistent with the spatial accuracy of the road kill point events.
(lower priority) are ungulate-only or focal species-only ECA that overlap with linkages ranked high.

<table>
<thead>
<tr>
<th></th>
<th>Priority Linkage Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very High</td>
</tr>
<tr>
<td>Both Ungulate and Focal Species</td>
<td>Class C</td>
</tr>
<tr>
<td>Ungulate Species or Focal Species</td>
<td>Class B</td>
</tr>
</tbody>
</table>

Fig. 2.4. Schematic illustrating elevated concentration area & priority linkage contribution to Potential Priority Areas classes (in purple).

2.3 Results

Spatial Relationships

**Ungulates:** Of 66 ungulate elevated concentration areas, 48 intersect with a wildlife linkage area. Almost half of these (23 ECA) occurred in a very high or high priority linkage.

**Focal Species:** Of 25 focal species elevated concentration areas, 21 intersect with a wildlife linkage area. A third of these (7 ECA) occurred in a very high or high priority linkage.

Potential Project Areas

We identified a total of twenty-nine Potential Project Areas: 0 Class A, 13 Class B and 16 Class C (Fig. 2.5). Priority Linkage Assessment data, Chapter 1 results and site specific details are referenced in Appendix C-1.4 for each PPA.

4 We chose to include the Class A category even though no Potential Project Areas met the criteria. We did this to retain the ranks in the event that this procedure is repeated in the future and the data meets this Class A condition.

5 At PPA-12 ungulate and focal species ECA overlapped. We identified this area as a single project area.

Fig. 2.5. Potential Project Areas resulting from grid overlay analysis (displayed here with priority linkage areas). For a larger version of this map, see Appendix C. Numbered labels reference Appendix C-4.1.

2.4 Discussion

The analysis and results presented in this chapter represent the first phase in prioritizing wildlife mitigation project areas along western Montana transportation routes. In Chapter 1, we used road kill data to identify 89 ungulate and focal species elevated concentration areas of wildlife mortality. In this chapter, we overlaid these elevated concentration areas with wildlife priority linkage data to further refine our results to a set of 29 Potential Projects Areas.

The 29 identified PPA are locations where ungulate and/or focal species elevated concentration area results overlap with either very high or high ranked wildlife linkage areas. The various PPA classes will be of interest to different organizations. There are 11 Potential Project Areas where focal species mortality is an issue. For organizations more concerned with sensitive wildlife species, we recommend these areas...
be given attention. Sites with an ungulate species concern are, however, likely to have higher levels of road kill incidence (see Ch. 1) and therefore may be of greater interest to other agencies and organizations where human safety is a primary concern.

American Wildlands will likely focus on those areas where both focal species and ungulate species ECA exist. This is due to the increased likelihood of collaboration with other agencies, especially MDT due to the safety concerns due to having both ECA groups present. Since none met these conditions in very high wildlife linkage areas (Class A), we will consider strongly areas with dual ECA presence in high linkage areas (Class B). Also those focal species ECA in high ranked wildlife linkages will also be considered a priority by American Wildlands. Our choices of activity and priority will also be driven our organizational resources and by the threats and opportunities in the respective wildlife linkages (see Ch. 4).

Details about the ecological quality, threat and opportunities of wildlife linkages for each potential priority area can be found in the Priority Linkage Area reports on the American Wildlands website (wildlands.org).

2.5 Chapter Summary and Recommendations

Recommendations for interpreting the ECA and priority linkage area results

1. For each Potential Project Area of interest, cross reference the wildlife linkage details provided in the Priority Linkage Assessment reports (for the report and linkage name for each PPA see Appendix C-4.1).

2. To determine which elevated concentration areas (i.e., ungulate or focal species) overlap with very high and high priority linkage areas, see Appendix C-4.1.

2.6 GIS Data Products

Below are the GIS data products available from Chapter 2. The datasets are accompanied by metadata and can be used by organizations and agencies for wildlife and transportation planning:


Potential Project Areas: Details regarding the 29 PPA; based on the results of the ungulate and focal species elevated concentration areas of road kill and priority linkage areas overlay. See Appendix B- GIS Data Products for details.
CHAPTER 3: IDENTIFYING ADDED OPPORTUNITIES FOR POTENTIAL PROJECT AREAS BASED ON PLANNED HIGHWAY PROJECTS AND LAND OWNERSHIP

3.1 Introduction

The purpose of this project is to prioritize areas for wildlife mitigation along western Montana Department of Transportation roadways. In Chapter 1, we used kernel density estimation and percent volume contours to identify 89 ungulate and focal species elevated concentration areas (ECA) where there is a dual concern for wildlife and human safety due to elevated levels of road kill. In Chapter 2, to identify the Potential Priority Areas, we overlaid the elevated concentration areas of road kill with western Montana wildlife linkage data from the American Wildlands 2007-2008 Priority Linkage Assessment.

In this chapter, we use two additional datasets to provide further rankings for the Potential Priority Areas identified in the previous chapter: State Transportation Improvement Program project areas and a Land Ownership Conservation Potential Index. The sites identified in this chapter are termed “Added Opportunity Areas” to indicate the added potential for mitigation work due to planned or existing transportation projects and favorable land ownership. For those intending to use this report and/or the results of this chapter as a tool to inform project planning efforts, be sure to reference the tables in Appendix C. Of particular interest may be Table C-4.1 which provides details regarding all of the Potential Project Areas, including those identified as added opportunity areas in this chapter.

3.2 Methods

Data

Potential Project Areas

Chapter 2 outlines our approach to selecting highway segments where a high concentration of ungulate and focal species road kill overlapped with the most important wildlife linkage areas. We identified 29 Potential Project Areas within the study region (Fig. 2.5) and assigned each to a class (A, B or C) based on the quality of wildlife linkage and degree of overlap with elevated concentration areas.

Statewide Transportation Improvement Program

The Montana Department of Transportation (MDT) Statewide Transportation Improvement Program (STIP) data represent transit improvement projects proposed for 2008 through 2012. Some STIP projects will be more natural targets for the inclusion of wildlife crossing mitigations than others. For example, a bridge construction project has greater implications for the safe passage of wildlife than a resurfacing project. Therefore, the defined scope of the project is an important criterion to consider in this analysis.

The dataset includes 321 proposed STIP projects, 151 of which occur in the study area.

Land Ownership

Surrounding land ownership is an effective indicator for gauging the ease and efficacy of implementing wildlife mitigation projects in an area. Public and private lands protected by conservation easement are less likely to be developed or to undergo invasive practices (e.g., mining, energy development) that
would be detrimental to wildlife habitat and connectivity. Thus, mitigation projects on public or protected lands may have greater long-term effectiveness than those surrounded by unprotected or unmanaged lands.

To evaluate the landscape surrounding Potential Project Areas, we created a land ownership data layer from four existing datasets: 1) Land Ownership and Managed Areas in Montana, 2) Montana Public Land Ownership, 3) Montana Conservation Easements and 4) Montana Legacy Project Lands (Table 3.1).

<table>
<thead>
<tr>
<th>Data Title</th>
<th>Source</th>
<th>Created/Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Ownership and Managed Areas</td>
<td>Montana Natural Heritage Program</td>
<td>2005</td>
</tr>
<tr>
<td>Montana Public Land Ownership</td>
<td>Montana Natural Heritage Program</td>
<td>2008</td>
</tr>
<tr>
<td>Montana Conservation Easements</td>
<td>Montana Natural Heritage Program</td>
<td>2008</td>
</tr>
<tr>
<td>Montana Legacy Project Lands</td>
<td>The Nature Conservancy</td>
<td>2008</td>
</tr>
</tbody>
</table>

Table 3.1. Datasets combined to create the land ownership data layer.

The dataset “Land Ownership and Managed Areas in Montana,” which includes both private and public land ownership, served as the base layer for our dataset. We used the remaining three datasets to update the ownership and management status of public lands and land easements. The “Montana Public Land Ownership” dataset represents public lands which are greater than or equal to 40 acres in size, Plum Creek Timber Company land, some private land trust parcels and surface water in the state of Montana. “Montana Conservation Easements” identifies land parcels in Montana under conservation easement as of August 2008. The Montana Legacy Project lands layer represents parcels of land currently owned by the Plum Creek Timber Company that will be sold to the Nature Conservancy and the Trust for Public Land through the Montana Legacy Project. The 312,000 acres of forested land to be purchased in this agreement will be transferred into public and private ownership under conservation easement. Users should take into consideration that some error may exist within these datasets due to changes in land ownership that took place subsequent to our evaluation.

**Analysis**

To identify the added opportunities in the 29 Potential Project Areas, we setup independent decision matrices and ranked each project area based on coincidence with Statewide Transportation Improvement Program projects and surrounding land ownership type. We evaluated these additional factors independently to isolate the possible contribution of each to mitigation opportunities in the Potential Project Areas.

**Statewide Transportation Improvement Program projects**

As a first step in the STIP added opportunity analysis, Montana Department of Transportation representatives weighted each project scope category on a scale from 1-10 (one being the lowest suitability for potential mitigation, 10 the highest; Table 3.2). We then organized these weighted groups into one of three decision categories: high, moderate and low (Table 3.2). Highway projects that received a weighted value in the range of 8-10 have a high opportunity for mitigation incorporation; projects that received a weighted value between 4 and 7 have a moderate opportunity for mitigation; and projected weighted between 1 and 3 have low opportunity for mitigation.

---

1 A decision matrix is a way to systematically evaluate and rank a list of options, or alternatives, based on a set of selection criteria.
Table 3.2. STIP project scope weighting scheme. Relative importance weights, 1 (low) to 10 (high), were determined by MDT advisory group members.

<table>
<thead>
<tr>
<th>STIP Scope Code</th>
<th>Scope Description</th>
<th>Relative Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>New Construction</td>
<td>10</td>
</tr>
<tr>
<td>130</td>
<td>Reconstruction with added capacity</td>
<td>10</td>
</tr>
<tr>
<td>140</td>
<td>Reconstructions without added capacity</td>
<td>10</td>
</tr>
<tr>
<td>220</td>
<td>Bridge replacement with added capacity</td>
<td>10</td>
</tr>
<tr>
<td>221</td>
<td>Bridge replacement with no added capacity</td>
<td>10</td>
</tr>
<tr>
<td>141</td>
<td>Reconstruction-Remove and Replace Culverts</td>
<td>9</td>
</tr>
<tr>
<td>231</td>
<td>Major Bridge Rehabilitation Without Added Capacity</td>
<td>8</td>
</tr>
<tr>
<td>151</td>
<td>Major Rehabilitation Without Added Capacity</td>
<td>6</td>
</tr>
<tr>
<td>160</td>
<td>Minor Rehabilitation</td>
<td>5</td>
</tr>
<tr>
<td>310</td>
<td>Roadway and Roadside Safety Improvements</td>
<td>5</td>
</tr>
<tr>
<td>170</td>
<td>Restoration and Rehabilitation</td>
<td>4</td>
</tr>
<tr>
<td>232</td>
<td>Minor Bridge Rehabilitation</td>
<td>4</td>
</tr>
<tr>
<td>312</td>
<td>Structure Safety</td>
<td>3</td>
</tr>
<tr>
<td>111</td>
<td>New Construction-Facilities</td>
<td>2</td>
</tr>
<tr>
<td>172</td>
<td>Restoration and Rehabilitation- Facilities</td>
<td>2</td>
</tr>
<tr>
<td>311</td>
<td>Railroad/Highway Safety Improvements</td>
<td>2</td>
</tr>
<tr>
<td>181</td>
<td>Resurfacing/Asphalt</td>
<td>1</td>
</tr>
<tr>
<td>183</td>
<td>Resurfacing/Seal and Cover</td>
<td>1</td>
</tr>
<tr>
<td>410</td>
<td>Traffic Signals and Lighting</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3.3. Decision matrix to evaluate STIP project influence as an added opportunity (AO) for Potential Project Areas. The table takes into consideration PPA categories from Chapter 2 and ease of incorporating wildlife mitigation into highway project categories to create added opportunities rankings. AO-S I indicates project areas that have a high need for mitigation based on road kill density and a high potential for mitigation based on the type of STIP project. AO-S II and AO-S III project areas have a relatively decreasing added opportunity based on Chapter 2 PPA categories and ease of incorporating mitigation based on the scope of the STIP projects.

* Low includes areas where no STIP projects are planned.

Table 3.4. Land ownership conservation potential.

<table>
<thead>
<tr>
<th>Land Ownership Type</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>AO-S I</td>
<td>AO-S II</td>
<td>AO-S III</td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The decision matrix defines the overlap between Potential Project Area categories (as defined in Ch. 2) and the weighted STIP groupings described above (Table 3.2). The resulting categories — AO-S I, II and III (see Table 3.3 description for category explanations) — reflect both the opportunity for incorporating wildlife mitigation into highway projects and the need for mitigation based on high density road kill locations.
### Added Opportunity Criterion 2: Land Ownership Conservation Potential (LOCP)

<table>
<thead>
<tr>
<th>Land Ownership &amp; Management</th>
<th>Relative Importance</th>
<th>% Area in Relative Importance</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easements</td>
<td>10</td>
<td>67.5 - 100</td>
<td>Very High</td>
</tr>
<tr>
<td>Five Valleys Land Trust</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Park Service</td>
<td>10</td>
<td>49.6 - 67.4</td>
<td>High</td>
</tr>
<tr>
<td>Prickly Pear Land Trust</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Nature Conservancy</td>
<td>10</td>
<td>32.8 — 49.5</td>
<td>Intermediate</td>
</tr>
<tr>
<td>US Fish and Wildlife Service</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocky Mountain Elk Foundation</td>
<td>9</td>
<td>15.4 — 32.7</td>
<td>Low</td>
</tr>
<tr>
<td>US Bureau of Land Management</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana Fish, Wildlife, and Parks</td>
<td>8</td>
<td>0 — 15.3</td>
<td>Very Low</td>
</tr>
<tr>
<td>USDA Forest Service</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana Department of Natural Resources Water Projects</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana State Trust Land</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bureau of Indian Affairs Trust Land</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boone and Crockett Club</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Bureau of Reclamation</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department of Agriculture</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana Department of Transportation</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana University System</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Cheyenne Tribal Lands</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salish Kootenai Tribal Lands</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State of Montana</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Army Corps of Engineers</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blackfeet Land Trust Corporation</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County Government</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crow Tribal Lands</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plum Creek Timber Company</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Land</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Land Trust</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turtle Mountain Allotted Lands</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Department of Defense</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Government</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City Government</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana Department of Corrections</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Not included in % area LOCP calculation               |                     |

**Table 3.4. Land ownership conservation potential weighting scheme.** Relative importance values, 1 (low) through 10 (high), were determined by the assessment advisory committee.
percentage of land with high conservation potential, whereas very low values represent Potential Project Areas with the lowest percentage of land with high conservation potential (Table 3.5).

As with the STIP decision matrix, the land ownership decision matrix defines the overlap between Potential Project Area categories (as defined in Ch. 2) and the conservation potential of land ownership types (Table 3.5). The resulting categories — AO-L I, II and III (see Table 3.5 for detailed category explanations) — reflect both land ownership opportunity and need for mitigation based on high density road kill locations.

<table>
<thead>
<tr>
<th>Land Ownership Conservation Potential (LOCP) Category</th>
<th>Very High</th>
<th>High</th>
<th>Intermediate</th>
<th>Low</th>
<th>Very Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>AO-L I</td>
<td>AO-L II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B</td>
<td>AO-L II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class C</td>
<td>AO-L III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.5. Decision matrix to evaluate land ownership influence on Potential Project Areas. The table takes into consideration PPA categories from Chapter 2 and land ownership conservation potential categories to determine the added opportunity (AO) rankings presented by favorable land ownership. AO-L I project areas have a high need for mitigation based on road kill density and a high potential for mitigation based on land ownership conservation potential. AO-L II and AO-L III project areas have relatively decreasing need and potential for mitigation based on the same criteria.

3.3 Results

Added Opportunity Areas: Statewide Transportation Improvement Program projects

Of the 29 Potential Project Areas, 11 intersect with STIP projects. The remaining 19 Potential Project Areas did not intersect a STIP project (Fig. 3.1).

Six of the 11 intersecting Potential Project Areas received the highest added opportunity ranking (AO-S I): PPA-8, PPA-9, PPA-22, PPA-23, PPA-25 and PPA-26. Of these areas, four are located on US Route 93 south of Missoula and two are located on Interstate 90 near Superior. All six AO-S I added opportunity areas intersected a STIP project with a high STIP scope value.

Three of the 11 Potential Project Areas — PPA-7, PPA-12 and PPA-13 — received a mid-range added opportunity ranking (AO-S II). PPA-7 is located on Interstate 90 near Superior while PPA-12 and PPA-13 are located on State Route 200 near the junction with State Route 83. All three areas in the AO-S II category intersected a STIP project with a moderate STIP scope value.

Two Potential Project Areas — PPA-2 and PPA-3 — received a low added opportunity ranking (AO-S III). PPA-2 is located on Highway 83 in the Swan Valley.

Fig. 3.1. Map of the 29 Potential Project Areas and the added opportunity ranking based on STIPS projects. For a larger version of this map, see Appendix C. Numbered labels reference Appendix C-4.1.
Land Ownership Conservation Potential and Potential Project Areas

We identified six Potential Project Areas in western Montana with a high added opportunity ranking (AO-L I) based on a very high percentage of favorable land ownership within a one mile buffer of the defined area. These top added opportunity areas include PPA-2 on state route 83 near Condon, PPA-5 on Interstate 90 near the Idaho border, PPA-12 and PPA-13 (which overlap each other and occur at the junction of state route 83 and state route 200), PPA-16 on state route 200 and PPA-19 on US highway 12 near Lolo Pass.

Four Potential Project Areas received a mid-range added opportunity ranking (AO-L II) based on a high percentage of favorable surrounding land ownership. These include PPA-1 located on US 2 south of Libby, PPA-7 on Interstate 90 near Superior, and PPA-10 and PPA-11, which are adjacent to one another on state route 83 near the junction with state route 200 (Fig. 3.2).

The remaining 19 Potential Project Areas received the lowest added opportunity ranking (AO-L III) based on surrounding land ownership composition with an intermediate, low, or very low conservation potential. These include PPA-3 on state route 83 near Condon, PPA-4 on Interstate 90 near the Idaho border, PPA-6 on US 93 north of Missoula, PPA-8 and PPA-9 which are adjacent to one another near the town of Superior on Interstate 90, and PPA-14 and PPA-15 on state highway 200 near Lincoln. PPA-17, PPA-18, and PPA-20 through PPA-26 are located on US route 93 south of Missoula where much of the land is in private ownership. In southwestern Montana, PPA-27 and PPA-28 overlap each other near the junction of US route 287 and state route 287. PPA-29 is located farther south on US route 287.

3.4 Discussion

In this chapter, we evaluated and ranked added opportunities for wildlife mitigation in the 29 Potential Project Areas identified in Chapter 2. We designed this step to assist with the prioritization process. Overlap between PPA and high-ranking STIP projects may make highway-based mitigation easier to achieve, but we recognize that other areas without a planned STIP project may at times be more important for protecting wildlife movement or improving human safety. In cases where STIP projects exist, mitigation projects can be nominated through the STIP process. The same holds true for the Land Ownership Conservation Potential Index. Although the LOCP is designed to highlight areas where the costs of conservation (in terms of dollars and political capital) may be less, there may be areas that received low LOCP ranking yet warrant conservation priority due to high value for wildlife.

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Fig. 3.2. Map of the 29 Potential Project Areas and the added opportunity ranking based on Land Ownership Conservation Potential. For a larger version of this map, see Appendix C. Numbered labels reference Appendix C-4.1.

2 To nominate a STIP and to learn more about factors which improve the chance a nominated STIP will be completed, contact Gary Larson, the MDT STIP Coordinator at (406) 444-6110.
3.5 Chapter Summary and Recommendations

Updates on STIP-based added opportunity areas

We believe the STIP to be a useful tool for Montana Department of Transportation (MDT) to prioritize transportation projects, particularly those projects that are already planned. Upon discussing STIP with MDT however, we learned that the projects included in the program are not guaranteed. They are provisional and, due to a variety of factors, some projects may not make it to completion. Thus, it will be important to contact MDT when using the STIP-based added opportunity as part of any decision making. To augment our recommendations, we provide the following updates regarding the STIP projects based on May 2009 conversations with MDT personnel.

The results of our assessment identified nine added opportunities in the top two STIP-based rankings; six in AO-S I and three in AO-S II. Of the six STIP AO-S I areas, four are located in the Bitterroot Valley along Hwy 93 south (PPA-22, PPA-23, PPA-25 and PPA-26) (see Fig. 3.1 & Appendix C-3.2). All of these Potential Project Areas are based on high volumes of ungulate road kill. Currently, a suite of wildlife mitigation projects, in various stages of design, exist in these areas, including bridge reconstruction and a series of underpasses (see Appendix C-4.1 for additional details). The two remaining areas in the AO-S I category (PPA-8 and PPA-9) occur along Interstate 90 in the Superior priority linkage area. MDT has major bridge rehabilitation projects planned for 2010 at both sites. According to Pat Basting, District Biologist at MDT, these are full resurfacing projects that are still in the planning stages. Although MDT considered fencing the highway segment between these bridges, they ultimately decided against this mitigation due to the relatively large distance of fencing required (>3 miles), the fact that ungulate populations in the area were stable and in some cases growing and concern that movement through the area may be disrupted by the extensive fencing. Other opportunities for wildlife mitigation may still exist at these STIP project sites, but none are currently planned.

Of the three added opportunity areas in the AO-S II category, two are located in the Blackfoot Clearwater linkage area (PPA-12 & PPA-13). According to Bonnie Gundrum, Environmental Service Resource Section Supervisor at MDT, conservation efforts in this area to date have been steered toward land conservation in the form of easements, rather than crossing structures. This was based on consultations and recommendations from biologists at MTFWP. The third of the AO-S II areas (PPA-7) is located north of the AO-I areas along I-90 and 2 miles southeast of a focal carnivore ECA (ECA-102). Restoration and rehabilitation is planned for this site, but the status of these projects is unknown.

Recommendations on how to interpret and utilize the added opportunity results

1. Chapter 3 applies two independent added opportunity analyses to the Potential Project Areas identified in Chapter 2. While these additional analyses will help users of this report prioritize projects based on existing transportation project areas or based on the conservation potential of land ownership types, we emphasize the value of all PPA as potential mitigation areas.

2. We recommend that readers who are using this report as a planning tool consider the 19 AO-I and AO-II added opportunity areas based on STIP and LOCP as potential focus areas for wildlife mitigation efforts and opportunities. Extra focus should be given to the three overlapping areas (PPA-7, PPA-12 and PPA-13).³

3. Where sites are chosen for further focus, we recommend fine scale/local area evaluation

³ Utilize the Potential Project Area and elevated concentration areas of road kill tables in Appendix C-4.1 and C-1.4 respectively, to find additional details regarding the sites identified in this chapter. Reference the Priority Linkage Assessment reports (American Wildlands 2008) to find more details regarding the linkage areas in the potential project areas, as well as the added opportunity areas.
to determine appropriate mitigation actions. Agencies or organizations focused on species other than those included in this analysis, may want to use additional data based on the species of interest and then determine if there is overlap between that data and our results.

5. The STIPS lists are not all guaranteed projects and may be in various stages of planning. Contact MDT if an area is identified that is of interest for mitigation. Additional data is available regarding each project in the online annual report for STIPs and the Ranked STIP data layer. Also, projects can be nominated. Do not rely solely on STIP added opportunity areas for prioritizing project areas.

4 We suggest using high resolution (30 meter) Cadastral (land parcel ownership)/CAMA (computer assisted mass appraisal) data for this purpose (available from the MT Library's NRIS).

3.6 GIS Data Products

Below are the GIS Data products available from Chapter 3. The datasets are accompanied by metadata and can be used by organizations and agencies for wildlife and transportation planning:

- **Ranked STIP**: This polygon layer represents those Statewide Transportation Improvement Program (STIP) projects located in western Montana for 2008-2012 surrounded by a one-mile buffer. See Appendix B- GIS Data Products for more details.

- **Land Ownership Conservation Potential**: This polygon layer illustrates the relative potential of unique land ownership types in western Montana to facilitate highway mitigation and address wildlife connectivity and human safety issues. See Appendix B- GIS Data Products for more details.

- **Potential Project Areas**: Details regarding the 29 PPA; continuation of the data set created in Chapter 2. See Appendix B- GIS Data Products for more details.
4.1 Introduction

American Wildlands plans to use the results of this assessment to help determine the most important and appropriate areas for focusing our wildlife mitigation efforts. Through this prioritization process, we hope to improve communication and coordination between our own internal programs as well as between AWL and our partners.

4.2 Use of the assessment by American Wildlands

Moving forward to apply the results of this assessment internally, American Wildlands decided to prioritize those areas that overlap with ongoing projects. Thus, we categorized Potential Project Areas as follows:

1. **Immediate (PPA-7,12,13):** Projects in this category have high concentrations of road kill, are located in very high or high priority wildlife linkage areas, include a high-ranking STIP project and have land ownership patterns conducive to conservation. Furthermore, these PPA occurred in regions important to forest-sensitive carnivores and close to existing American Wildlands projects.

2. **Requires More Research (all remaining PPA):** American Wildlands will continue to monitor these areas for future mitigation or research opportunities.

3. **Future Possibilities:** This category incorporates the high-ranking ungulate and focal species elevated concentration areas (ECA) that intersect a priority linkage area, but were not included in the Chapter 2 Potential Project Areas. American Wildlands decided on this approach for two reasons: (1) a majority of the 29 Potential Project Areas identified in Chapters 2 and 3 fall into the northern half of western Montana (this is because most PPA in the southwestern part of the state fail to intersect MDT managed transportation routes) and (2) all the linkages identified by the Priority Linkage Assessment (even those with a ‘low’ priority rating) are valuable to wildlife movement and important to consider over time. Since few Potential Project Areas fall into our southwestern conservation region, this inclusive list keeps a larger number of sites available for future activity by American Wildlands.

4.3 Chapter Summary

American Wildlands has targeted three areas for immediate activity. These are PPA-7, PPA-12 and PPA-13. These areas are located along Interstate 90 near Superior, on Highway 200 and on Highway 83, respectively. We will be communicating with the advisory group, especially MDT and MT Fish, Wildlife and Parks, to determine if these sites warrant additional effort in terms of wildlife mitigation. We are researching and evaluating linkage importance.

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1 This assessment was also designed as an external planning coordinating tool that will be shared with our conservation partners and agencies (through the project advisory group). This additional effort was to ensure better cooperation outside our organization with wildlife and highways entities within the region. Evaluation of assessment results, and plans for use, by the advisory group is summarized in Chapter 5.

2 The focal carnivore ECA which intersect a linkage are not considered as possible wildlife mitigation areas (due to the small sample size) on their own, but when nearby, they to act as a booster for other ungulate and focal species Potential Project Areas (see Appendix D).
threat and opportunity for the remaining 26 Potential Project Areas. Finally, we will consider for possible future attention the remaining 39 ungulate and focal species elevated concentration areas of road kill located in intermediate, low and very low wildlife linkages. American Wildlands will take these conclusions and ideas to the advisory group and look for partners in our short-term and long-term efforts in the areas identified in this report.
CHAPTER 5: SUMMARY OF THE WILDLIFE HIGHWAY MORTALITY AND LINKAGE ASSESSMENT USE BY THE ADVISORY GROUP

5.1 Introduction

American Wildlands initiated this assessment with the intention of developing a planning tool that could be used not only by American Wildlands, but by current and future partner agencies and organizations. To that end, we convened an advisory group composed of representatives from eight agencies and three non-governmental organizations with an interest in wildlife connectivity and transportation to guide our analysis, GIS data products and report delivery. This chapter summarizes the advisory group’s plans for using this assessment.

5.2 Advisory Group Priorities

In setting priorities for using this assessment, two points warrant emphasis. First, this assessment is not designed to pinpoint areas for wildlife mitigation, but may provide guidance in identifying general regions that deserve mitigation attention. In some of these Potential Project Areas sufficient data on wildlife movement patterns and conservation/mitigation opportunities may exist to move quickly on project opportunities; other areas may require significantly more information. Second, the added opportunity analysis conducted for the Montana State Transportation Improvement Program (STIP) does not provide a comprehensive assessment of potential Montana Department of Transportation projects. Many transportation project sites identified for western Montana are not included in the STIP database and could be nominated for future attention by the advisory group.

The advisory group strongly supports the project priorities identified by American Wildlands in Chapter 4 of this report. Following publication of this report, the advisory group recommends forming a committee to maintain the collaboration and momentum generated by this project. As a first step, this committee will use the priority project areas identified in this report along with other information to conduct an inter-agency/organizational capacity analysis to locate the most appropriate areas for collaborative commitment. Identification of specific goals and objectives will follow completion of the capacity analysis. Advisory group members who expressed a willingness to participate in the committee include: MT Fish Wildlife and Parks, MT Department of Transportation (MDT), Western Federal Lands, US Forest Service, US Fish and Wildlife Service, Federal Highways Administration-MT, Western Transportation Institute and American Wildlands.

5.3 Dissemination of Results

To facilitate communication and dissemination of the results reported in this assessment, the advisory group requested development of a presentation. This presentation will be used by members of the advisory group to inform other partners and colleagues as they see fit. The advisory group identified three initial targets for this presentation: (1) the Inter-agency Resource Team (IRT) – a collaborative designed to improve agency coordination; (2) the Western Governors’Association and (3) county governments (a particularly important target given the absence of county representatives from the advisory group and the opportunities that exist for mitigation dollars through the Federal Highways Transportation Enhancement Fund).1

1 We invited the Montana Association of Counties (MACO) to participate in the advisory group at the request of Montana Fish, Wildlife and Parks. MACO did not respond to the invitation.
5.4 Future Directions for Improvement

In guiding the development of this assessment, the advisory group identified several improvements that would enhance the transportation/wildlife mitigation planning process:

1. **Improved road kill database**: There is a need to re-design the collection and management of road kill data throughout Montana. Currently, the MT Department of Transportation controls this database, but other agencies including the U.S. Fish and Wildlife Service and MT Fish, Wildlife and Parks also collect road kill data. However, no standardized approach or centralized database exists. To this end, the advisory group committed to facilitating such a project using Idaho and other states with centralized databases as examples.

2. **State-wide assessment**: This assessment focused solely on transportation routes in western Montana, but there is a need to expand it to the state-wide scale. Montana Fish, Wildlife and Parks’ Crucial Areas and Connectivity Assessment includes a transportation risk assessment which could serve as a foundation for applying the approach in this assessment state-wide. To this end, the advisory group examined the potential for expanding the methods used in this assessment to all of Montana. Recommendations for expanding the project include: (a) developing a collective road kill database to fill in the gaps in MDT’s current dataset and (b) inclusion of threatened, endangered and sensitive species in the road kill database.

5.5 Chapter Summary

**Advisory Group Commitments:**

1. Form a wildlife linkage and transportation safety committee to sustain the collaboration and momentum generated by this project and ensure follow-through on goals and objectives identified by the advisory group;
2. Review the results of this assessment and complete a collaborative capacity analysis to determine priorities and next steps;
3. Disseminate the data and results of this assessment to partners and colleagues to facilitate mitigation and the incorporation of wildlife movement information into the transportation planning process;
4. Facilitate development of an inter-agency, centralized road kill database for Montana.

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2 For details on Idaho's roadkill database model, see the Idaho Fish and Game Wildlife Collisions website: [fishandgame.idaho.gov/cms/wildlife/manage_issues/collision](http://fishandgame.idaho.gov/cms/wildlife/manage_issues/collision)
CHAPTER 6: OVERARCHING RECOMMENDATIONS

Below is a summary of the overarching recommendations stemming from this report.

Setting Priorities
1. Members of the advisory group and subsequent wildlife linkage and transportation safety committee should use this report as a foundation for setting collective transportation and wildlife mitigation priorities. Ideally, this step should take place shortly after publication of this assessment.

2. The advisory group and subsequent wildlife linkage and transportation safety committee should establish collaborative commitments and goals for decreasing road kill, improving human safety and maintaining wildlife linkage within agreed upon priority areas.

Assessment Improvement
3. Standardize agency-based road kill collection methods. The most effective way to accomplish this would be to equalize the effort of carcass collection across highways as some roads are driven more than others by highway maintenance crews. As an initial step, Montana Department of Transportation (MDT) could mandate carcass reporting. Use of GPS data collection tools would facilitate this process as well as improve the spatial accuracy of the data.

4. Create a cooperative, inter-agency road kill database. In addition to relieving MDT from the sole responsibility of road kill reporting, an inter-agency effort would help improve road kill reporting for more sensitive species, which fall under the jurisdiction of MT Fish, Wildlife and Parks (MTFWP) and US Fish and Wildlife Service. We recommend initiating this as soon as possible so as to coincide with recommendation #5 (below). We suggest referencing the cooperative model set up by Idaho’s Transportation Department and Department of Fish and Game: fishandgame.idaho.gov/cms/wildlife/manage_issues/collision.

5. Redo data analysis and update this report within the next five years to capture changes on the landscape and take advantage of improved data. In addition to incorporating updates to the road kill database, we suggest this process incorporate empirical data for select sensitive species that may represent particular conservation values.

6. Expand the analysis to the entire state of Montana to better meet state agency wildlife and highway management needs. For this process, we recommend using MTFWP’s Crucial Areas and Connectivity Assessment rather than American Wildlands’ Priority Linkage Assessment for two important reasons: (a) the MTFWP assessment is state-wide and (b) the MTFWP assessment is endorsed by the state and may receive broader support from the conservation community as a result.

7. Use the added opportunity land ownership conservation potential analysis to help target future state transportation improvement program projects. Reclassification of the
land ownership values may be appropriate depending on the interests of the user. For example, Potential Project Areas completely surrounded by private lands may offer significant added opportunities for mitigation projects given appropriate land use planning. In such a situation, county planning offices or private lands interest groups may want to re-rank land ownership values with a high ranking for private land values to represent the potential for private lands conservation.

Use of Products

8. Take advantage of the data provided in this report. Maps, tables and summaries are provided in the Appendices. GIS data layers are available for download from: wildlands.org. Please feel free to contact American Wildlands with any questions or to schedule a presentation on Wildlife Highway Mortality and Linkage in Western Montana (see Contact List at beginning of report).

9. The advisory group and subsequent wildlife linkage and transportation safety committee should consider committing funds to incorporate this and other/future datasets (including MTFWP’s Crucial Areas and Connectivity Assessment) into public information services such as the Montana State Library and the Natural Resources Information Service in the form of an interactive data and map server.
CHAPTER 7: LITERATURE CITED


APPENDIX A: TERMS AND CONDITIONS

Report Disclaimer:
The information contained within this report is the result of a joint effort by American Wildlands and the advisory group assembled to guide the development of this assessment. We compiled this report as a guide to help wildlife managers and land use planners identify and prioritize potential mitigation project areas that exhibit a high incidence of wildlife-vehicle collisions, but also have value as wildlife linkage. We recommend that users of this report corroborate the information and results contained herein with a qualified, third-party source. The user shall assume full responsibility for the misinterpretation or re-use of the report information. The user of this information shall indemnify and hold free American Wildlands and advisory group members from any and all liabilities, damages, lawsuits and causes of action that may result as a consequence of his/her reliance on information provided herein or from any misinterpretation or manipulation of the data herein.

GIS Data Disclaimer:
In assembling this report, American Wildlands compiled a variety of digital information available to the user. As with the information and results reported in the assessment, this digital information is meant as a guide and should be corroborated with a qualified, third-party source by all users. The user shall assume full responsibility for the misinterpretation or manipulation of the data. The user of this information shall indemnify and hold free American Wildlands, the Montana Department of Transportation (MDT) and the State of Montana from any and all liabilities, damages, lawsuits and causes of action that may result as a consequence of his/her reliance on information provided herein or from any misinterpretation or manipulation of the data.

The information provided by MDT is not a comprehensive record of all possible animal-vehicle collision incidents in western Montana. The MDT Animal Incident Reporting System is a voluntary, opportunistic collection and reporting system and may not capture the full volume of wildlife collisions that occur along Montana’s highways. Montana Department of Transportation provided the data contained within this assessment in response to a request. Therefore, the accuracy and/or statistical validity of the data cannot be guaranteed.

Furthermore, this data is not intended to, and does not create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by a party against the United States, the State of Montana, their agencies, their officers, or any person.

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1 Modified with the help from MT Department of Transportation legal staff. Based on language available at the AZ Department of Transportation and State of Arizona Wildlife Linkage website.
APPENDIX B: GIS DATA PRODUCT LIST AND DESCRIPTION

The GIS data contained within this assessment is available for download from American Wildlands website (wildlands.org) and the Natural Resource Information System (NRIS) website (nris.mt.gov/gis). See associated metadata for details regarding each data layer listed below. For agencies and organizations, other than financially supporting advisory group members, copies of the data layers are also available with the report on CD for a fee.

1. Road kill point events (1 layer): This layer depicts the point locations of select animal carcasses found on state maintained routes in western Montana. In November 2008, American Wildlands spatially referenced the tabular data reported by the maintenance division of the Montana Department of Transportation from January 2003 through December 2007. Species of interest included in the dataset are: antelope, bighorn sheep, bison, black bear, bobcat, deer, elk, fox, grizzly bear, moose, mountain goat, mountain lion, mule deer, whitetail deer, and wolf.

2. Elevated Concentration Areas of road kill (1 layer): This polygon layer represents locations in western Montana that have relatively high concentrations of road kill for select species of interest compared to all other locations in western Montana. The maintenance division of the Montana Department of Transportation collected the raw road kill data used in this layer between January 2003 and December 2007. We used three separate analyses to assess road kill concentrations for ungulate species, focal species and focal carnivore species. Species groups are not mutually exclusive, thus certain road kill events were included in more than one species group analysis. Thus we advise caution when interpreting a map of this data. It is important to recognize that the results of these three independent analyses should not be combined since some features will be represented more than once across analyses. Furthermore, the dataset comprising the “focal carnivores” group is particularly small (n=166) making it difficult to draw conclusive results from this particular analysis.

3. Priority Linkage Assessment (1 layer): In 2007, American Wildlands (Bozeman, MT) initiated a “Priority Linkage Assessment” (PLA) through which we have identified, cataloged and prioritized the threats to, and opportunities for, maintaining connectivity in the western Montana. American Wildlands interviewed wildlife movement and connectivity experts from state and federal agencies as well as independent biologists with proven knowledge of wildlife movement patterns. This data layer contains the major prioritized linkages, associated species of concern, and a field that distinguishes which linkages are used for seasonal movement. American Wildlands prioritized each linkage based on ecological quality, conservation threat, and conservation opportunity. For the complete methodology of the Priority Linkage Assessment, please see our Priority Linkage Assessment Reports at wildlands.org.
4. **Ranked STIP (1 layer):** This polygon layer represents those Statewide Transportation Improvement Program (STIP) projects located in western Montana for 2008-2012 surrounded by a one-mile buffer. Relevant attributes available through the data set include: project identification number, transportation route number, project name, project scope, project type. Some records may have more than one project listed due to overlap created by the one-mile buffer zone.

5. **Land Ownership Conservation Potential (1 layer):** This polygon layer illustrates the relative potential of unique land ownership types in western Montana to facilitate highway mitigation and address wildlife connectivity and human safety issues. Features represent land parcels classified according to ownership type derived from the Montana Natural Heritage Program (MTNHP) data (2005) and updated with data from the Nature Conservancy and MTNHP (2008).

6. **Potential Project Areas (1 layer):** This polygon layer identifies areas where important wildlife linkages overlap with elevated concentrations of road kill in western Montana. In separate analyses, we also examined the ability of Montana’s Statewide Transportation Improvement Program and the conservation potential of land ownership types surrounding our identified Potential Project Areas to facilitate mitigation efforts in these areas. Each separate analysis resulted in a distinct prioritization of Potential Project Areas. In a separate section, American Wildlands also conducted an internal analysis of Potential Project Areas, which included all of the above criteria, to identify internal priorities and program direction.
APPENDIX C: MAPS AND TABLES

C-2.1. Western Montana priority wildlife linkage areas as identified in American Wildlands’ 2007-2008 Priority Linkage Assessment. Details regarding the methods and results of the Priority Linkage Assessment can be found on American Wildlands’ website: (wildlands.org).
APPENDIX C: MAPS AND TABLES

Priority Linkage Assessment (PLA) and Elevated Concentration Areas (ECA)

C-2.2. Overlay of Priority Linkage Areas (very high to very low) with elevated concentration areas (ECA) of road kill (ungulate and focal species only). Although focal carnivore ECA results are displayed on map, they were not used in identifying the Potential Project Areas. See Chapters 1 and 2 for details.
APPENDIX C: MAPS AND TABLES

C-2.3. Potential Project Areas based on overlap between elevated concentration areas (ECA) of road kill and very high/high wildlife priority linkage areas. Within the PPA categories, Class A = highest priority project areas, Class B = mid-level priority and Class C = lower-level priority. For details on this ranking see Chapter 2, Figure 2.4. Additional details for individual Potential Project Areas may be found in Appendix C-4.1 and Appendix D.

1 Elevated concentration areas of road kill are based on ungulate and focal species subgroups only. Although illustrated in this map, intermediate, low and very low priority linkages were not included in the analysis.
APPENDIX C: MAPS AND TABLES

C-3.1. Added opportunity rankings for Potential Project Areas (PPA) based on ranked State Transportation Improvement Program (STIP) projects. AO-S I and AO-S II Potential Project Areas have some form of transportation project planned; PPA in AO-S I have a relatively higher ease of adding wildlife mitigation than AO-S II. Potential Project Areas in AO-S III have little or no transportation projects planned in or within one mile of the area. For a detailed explanation of the added opportunity rankings and the STIP project scope value, see Chapter 3. For details on each PPA identified in this map see Appendix C-4.1 and Appendix D.
C.3.2. Added opportunity rankings for Potential Project Areas (PPA) based on land ownership conservation potential (LOCP). AO-L I PPA had the highest potential for wildlife mitigation projects based on surrounding land ownership. AO-L II and AO-L III project areas had relatively less potential for incorporating wildlife mitigation into transportation projects. For a detailed explanation of the LOCP added opportunity rankings see Chapter 3. For details on each PPA identified in this map, see Appendix C-4.1 and Appendix D.
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**Abbreviations for Conservation Areas, for use in referring to Priority Linkage Areas reports:**
- CP: Cabinet Purcells
- CC: Crown of the Continent
- Hub: The Hub
- HD: High Divide

**Chapter 4: C-4.1 Potential Project Area (PPA) details**
- This table includes cumulative data from Chapters 1, 2, 3 and 4 on road kill concentration areas (ECA) of road kill, priority linkage areas (PLA), State Transportation Improvement Program (STIP) projects and land ownership conservation potential (LOCP) analyses.
- Also included are American Wildlands’ internal priorities for each PPA. This table complements the report maps and Table 1.1 (Wildlife Highway Mortality and Linkage Assessment: A Prioritization and Planning Tool for Western Montana).
### APPENDIX C: MAPS AND TABLES

#### Chapter 2: Case Study

#### Chapter 3: Case Study

#### Case Study 1

<table>
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#### Case Study 3

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C-1.4. Elevated concentration area (ECA) details (all subgroups). Data includes ECA-10 subgroup name, number of road kill, density of road kill per mile, transportation route name (see Appendix C-1.5 for the equivalent MDT route ID number), length of road segment and start/end mile markers. For ECA that included more than one route (i.e., two routes intersected or closely paralleled each other), details on the second route are also provided. For more details on this analysis, see Chapter 1.

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C-1.5. Cross reference for Appendix tables C-1.4 & C-4.1. Table provides Common Route Name with Montana Department of Transportation’s Route ID#.

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APPENDIX C: MAPS AND TABLES

C-1.1. Elevated concentration areas (ECA) for the ungulate subgroup. Data were derived from the 2003-2007 Montana Department of Transportation animal carcass dataset using a kernel density estimate in ArcGIS 9.2. To determine the final ECA, we chose the top 15% of values using a percent volume contour. For full details, see Chapter 1.
APPENDIX C: MAPS AND TABLES

Focal Species Road Kill Elevated Concentration Areas (ECA)

- Focal Species ECA
- ECA ID #
- MT Routes

C-1.2. Elevated concentration areas (ECA) for the focal species subgroup. Data were derived from the 2003-2007 Montana Department of Transportation animal carcass dataset using a kernel density estimate in ArcGIS 9.2. To determine the final ECA, we chose the top 15% of values using a percent volume contour. For full details, see Chapter 1.
C-1.3. Elevated concentration areas (ECA) for the focal carnivore subgroup. Data were derived from the 2003-2007 Montana Department of Transportation animal carcass dataset using a kernel density estimate in ArcGIS 9.2. To determine the final ECA, we chose the top 15% of values using a percent volume contour. For full details, see Chapter 1.
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Potential Project Area: PPA 1

ECA ID: 60

Associated Transportation Routes: U.S. Highway 2

Mile Marker: 60.2-61.9

Ecological Information: PPA-1 lies within the Lost Trail-Kenelty linkage (see American Wildlands’ Cabinet-Purcell Priority Linkage Assessment). Regionally, this large linkage area connects the Northern Continental Divide Ecosystem and the Cabinet-Yaak Ecosystem. On a smaller scale, Lost Trail-Kenelty links the Salish Range to the Cabinet Mountains. Natural funnels and ridge systems make this linkage area a geographically important movement corridor for species such as mule deer, whitetail deer, elk, wolves, black bear, grizzly bear, mountain lion, lynx, fisher, and moose.

Number of Road Kill Records: 69 (40.6/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L II. Fifty-nine percent of the land within this linkage falls into the highest LOCP category. Of this, approximately 35% scored the highest value ranking, which means these lands are already under protection in the form of conservation easement, national parks, wilderness areas, or wildlife refuges. The remaining 24% of the lands with high conservation potential are owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
ECA 60 - Ungulate
Avg 40.6 Kill/Mi
Lost Trail-Kenelty Linkage Area

Kootenai Nat'l Forest
Lincoln Co

The GIS Lab at American Wildlands - BJB Aug, 2009
Potential Project Area: PPA 2

ECA ID: 59

Associated Transportation Routes: Montana Highway 83

Mile Marker: 45.2-46.6

Ecological Information: PPA-2 lies within the Swan Valley linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which connects the Swan Range and Mission Mountains. Regionally, this area links the Bob Marshall Wilderness complex with the Mission Mountains wilderness areas, and provides north-south connectivity between the Northern Continental Divide, Salmon-Selway and Greater Yellowstone ecosystems. The Swan Valley linkage functions as both a wildlife corridor and habitat for carnivores and ungulates, and is one of the highest ranked corridors in the PLA. Important species using this connection include grizzly bear, black bear, elk, deer, lynx, wolves, whitetail deer, mountain lion, turkeys, bull trout, wolverine, and fisher

Number of Road Kill Records: 60 (42.9/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; Resurfacing

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Approximately 70% of the land falls into the highest land ownership conservation potential category. Of this, nearly 40% is already protected in conservation easements, national parks, wilderness areas, or wildlife refuges and 30% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 3

ECA ID: 58

Associated Transportation Routes: Montana Highway 83

Mile Marker: 41.0-43.2

Ecological Information: PPA-3 falls within the Swan Valley linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which connects the Swan Range and Mission Mountains. Regionally, this area links the Bob Marshall Wilderness complex with the Mission Mountains wilderness areas, and provides north-south connectivity between the Northern Continental Divide, Salmon-Selway and Greater Yellowstone ecosystems. The Swan Valley linkage functions as both a wildlife corridor and habitat for carnivores and ungulates, and is one of the highest ranked corridors in the PLA. Important species using this connection include grizzly bear, black bear, elk, deer, lynx, wolves, whitetail deer, mountain lion, turkeys, bull trout, wolverine, and fisher.

Number of Road Kill Records: 106 (48.2/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; Resurfacing

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Approximately 41% of the land in this PPA falls into the highest land ownership conservation potential category. Of this, 21% is already protected in conservation easements, national parks, wilderness areas, or wildlife refuges, and over 20% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 4

ECA ID: 56

Associated Transportation Routes: Interstate 90


Ecological Information: PPA-4 falls within the Haugan linkage (see American Wildlands’ Cabinet-Purcells Priority Linkage Assessment) along Interstate 90, which bisects the linkage area. The Haugan linkage connects the Bitterroot Mountains to the south with the Coeur d’Alene Mountains to the north and is important for elk, moose, black bear, lynx, mule deer, whitetail deer and potentially grizzly bear. On a regional scale, this linkage could be the southernmost connection between the Cabinet-Yaak and Salmon-Selway ecosystems.

Number of Road Kill Records: 65 (19.1/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Almost 38% of the land falls into the highest land ownership conservation potential category, of which 100% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Wildlife Highway Mortality and Linkage Assessment: A Prioritization and Planning Tool for Western Montana

November 2009

ECA 56 - Ungulate
Avg 19.1 Kill/Mi
Haugan Linkage Area

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Potential Project Area
△ Wildlife Post
○ Existing Bridges

Land Ownership Conservation Potential
Relative Importance
1. MT DOC, City Govt
2. US DCD, Local Govt
3. Private, Army Corp of Engineers
4. US Bureau of Reclamation, Tribal Lands
5. Bureau of Indian Affairs
6. DNRC, State Trust Lands
7. USFWS, US BLM, MT Fish, Wildlife, and Parks
8. Rocky Mt Ed Foundation

MVT Planned Improvements
STIP Project (2008-2012) Scope Value
☐ No Data
1. Resurfacing
2. Restoration
3. Safety
4. Minor Bridge Rehabilitation
5. Minor Rehab and Roadway Safety
6. Major Rehab w/o added Capacity
7. Major Bridge Rehabilitation
8. Reconstruction
9. Bridge Replacement and New Construction

Roadkill (2003-2007)
1 - 3
4 - 8
9 - 18
19 - 42

November 2009
Potential Project Area: PPA 5

ECA ID: 82

Associated Transportation Routes: Interstate 90

Mile Marker: 21.0-22.7

Ecological Information: PPA-5 falls within the Haugan linkage (see American Wildlands’ Cabinet-Purcells Priority Linkage Assessment) along Interstate 90, which bisects the linkage area. The Haugan linkage connects the Bitterroot Mountains to the south with the Coeur d’Alene Mountains to the north and is important for elk, moose, black bear, lynx, mule deer, whitetail deer and potentially grizzly bear. On a regional scale, this linkage could be the southernmost connection between the Cabinet-Yaak and Salmon-Selway ecosystems.

Number of Road Kill Records: 8 (4.7/mi)

Road Kill Species Subgroup: Focal Species

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Seventy-two percent of the land in this project area falls into the highest land ownership conservation potential category, of which 100% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 6

ECA ID: 55

Associated Transportation Routes: U.S. Highway 93

Mile Marker: 37.2-38.4

Ecological Information: PPA-6 occurs within the Ninepipes linkage (see American Wildlands’ Cabinet-Purcell Priority Linkage Assessment), located in the Mission Valley of northwestern Montana. The Ninepipes linkage provides connectivity between the Mission Mountains Wilderness to the east and the Salish Mountains, Moise Hills, and Flathead River to the west and encompasses the Ninepipe Wildlife Refuge, Ninepipe Wildlife Management Area, and the Ninepipe and Kicking Horse Reservoirs. Unfortunately, Highway 93 and the Montana Rail Link bisect this area.

Number of Road Kill Records: 58 (44.6/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): PPA- received an LOCP added opportunity rank of AO-L III. A little over one percent of the land in this PPA falls into the highest land ownership conservation potential category and is entirely protected in conservation easement, national parks, wilderness areas, or wildlife refuges.
ECA 55 - Ungulate
Avg 44.6 Kill/Mi
Ninepipes Linkage Area

The GIS Lab at American Wildlands - BJB Aug, 2009

Potential Project Area
Maplepost
Existing Bridges

* LAND OWNERSHIP & CONSERVATION POTENTIAL
  1. MT DOC, City Govt
  2. US DOD, Local Govt
  3. Private, Army Corp of Engineers
  4. US Bureau of Reclamation, Tribal Lands
  5. Bureau of Indian Affairs
  6. DNRC, State Trust Lands
  7. USFL, US BLM, MT Fish, Wildlife, and Parks
  8. Rocky Mt’s Ed Foundation

PPA 6
Missoula
Kalispell
Bozeman

November 2009
Potential Project Area: PPA 7

ECA ID: 51

Associated Transportation Routes: Interstate 90; X-31203

Mile Marker: I-90: 38.3-39.7, X-31203: 0.8-2.0

Ecological Information: PPA-7 falls within the Superior linkage (see American Wildlands’ Cabinet-Purcell Priority Linkage Assessment), located in the Clark Fork River Valley. This area links the Bitterroot Range with the Nine Mile Divide. Major threats to the region include rapid development and subdivision, Interstate 90, a railroad and a major power line. This linkage is particularly important as a movement corridor for black bear, elk, deer, lynx, wolverine, wolves, with a high potential for grizzly bear.

Number of Road Kill Records: 52 (20.0/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes; two focal carnivore species were killed two miles to the northwest of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S II; Restoration/rehabilitation planned in 2009

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L II. Fifty seven percent of the land in this PPA falls into the highest land ownership conservation potential category. All of the land ranked an “8”, which indicates land owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 8

ECA ID: 50

Associated Transportation Routes: Interstate 90; X-31007

Mile Marker: I-90: 45.3-46.2, X-31007: 0.7-1.4

Ecological Information: PPA-8 lies within the Superior linkage (see American Wildlands’ Cabinet-Purcell Priority Linkage Assessment), located in the Clark Fork River Valley. This area links the Bitterroot Range with the Nine Mile Divide. Major threats to the region include rapid development and subdivision, Interstate 90, a railroad and a major power line. This linkage is particularly important as a movement corridor for black bear, elk, deer, lynx, wolverine, wolves, with a high potential for grizzly bear.

Number of Road Kill Records: 38 (23.8/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S I; Major bridge rehabilitation

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Nearly 41% percent of the land in this PPA falls into the highest land ownership conservation potential category, of which 100% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Wildlife Highway Mortality and Linkage Assessment: A Prioritization and Planning Tool for Western Montana

ECA 50 - Ungulate
Avg 23.8 Kill/Mi
Superior Linkage Area

Potential Project Area
Milepost
Existing Bridges

Land Ownership/Conservation Potential
Relative Importance:
1 MT DOT, City Gov't
2 US DOD, Local Gov't
3 Private, Army Corp of Engineers
4 US Bureau of Reclamation, Tribal Lands
5 Bureau of Indian Affairs
6 DNRC, State Trust Lands
7 USFS, US BLM, MFT Fish, Wildlife, and Parks
8 Rocky Mt Elk Foundation
9 Easements, Land Trusts, US FWS

MDT Planned Improvements
STIP Project (2009-2012) Scope Value
No Data
1 Resurfacing
2 Restoration
3 Safety
4 Minor Bridge Rehabilitation
5 Minor Rehab and Rodway Safety
6 Major Rehab w/o added Capacity
8 Major Bridge Rehabilitation
9 Reconstruction
10 Bridge Replacement and New Construction

Roadkill (2003-2007)

November 2009
Potential Project Area: PPA 9

ECA ID: 59

Associated Transportation Routes: Interstate 90; S-257

Mile Marker: I-90: 48.6-49.5, S-257: 1.1-2.0

Ecological Information: PPA-9 lies within the Superior linkage (see American Wildlands’ Cabinet-Purcell Priority Linkage Assessment), located in the Clark Fork River Valley. This area links the Bitterroot Range with the Ninemile Divide. Major threats to the region include rapid development and subdivision, Interstate 90, a railroad and a major power line. This linkage is particularly important as a movement corridor for black bear, elk, deer, lynx, wolverine, wolves, with a high potential for grizzly bear.

Number of Road Kill Records: 45 (23.7/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S I; Major bridge rehabilitation

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Just over 26% of the land in this PPA falls into the highest land ownership conservation potential category and is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
PPA: PPA 10

ECA ID: 46

Associated Transportation Routes: Montana Highway 83

Mile Marker: 6.8-8.7

Ecological Information: PPA-10 occurs within the Blackfoot-Clearwater linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which encompasses the Blackfoot-Clearwater Wildlife Management Area and offers regional connectivity between several mountain ranges including the Garnets, Rattlesnakes, Missions, and Bob Marshall Wilderness. Major conservation threats to this region include residential development, agricultural development and Highways 83 and 200, which pass directly through the linkage. A variety of species including grizzly bear, elk, deer, wolves, mountain lions, black bear and lynx use this area as both a movement corridor and habitat.

Number of Road Kill Records: 84 (44.2/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, 2 focal carnivore species were killed three miles to the northwest of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L II. Nearly 56% of the land in this PPA falls into the highest land ownership conservation potential category. Of this, just over 1% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges and nearly 55% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 11

ECA ID: 45

Associated Transportation Routes: Montana Highway 83

Mile Marker: 3.5-4.4

Ecological Information: PPA-11 occurs within the Blackfoot-Clearwater linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which encompasses the Blackfoot-Clearwater Wildlife Management Area and offers regional connectivity between several mountain ranges including the Garnets, Rattlesnakes, Missions, and Bob Marshall Wilderness. Major conservation threats to this region include residential development, agricultural development and Highways 83 and 200, which pass directly through the linkage. A variety of species including grizzly bear, elk, deer, wolves, mountain lions, black bear and lynx use this area as both a movement corridor and habitat.

Number of Road Kill Records: 40 (44.4/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, two focal carnivore species were killed five miles to the north of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L II. Nearly 50% of the land within this PPA falls into the highest land ownership conservation potential category and is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Wildlife Highway Mortality and Linkage Assessment: A Prioritization and Planning Tool for Western Montana

ECA 45 - Ungulate
Avg 44.4 Kill/Mi
Blackfoot-Clearwater Linkage Area

Potential Project Area
△ Milepost
○ Existing Bridges

Land Ownership Conservation Potential
- 2 MT DOC, City, Gov't
- 3 US DOD, Local Gov't
- 4 Private, Army Corp of Engineers
- 5 US Bureau of Reclamation, Tribal Lands
- 6 Bureau of Indian Affairs
- 7 DNRC, State Trust Lands
- 8 USFS, US BLM, US Fish, Wildlife, and Parks
- 9 Rocky Mt Elk Foundation
- 10 Easements, Land Trusts, US FWS

MDT Planned Improvements
STIP Project (2009-2012) Scope Value
☐ No Data
- 1 Resurfacing
- 2 Restoration
- 3 Safety
- 4 Minor Bridge Rehabilitation
- 5 Minor Rehab and Roadway Safety
- 6 Major Rehab w/o added Capacity
- 8 Major Bridge Rehabilitation
- 9 Reconstruction
- 10 Bridge Replacement and New Construction

Roadkill (2003-2007)
○ 1 - 5
△ 4 - 8
+ 9 - 18
□ 19 - 42

The GIS Lab at American Wildlands - BJB Aug, 2009

November 2009
Potential Project Area: PPA 12a

ECA ID: 44

Associated Transportation Routes: Montana Highway 83 and 200

Mile Marker: MT 200: 33.4-34.8

Ecological Information: PPA-12a lies within the Blackfoot-Clearwater linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which encompasses the Blackfoot-Clearwater Wildlife Management Area and offers regional connectivity between several mountain ranges including the Garnets, Rattlesnakes, Missions, and Bob Marshall Wilderness. Major conservation threats to this region include residential development, agricultural development and Highways 83 and 200, which pass directly through the linkage. A variety of species including grizzly bear, elk, deer, wolves, mountain lions, black bear and lynx use this area as both a movement corridor and habitat.

Number of Road Kill Records: 57 (40.7/mi)

Road Kill Species Subgroup: Ungulate and Focal Species

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S II; Roadway roadside safety improvement

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Just over 79% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, approximately 45% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges while 34% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.

Potential Project Area: PPA 12b

ECA ID: 68

Associated Transportation Routes: Montana Highway 83 and 200

Mile Marker: MT 200: 32.3-34.8, MT 83: 0.4-2.1

Ecological Information: PPA-12b occurs within the Blackfoot-Clearwater linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which encompasses the Blackfoot-Clearwater Wildlife Management Area and offers regional connectivity between several mountain ranges including the Garnets, Rattlesnakes, Missions, and Bob Marshall Wilderness. Major conservation threats to this region include residential development, agricultural development and Highways 83 and 200, which pass directly through the linkage. A variety of species including grizzly bear, elk, deer, wolves, mountain lions, black bear and lynx use this area as both a movement corridor and habitat.

Number of Road Kill Records: 28 (6.7/mi)

Road Kill Species Subgroup: Ungulate and Focal Species

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S II; Roadway roadside safety improvement

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Just over 79% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, approximately 45% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges while the remaining 34% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
ECA 44, 68 - Ungulate & Focal

Avg 40.7, 6.7 Kill/Mi
Blackfoot-Clearwater Linkage Area

Potential Project Area
Milepost
Existing Bridges

Land Ownership Conservation Potential
Relative Importance
1 MT D.O.C. City Gov't
2 U S D.O.D. Local Gov't
3 Private, Army Corp of Engineers
4 US Forest Service
5 US Bureau of Reclamation, Tribal Lands
6 Bureau of Indian Affairs
7 MFC, State Trust Lands
8 USFS, US BLM, MT Fish, Wildlife, and Parks
9 Rocky Mtn Elk Foundation
10 Easements, Land Trusts, US FWS

MDT Planned Improvements
STIP Project (2008-2012) Scope Values

Roadkill (2003-2007)

November 2009
Potential Project Area: PPA 13

ECA ID: 68

Associated Transportation Routes: Montana Highway 83 and 200

Mile Marker: MT 200: 32.3-34.8, MT 83: 0.4-2.1

Ecological Information: PPA-13 occurs within the Blackfoot-Clearwater linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment), which encompasses the Blackfoot-Clearwater Wildlife Management Area and offers regional connectivity between several mountain ranges including the Garnets, Rattlesnakes, Missions, and Bob Marshall Wilderness. Major conservation threats to this region include residential development, agricultural development and Highways 83 and 200, which pass directly through the linkage. A variety of species including grizzly bear, elk, deer, wolves, mountain lions, black bear and lynx use this area as both a movement corridor and habitat.

Number of Road Kill Records: 28 (6.7/mi)

Road Kill Species Subgroup: Focal Species

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S II; Roadway roadside safety improvement

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Nearly 68% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, 27% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges and 41% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 14

ECA ID: 89

Associated Transportation Routes: Montana Highway 200

Mile Marker: 78.0-79.0

Ecological Information: PPA-14 occurs within the Lincoln linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment) – a key stepping stone connecting the Bob Marshall Wilderness complex in the Northern Continental Divide ecosystem with Rocky Mountain Front and the Salmon-Selway and Greater Yellowstone Ecosystems. Major threats to the area for wildlife include increasing urban and agricultural development as well as Highway 200. This linkage supports connection to white-tailed deer winter range and between core areas of lynx habitat. In addition, grizzly bears, mountain lions, mountain goats, bighorn sheep, and moose use this linkage.

Number of Road Kill Records: 6 (6.0/mi)

Road Kill Species Subgroup: Focal Species

Presence of Focal Carnivore High Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Just over 17% of the land within this PPA falls into the highest land ownership conservation potential category and is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 15

ECA ID: 43

Associated Transportation Routes: Montana Highway 200

Mile Marker: 66.5-70.0

Ecological Information: PPA-15 occurs within the Lincoln linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment) – a key stepping stone connecting the Bob Marshall Wilderness complex in the Northern Continental Divide ecosystem with Rocky Mountain Front and the Salmon-Selway and Greater Yellowstone Ecosystems. Major threats to the area for wildlife include increasing urban and agricultural development as well as Highway 200. This linkage supports connection to white-tailed deer winter range and between core areas of lynx habitat. In addition, grizzly bears, mountain lions, mountain goats, bighorn sheep, and moose use this linkage.

Number of Road Kill Records: 140 (40.0/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, two focal carnivore species were killed two miles west of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Forty-six percent of the land within this PPA falls into the highest land ownership conservation potential category. Of this, 31% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges, while about 15% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.
Potential Project Area: PPA 16a

ECA ID: 41

Associated Transportation Routes: Montana Highway 200

Mile Marker: 59.2-61.7

Ecological Information: PPA-16a occurs within the Lincoln linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment) – a key stepping stone connecting the Bob Marshall Wilderness complex in the Northern Continental Divide ecosystem with Rocky Mountain Front and the Salmon-Selway and Greater Yellowstone Ecosystems. Major threats to the area for wildlife include increasing urban and agricultural development as well as Highway 200. This linkage supports connection to white-tailed deer winter range and between core areas of lynx habitat. In addition, grizzly bears, mountain lions, mountain goats, bighorn sheep, and moose use this linkage.

Number of Road Kill Records: 80 (32.0/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, five focal carnivore species were killed four miles northwest of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Approximately 83% of the land in this PPA falls into the highest land ownership conservation potential category. Of this, about 20% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges and about 63% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management, or the U.S. Forest Service.

Potential Project Area: PPA 16b

ECA ID: 42

Associated Transportation Routes: Montana Highway 200

Mile Marker: 57.3-59.1

Ecological Information: PPA-16b occurs within the Lincoln linkage (see American Wildlands’ Crown of the Continent Priority Linkage Assessment) – a key stepping stone connecting the Bob Marshall Wilderness complex in the Northern Continental Divide ecosystem with Rocky Mountain Front and the Salmon-Selway and Greater Yellowstone Ecosystems. Major threats to the area for wildlife include increasing urban and agricultural development as well as Highway 200. This linkage supports connection to white-tailed deer winter range and between core areas of lynx habitat. In addition, grizzly bears, mountain lions, mountain goats, bighorn sheep, and moose use this linkage.

Number of Road Kill Records: 77 (45.3/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, five focal carnivore species were killed four miles northwest of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Nearly 83% of the land in this PPA falls into the highest land ownership conservation potential category. Of this, about 20% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges while Montana Fish, Wildlife and Parks, the Bureau of Land Management and the U.S. Forest Service own the remaining 63%.
ECA 41, 42 - Ungulate

Avg 32.0, 45.3 Kill/Mi
Lincoln
Linkage Area

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PPA: PPA 17

ECA ID: 40

Associated Transportation Routes: U.S. Highway 93

Mile Marker: 87.5-90.3

Ecological Information: PPA-17 occurs within the Lower Bitterroot linkage (see American Wildlands’ Cabinet-Purcell Priority Linkage Assessment), an important connection for wildlife attempting to avoid Missoula’s fracture zone. This area provides critical connectivity between the Northern Continental Divide and Salmon-Selway ecosystems, but is also threatened by fragmentation from subdivision, development and Highway 93.

Number of Road Kill Records: 128 (44.1/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore High Concentration Area: Yes, four focal carnivore species were killed four miles south of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Just over 19% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, about 4% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges while Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service owns about 15%.
Potential Project Area: PPA 18

ECA ID: 40

Associated Transportation Routes: U.S. Highway 93

Mile Marker: 87.5-90.3

Ecological Information: PPA-18 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 128 (44.1/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, five focal carnivore species were killed three miles south of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Approximately 33% of the land in this PPA falls into the highest land ownership conservation potential category. Of this, almost 10% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges, and Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service owns the remaining 23%.
Potential Project Area: PPA 19

ECA ID: 70

Associated Transportation Routes: U.S. Highway 12

Mile Marker: 8.5-10.8

Ecological Information: PPA-19 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 18 (7.8/mi)

Road Kill Species Subgroup: Focal Species

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L I. Just over 90% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, about 38% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges while Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service owns the remaining 53%.
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ECA 70 - Focal

Avg 7.8 Kill/Mi
Lolo to Turah Linkage Area

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Potential Project Area: PPA 20

ECA ID: 39

Associated Transportation Routes: U.S. Highway 12 and 93

Mile Marker: U.S. 12: 31.7-32.6, U.S. 93: 81.8-84.0

Ecological Information: PPA-20 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 116 (36.2/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: Yes, four focal carnivore species were killed two and one half miles north of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Nearly 4% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, 3% is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges and Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service owns the remaining 1%.
Potential Project Area: PPA 21

ECA ID: 38

Associated Transportation Routes: U.S. Highway 93

Mile Marker: 77.8-79.0

Ecological Information: PPA-21 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 50 (41.7/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Just over 2% of the land within this PPA falls into the highest land ownership conservation potential category and is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges.
Wildlife Highway Mortality and Linkage Assessment: A Prioritization and Planning Tool for Western Montana

ECA 38 - Ungulate
Avg 41.7 Kill/Mi
Lolo to Turah
Linkage Area

The GIS Lab at American Wildlands - BBJ Aug, 2009

Potential Project Area
● Milepost
● Existing Bridges

Land Ownership Conservation Potential
Relative Importance:
1. MT DOC, City Gov't
2. US DOC, Federal Gov’t
3. Private, Army Corp of Engineers
4. US Bureau of Reclamation, Tribal Lands
5. Bureau of Indian Affairs
6. DNREC, State Trust Lands
7. USFS, US BLM, MT Fish, Wildlife, and Parks
8. Rocky Mt Elk Foundation
9. Livestock, Land Trusts, US PWS

MDT Planned Improvements
STIP Project (2009-2012) Scope Value
1. Data
2. Resurfacing
3. Restoration
4. Safety
5. Minor Bridge Rehabilitation
6. Major Rehab w/o added Capacity
7. Major Bridge Rehabilitation
8. Reconstruction
9. New Construction
10. Bridge Replacement and New Construction

Roadkill (2003-2007)
1 - 3
4 - 8
9 - 18
19 - 42

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Potential Project Area: PPA 22

ECA ID: 37

Associated Transportation Routes: U.S. Highway 93

Mile Marker: 75.0-76.6

Ecological Information: PPA-22 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 58 (36.2/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S I; Reconstruction with added capacity

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. None of the land within this PPA qualifies for the highest land ownership conservation potential category (i.e. none of the land is under protection or owned by a state or federal agency).
ECA 37 - Ungulate
Avg 36.2 Kill/Mi
Lolo to Turah
Linkage Area

Potential Project Area
- Milepost
- Existing Bridges

Land Ownership: Conservation, Potential
Relative Importance:
1. MT DCC, City Gov't
2. US DOD, Local Gov't
3. Private, Army Corp of Engineers
4. US Bureau of Reclamation, Tribal Lands
5. Bureau of Indian Affairs
6. DNRC, State Trust, Lands
7. USFS, US BLM, MT Fish, Wildlife, and Parks
8. Rocky Mtn Elk Foundation
9. 10 Cemeteries, Land Trusts, US FWS

MDT Planned Improvements
STIP Project (2009-2012) Scope Value:
- 0-3 Data
- 1 Resurfacing
- 2 Restoration
- 3 Safety
- 4 Minor Bridge Rehabilitation
- 5 Minor Rehab and Roadway Safety
- 6 Major Rehab w/o added Capacity
- 8 Major Bridge Rehabilitation
- 9 Reconstruction
- 10 Bridge Replacement and New Construction

Roadkill (2003-2007)
- 1 - 3
- 4 - 8
- 9 - 18
- 19 - 42

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Potential Project Area: PPA 23

ECA ID: 36

Associated Transportation Routes: State 203

Mile Marker: 9.0-10.3

Ecological Information: PPA-23 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 56 (43.1/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore High Concentration Area: Yes, three focal carnivore species were killed one mile south of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S I; Reconstruction with added capacity

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Approximately 4% of the land within this PPA falls into the highest land ownership conservation potential category and is already protected in conservation easement, national parks, wilderness areas, or wildlife refuges. None of this land is owned by a state or federal agency.
Potential Project Area: PPA 24

ECA ID: 35

Associated Transportation Routes: State 203

Mile Marker: 7.0-7.7

Ecological Information: PPA-24 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 17 (24.3/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore High Concentration Area: Yes, three focal carnivore species were killed one mile north of this area.

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Approximately 16% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, about 15% is protected in conservation easement, national parks, wilderness areas, or wildlife refuges while Montana Fish, Wildlife and Parks, the Bureau of Land Management and the U.S. Forest Service own the remaining 1%.
Potential Project Area: PPA 25

ECA ID: 33

Associated Transportation Routes: U.S. Highway 93


Ecological Information: PPA-25 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 53 (31.2/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S I; Reconstruction with added capacity

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. About 2% of the land in this PPA falls into the highest land ownership conservation potential category and is protected in conservation easement, national parks, wilderness areas, or wildlife refuges. None of this land is owned by a state or federal agency.
Potential Project Area: PPA 26

ECA ID: 32

Associated Transportation Routes: U.S. Highway 93

Mile Marker: U.S. 93: 60.9-65.8, State 269: 14.3-19.2

Ecological Information: PPA-26 occurs within the Lolo to Turah linkage (see American Wildlands’ Hub Priority Linkage Assessment), which connects the Bitterroot Range, John Long Mountains, and Sapphire Mountains. Essentially, this area links the Selway-Bitterroot Wilderness in the south to the Cabinet and Yaak Mountains further north. Highway 93, a high-speed four lane highway, bisects the valley and residential and commercial development in the corridor is extensive. This area is of utmost importance for wildlife movement between Idaho and Montana, providing both linkage habitat and occupied habitat for carnivores and ungulates.

Number of Road Kill Records: 808 (81.6/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S I; Reconstruction with added capacity

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Eight percent of the land within this PPA falls into the highest land ownership conservation potential category and is protected in conservation easement, national parks, wilderness areas, or wildlife refuges. Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service owns less than 1% of the land in this category.
Potential Project Area: PPA 27

ECA ID: 5

Associated Transportation Routes: Montana Highway 287 and State 249

Mile Marker: MT 287: 1.6-2.4, State 249: 0.0-0.3

Ecological Information: PPA-27 occurs within the Madison Valley – the first major area of human development that wildlife encounter when dispersing westward out of the Greater Yellowstone Ecosystem. This linkage is a broad north-south oriented valley bounded by the Madison Range to the east and the Tobacco Root Mountains and Gravelly Range to the west. Ennis Lake and Raynolds Pass bound the area to the north and south, respectively. As a wildlife corridor, this area is important for birds, elk, moose, mule deer, pronghorn, bighorn sheep, mountain goats, wolves, wolverine and grizzly bear.

Number of Road Kill Records: 48 (43.6/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore High Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Nearly 26% of the land in this PPA falls into the highest land ownership conservation potential category. Of this, approximately 24% is protected in conservation easement, national parks, wilderness areas, or wildlife refuges. Nearly 2% is owned by Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service.
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ECA 5 - Ungulate
Avg 43.6 Kill/Mi
Madison Valley
Linkage Area

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Potential Project Area: PPA 28

ECA ID: 81

Associated Transportation Routes: Montana Highway 287

Mile Marker: 3.3-4.8

Ecological Information: PPA-28 occurs within the Madison Valley – the first major area of human development that wildlife encounter when dispersing westward out of the Greater Yellowstone Ecosystem. This linkage is a broad north-south oriented valley bounded by the Madison Range to the east and the Tobacco Root Mountains and Gravelly Range to the west. Ennis Lake and Raynolds Pass bound the area to the north and south, respectively. As a wildlife corridor, this area is important for birds, elk, moose, mule deer, pronghorn, bighorn sheep, mountain goats, wolves, wolverine and grizzly bear.

Number of Road Kill Records: 8 (5.3/mi)

Road Kill Species Subgroup: Focal Species

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Seven percent of the land within this PPA falls into the highest land ownership conservation potential category and is protected in conservation easement, national parks, wilderness areas, or wildlife refuges. No state or federal agencies own any of the land within this area.
Potential Project Area: PPA 29

ECA ID: 80

Associated Transportation Routes: U.S. Highway 287

Mile Marker: 17.6-19.0

Ecological Information: PPA-29 occurs within the Madison Valley – the first major area of human development that wildlife encounter when dispersing westward out of the Greater Yellowstone Ecosystem. This linkage is a broad north-south oriented valley bounded by the Madison Range to the east and the Tobacco Root Mountains and Gravelly Range to the west. Ennis Lake and Raynolds Pass bound the area to the north and south, respectively. As a wildlife corridor, this area is important for birds, elk, moose, mule deer, pronghorn, bighorn sheep, mountain goats, wolves, wolverine and grizzly bear.

Number of Road Kill Records: 8 (5.7/mi)

Road Kill Species Subgroup: Ungulate

Presence of Focal Carnivore Elevated Concentration Area: None present

Added Opportunity- State Transportation Improvement Program (STIP): AO-S III; None planned

Added Opportunity- Land Ownership Conservation Potential (LOCP): This PPA received an LOCP added opportunity rank of AO-L III. Approximately 9% of the land within this PPA falls into the highest land ownership conservation potential category. Of this, just over 3% is protected in conservation easement, national parks, wilderness areas, or wildlife refuges. Montana Fish, Wildlife and Parks, the Bureau of Land Management or the U.S. Forest Service owns the remaining 6%.
Appendix D: Potential Project Area Summaries

Added Opportunities (AO): To increase the ability to prioritize Potential Project Areas, we conducted two additional analyses and rankings using Montana’s State Transportation Improvement Program (STIP) data and a land ownership conservation potential (LOCP) index (Ch. 3). We refer to these additional analyses as ‘added opportunities.’

Community GIS Program: American Wildlands Community GIS Services program connects conservation organizations throughout the U.S. Northern Rockies with the benefits of Geographic Information System (GIS) computer modeling, analysis and mapping. This effort builds and expands relationships, enhances the conservation capacity of our partners and helps inform conservation work.

Connectivity: The degree to which a landscape facilitates the movement of organisms between existing areas of core habitat.

Core Habitat: Areas of relatively undisturbed habitat that provide species with those essential resources required for survival and reproduction over the long term.

Corridors of Life Program: Responding to increasing habitat fragmentation, American Wildlands Corridors of Life program is designed to keep the large, protected core habitats connected within the U.S. Northern Rockies. AWL works to restore and maintain wildlife movement corridors between these habitats for the benefit of elk, bear, wolves, cougars, and other wide-ranging or migratory animals.

Crucial Habitat: Areas that contain resources like food, water, cover, shelter and “important wildlife corridors” that contribute to the survival and reproduction of wildlife. They are necessary to prevent unacceptable declines and facilitate future recovery of wildlife populations. (Western Governors Association, Wildlife Corridors Initiative).

Crucial Areas and Connectivity Assessment: A Montana Department of Fish, Wildlife and Parks statewide initiative to organize Montana into three categories of habitat importance and wildlife corridors.

Focal Carnivores Subgroup: Small, mid-size and large carnivore species included in the Montana Department of Transportation road kill database.

Focal Species Subgroup: Native Montana wildlife in the Montana Department of Transportation road kill database, excluding white tail and mule deer.

Elevated Concentration Areas (ECA): Areas of relatively high road kill concentration within western Montana. Based on a kernel density estimate and a percent volume contour of 15%.

Land Ownership Conservation Potential (LOCP): Based on percent area of high value ownership types (including easements, forest service and national parks service) within one square mile of each potential project. The LOCP acted as an indicator of added opportunity within this assessment.

Natural Resource and Information Service (NRIS): A comprehensive collection of geospatial data for Montana (http://nris.mt.gov/gis/).

Percent Volume Contour (PVC): A tool used to create contour lines that represent “x”% by volume contour (e.g. 15% by volume contour).

Potential Project Areas (PPA): Areas identified in this assessment where there is an overlap between important wildlife linkages and areas of high road kill volumes.

Appendix E: Glossary

Added Opportunities (AO): To increase the ability to prioritize Potential Project Areas, we conducted two additional analyses and rankings using Montana’s State Transportation Improvement Program (STIP) data and a land ownership conservation potential (LOCP) index (Ch. 3). We refer to these additional analyses as ‘added opportunities.’

Community GIS Program: American Wildlands Community GIS Services program connects conservation organizations throughout the U.S. Northern Rockies with the benefits of Geographic Information System (GIS) computer modeling, analysis and mapping. This effort builds and expands relationships, enhances the conservation capacity of our partners and helps inform conservation work.

Connectivity: The degree to which a landscape facilitates the movement of organisms between existing areas of core habitat.

Core Habitat: Areas of relatively undisturbed habitat that provide species with those essential resources required for survival and reproduction over the long term.

Corridors of Life Program: Responding to increasing habitat fragmentation, American Wildlands Corridors of Life program is designed to keep the large, protected core habitats connected within the U.S. Northern Rockies. AWL works to restore and maintain wildlife movement corridors between these habitats for the benefit of elk, bear, wolves, cougars, and other wide-ranging or migratory animals.

Crucial Habitat: Areas that contain resources like food, water, cover, shelter and “important wildlife corridors” that contribute to the survival and reproduction of wildlife. They are necessary to prevent unacceptable declines and facilitate future recovery of wildlife populations. (Western Governors Association, Wildlife Corridors Initiative).

Crucial Areas and Connectivity Assessment: A Montana Department of Fish, Wildlife and Parks statewide initiative to organize Montana into three categories of habitat importance and wildlife corridors.

Focal Carnivores Subgroup: Small, mid-size and large carnivore species included in the Montana Department of Transportation road kill database.

Focal Species Subgroup: Native Montana wildlife in the Montana Department of Transportation road kill database, excluding white tail and mule deer.

Elevated Concentration Areas (ECA): Areas of relatively high road kill concentration within western Montana. Based on a kernel density estimate and a percent volume contour of 15%.

Land Ownership Conservation Potential (LOCP): Based on percent area of high value ownership types (including easements, forest service and national parks service) within one square mile of each potential project. The LOCP acted as an indicator of added opportunity within this assessment.

Natural Resource and Information Service (NRIS): A comprehensive collection of geospatial data for Montana (http://nris.mt.gov/gis/).

Percent Volume Contour (PVC): A tool used to create contour lines that represent “x”% by volume contour (e.g. 15% by volume contour).

Potential Project Areas (PPA): Areas identified in this assessment where there is an overlap between important wildlife linkages and areas of high road kill volumes.
Priority Linkage Assessment (PLA): An assessment conducted by American Wildlands from 2007-2008 to improve understanding of, and prioritize wildlife linkages in western Montana. The assessment focuses on the movement needs of wide ranging carnivore (wolf, lynx, wolverine and grizzly bear) and ungulate (elk, moose, pronghorn and bighorn sheep) species, although the report also includes information about additional, locally-significant species.

Safe Passages Program: American Wildlands Safe Passages program addresses the impact of major highways on wildlife and their movements through key travel corridors in the U.S. Northern Rockies.

State Transportation Improvement Program (STIP): A federally required publication that shows funding obligations over a three-year period. It identifies highway, rail, aeronautic and transit improvements to preserve and improve Montana’s transportation system. Although the STIP projects and dates are MDT objectives, the implementation of this program is contingent on a number of factors, including federal and state funding availability, right-of-way acquisition, utility relocations, environmental review, surveying and design. Complications with one or more of these factors may delay a project.

Ungulate Subgroup: All non-domestic ungulate species included in the Montana Department of Transportation road kill database.

Wildlife Corridors: According to the Western Governors’ Association, wildlife corridors are crucial habitats that provide connectivity over different time scales (seasonal or longer) among areas used by animal and plant species. Wildlife corridors can exist within unfragmented landscapes or join naturally or artificially fragmented habitats. They serve to maintain or increase essential genetic and demographic connections within populations.

Wildlife Linkage: A wildlife linkage is a specific area through which wildlife tend to move, forming a bridge or steppingstone between larger habitat or population areas. They are links through the environment at the landscape or regional scale, including substantial areas of habitat measured in kilometers that connect distances measured in kilometers, or tens of kilometers or more (Bennett 2003).
## Appendix F: Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AO-S</td>
<td>Added Opportunity (of a potential project area) based on STIP</td>
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<tr>
<td>AO-L</td>
<td>Added Opportunity (of a potential project area) based on LOCP</td>
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<tr>
<td>AWL</td>
<td>American Wildlands</td>
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<tr>
<td>CSKT</td>
<td>Confederation of Salish and Kootenai Tribes</td>
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<tr>
<td>CTEP</td>
<td>County Transportation Enhancement Projects</td>
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<td>FHWA</td>
<td>Federal Highways Administration</td>
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<td>GIS</td>
<td>Geographic Information Systems</td>
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<tr>
<td>ECA</td>
<td>Elevated (road kill) Concentration Area</td>
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<td>IRT</td>
<td>Interagency Review Team</td>
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<tr>
<td>ITEEM</td>
<td>Integrated Transportation and Ecological Enhancements for Montana</td>
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<tr>
<td>KDE</td>
<td>Kernel Density Estimate</td>
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<tr>
<td>LOCP</td>
<td>Land Ownership Conservation Potential</td>
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<tr>
<td>MACO</td>
<td>Montana Association of Counties</td>
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<tr>
<td>MDT</td>
<td>Montana Department of Transportation</td>
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<tr>
<td>MDFWP</td>
<td>Montana Department of Fish, Wildlife and Parks</td>
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<tr>
<td>NRIS</td>
<td>Natural Resource Information System</td>
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<td>PLA</td>
<td>Priority Linkage Assessment</td>
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<tr>
<td>PPA</td>
<td>Potential Project Area</td>
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<tr>
<td>PVC</td>
<td>Percent Volume Contour</td>
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<td>STIP</td>
<td>State Transportation Improvement Program</td>
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<td>USFS</td>
<td>United States Forest Service</td>
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<td>United States Fish and Wildlife Service</td>
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<td>Wildlife Conservation Society</td>
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<td>WFL</td>
<td>Western Federal Lands</td>
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<td>WTI</td>
<td>Western Transportation Institute</td>
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