An Assessment of Wildlife-Transportation Issues in the Greater Yellowstone Ecosystem

FINAL REPORT

by

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The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the Greater Yellowstone Coalition, Montana State University, or any of the agencies contacted for information summarized in this report.

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To use animal-vehicle collision data obtained from the Montana Department of Transportation (MDT), the authors respectfully abide by MDT's requirement of adherence to confidentiality interests, as follows:

> "By opening this data [delivered in a sealed envelope] you acknowledge that you understand that this information may be confidential under provisions of 23 U.S.C. 409. You also accept the State's confidentiality interest. This includes responsibility for its confidentiality, including, but not limited to, protection from dissemination or release to parties known or unknown involved or contemplating litigation as well as its security in any electronic database in which it is incorporated.
>
> Section 409 states:
>
> Nothwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway highway crossings, pursuant to Sections 130, 144, and 152 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data."

Montana Department of Transportation also provided this disclaimer with their 2004-2006 State Transportation Improvement Program (STIP):

> "While the projects and dates shown are official departmental objectives, it is important to bear in mind that this program is only tentative. Execution 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 cause a given project to be rescheduled."

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Transportation moves people and commerce, contributing to our quality of life. But roads can have negative impacts on wildlife and habitats (Forman 1998, Forman 2003, Jackson 2000). In the United States, approximately one million animal-vehicle collisions (AVCs) occur each year at an estimated cost of more than $1 billion in vehicle repairs alone (Conover et al. 1995). While roads occupy and directly impact only about 1% of land mass in the United States, it has been estimated that transportation infrastructure and traffic indirectly affects 15-20% of this landscape (Forman and Deblinger 1998). High traffic levels can create a barrier to animal movements across the landscape. Roads often bisect quality wildlife habitat into smaller patches of lower-quality habitat that may not provide the shelter, food, water, mates, and dispersal routes that wildlife need for long-term sustained wildlife population viability. These safety and ecological issues relative to transportation infrastructure are particularly concerning in areas that boast large areas of quality habitat that support healthy wildlife populations.

The Greater Yellowstone Ecosystem (GYE) is one of the last places in temperate North America with large tracts of relatively undisturbed lands that provide habitat for grizzly and black bears, wolves, cougars, wolverine, moose, elk, bison, deer, pronghorn antelope, bighorn sheep and many other northern Rocky Mountain wildlife species. Roads throughout the GYE cross through these quality habitats, resulting in costly AVCs, and potentially limiting animal movements across the landscape when and where traffic volumes are high. With increasing traffic volumes and developments that sprawl across the landscape, fragmentation of these habitats and AVCs will continue to increase. Proactive transportation planning and engineering approaches can help moderate these impacts and ultimately increase safety and the ecological integrity that makes the GYE a special region in the northern Rocky Mountains.

The Greater Yellowstone Coalition (GYC) is dedicated to "…protecting the lands, waters, and wildlife of the GYE, now and for future generations." In line with their mission, GYC recognizes the effects that transportation infrastructure can impose on habitat and wildlife. To better understand transportation-wildlife interactions in the GYE, GYC contracted the Western Transportation Institute (WTI) at Montana State University and American Wildlands (AWL) to assess where wildlife-transportation conflicts may be occurring and how concerned stakeholders can work with transportation agencies to reduce the impact of roads on wildlife and the habitats they rely on while increasing driver safety in terms of reducing AVCs.

The purpose of this report is to briefly summarize wildlife-transportation conflicts and potential opportunities to mitigate impacts in upcoming highway projects identified in the STIPs. This report synthesizes spatial data on reported AVCs occurrences, areas of ecological concern, and the State Transportation Improvement Program (STIP) projects in the GYE. We use a Geographic Information System (GIS) to identify stretches of roads with wildlife-transportation conflicts based on relative densities of reported AVCs. In addition, we isolate road segments that overlap modeled core and corridor habitat and priority "megasites" or highly irreplaceable or vulnerable ecological areas. This information can be used to proactively plan for future highway improvement projects to include mitigation techniques that increase safety by reducing AVCs while also supporting the long-term ecological integrity of the Greater Yellowstone region by reducing wildlife mortalities and maintaining or increasing habitat connectivity.

2. STUDY AREA

The project's spatial extent was determined by using the GYC's defined boundary of the GYE (Figure 1). The GYE is uniquely labeled the single remaining relatively intact ecosystem in the world's the northern temperate zone (Keiter and Boyce 1991). Encompassing approximately 18 million acres of northwest Wyoming, southwest Montana, and southeast Idaho, the GYE straddles the Continental Divide and the high elevation volcanic Yellowstone Plateau where the headwaters of seven major rivers (Yellowstone, Madison, Gallatin, Snake, Bighorn, Ruby, and Green) originate and descend to lower elevation valleys. Variation in elevation, geology, and climate influence the distribution of forest, shrubland, grassland, and lowland riparian habitats that support the numerous fish and wildlife species found in the GYE.

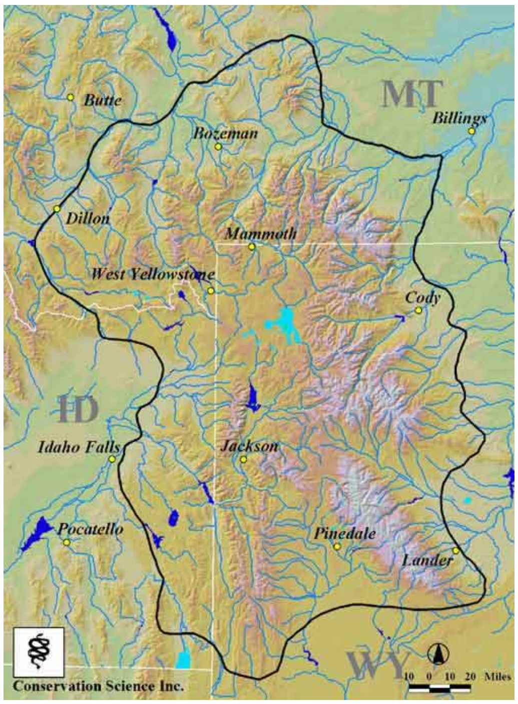

Figure 1: The Greater Yellowstone Ecosystem study area, as delineated by the Greater Yellowstone Coalition.

Two million acres of Yellowstone National Park habitat alone supports 381 known fish, wildlife, and bird species. Across the GYE, higher elevations provide summer habitat for approximately 35,000 elk (*Cervus elaphus*) plus smaller numbers of grizzly bear (*Ursus arctos horribilus*), black bear (*Ursus arctos americana*), wolves (*Canus lupus*), cougar (*Felis concolor*), bison (*Bison bison*), moose (*Alces alces*), pronghorn antelope (*Antilocapra americana*) bighorn sheep (*Ovis canadensis*), whitetail and mule deer (*Odocoileus virginianus* and *Odocoileus hemionus*, respectively). Many of these animals rely on habitats at lower elevations for winter range or to provide a diversity of seasonal food sources that omnivores such as bears depend on.

Lower elevation valley bottoms in the GYE are dominated by private lands where agriculture, domestic animal rangeland grazing, rural housing, and urban development occur (Hansen et al. 2002). About 32% of the GYE is privately owned (Hernandez 2004, Noss et al 2002). The majority of the GYE's protected public lands are at higher elevations and include 32% USDA Forest Service lands, 19% USDI Bureau of Land Management lands, while Yellowstone and Grand Teton National Parks together occupy 7% of the GYE, Tribal Lands make up 5% of the GYE, and wildlife refuges and other federal lands occupy the remaining 5% (Hernandez 2004).

While much of the private land in the GYE is currently undeveloped, rural residential land development of densities greater than one home per 16.2 acres increased by 350% between 1970 and 1999 (Hernandez 2004). By 2000, 359,492 residents occupied the 20 Montana, Wyoming, and Idaho counties in the GYE (Hansen et al. 2002), a 60% population increase since 1970 (Hernandez 2004).

Transportation infrastructure in the GYE includes airports, railways, and paved roads. The primary high-speed, high-capacity ground transportation in the GYE includes the interstate, US, and state highways covering 716 miles of roads in Montana, 929 miles in Wyoming, and 428 miles in Idaho; additionally, there are 310 and 159 miles of paved roads in Yellowstone and Grand Teton National Parks, respectively. Secondary routes such as unpaved road and trail networks accommodate lower volumes of travelers using a wider array of transportation modes (such as off-road recreational vehicles, bikes, foot travel, and horses) to access more remote areas in the GYE.

Most roads assessed in this project are managed by state departments of transportation (DOT). The main routes through federal lands are managed by the respective federal land management agency and Federal Lands Highways (FLH); the Federal Highway Administration of the U.S. Department of Transportation is a critical planning and funding partner for both state DOTs and FLH (FLH is a division of FHWA).

3. METHODOLOGY

3.1. Animal-vehicle collision density analysis

We contacted Montana, Wyoming, and Idaho state departments of transportation (DOTs), the National Park Service, and state wildlife management agencies to request existing AVC data for GYE roads. While secondary routes and unimproved roads have unique direct and indirect cumulative impacts on wildlife and habitats (Forman 2003), we restricted our request to the primary routes including the interstate system, US and state highways, and paved park roads.

We asked what methods were used to collect these data and qualitatively assessed each dataset with regards to the data collection effort, consistency of recording AVC events, and any other factors that would affect the rigor of the analyses. Each AVC dataset was systematically screened to eliminate obvious duplicate records, and standard procedures were used to delete other potential duplicate data that were not as obvious. The latter situation could have occurred if more than one source contributed to the dataset; for example, if highway patrol reported an AVC on a weekend while DOT maintenance staff removed and reported the same carcass on Monday, the records would have unique dates and appear to be separate events. To reduce the potential for double-counting in these cases, if more than one AVC record involved the same species and sex (if known) of animal, occurred at the same location (either as a Universal Transverse Mercator or UTM location or a mile marker location +/-0.2 miles) and the same date +/- 2 days, we assumed these were duplicates record(s) and deleted the redundant data from the dataset. Although each state's dataset underwent separate GIS analyses (each state's data recording protocols were different and therefore could not provide reliable relative comparisons from a single dataset), all datasets of reported AVCs were standardized to include the date, species of animal, route, mile marker for each AVC report.

The cleaned AVC datasets were converted to Dbase (.dbf) files and imported into a GIS software program (see end of methods for list of software used). Spatial data layers for roads with measured geometrics (PolylineM) were reprojected for a common geographic projection and clipped to the GYE boundary. The AVC records were spatially attached using the PolylineM road files. The data are in UTM zone 12 and North American Datum (NAD) 27.

We ran density analyses for the AVC dataset with a 1.5 mile search radius to produce a density grid with nine values and 30-meter resolution. The density outputs were a product of assessing the neighboring data points within a 1.5 mile radius around each point. Density grid outputs were converted to color-coded polygons representing the different relative densities of AVC occurrences. The dataset only included AVCs on roads, but the polygons are wider than the road because this analysis used a search radius around each data point.

3.2. State Transportation Improvement Programs

We asked each DOT for the most current State Transportation Improvement Program (STIP) Plans. We reviewed each state's STIP projects in the GYE and made a qualitative judgment of each project's potential for incorporating mitigation to reduce wildlife-transportation conflicts. Small projects that didn't appear to involve "moving dirt" (e.g., chip sealing, pavement overlays, signing or reflective striping projects) were classified as having lower potential for mitigation while larger and more involved projects (e.g., reconstruction, culvert or bridge replacements) were classified as potential opportunities to incorporate mitigation. The STIP datasets, with each project's linear extent identified and classified according to the potential for mitigation opportunities, were converted to database files, imported into GIS and attached using the PolylineM road files. The classifications were color-coded and overlaid upon roads and AVC density polygons.

3.3. Corridors and Megasites

Two existing GIS analyses, one assessing habitat connectivity, or corridors, in the GYE and the other assessing the vulnerability and "irreplaceability" of GYE sites, were incorporated into the same map. Walker and Craighead (1997) delineated wildlife corridors on a regional scale in GYE area. In summary, their model combined indicators of habitat quality, road density, and forest to edge ratio into an habitat effectiveness index to identify core areas of habitat for grizzly bears and then used least-cost path analysis to identify likely routes that grizzly bears might use when traveling between areas of core habitat (Walker and Craighead 1997). Noss et al (2002) identified and prioritized vulnerable and biologically irreplaceable sites throughout the GYE that were unprotected and subject to degradation. Their analyses incorporated basic conservation approaches to protect special features, environmental variation, and habitat for focal species (grizzly bear, wolf, and wolverine). Identification of sites of concern was accomplished by incorporating spatial data relating to habitat suitability and population viability into a simulated annealing site-selection algorithm (Noss et al. 2002). Prioritization of the identified sites (referred to as "megasites") was based on nine criteria that related to minimum threshold goals to protect species and communities, to represent the region's habitat types and geoclimatic classes, and to protect large areas of habitats that can support and maintain viable populations of the focal species (Noss et al. 2002). We overlaid the top 25 prioritized megasites on our map.

Additional spatial datasets of standard geographic information were added to the map. All maps included the GYE boundary, main roads, towns, topography, and state boundaries. Because the map with the AVC density polygons, STIPs, corridors, and megasites was saturated with information, we created a second map displaying land ownership with the AVC density polygons and STIPS. To accomplish these tasks, we used ArcGIS/ Arc/Info with Spatial Analyst extension, ArcView 3.3 with Spatial Analyst extension, Xtools, Add True X,Y Centroid, and FixJoin Avenue Scripts downloaded from ESRI's website, as well as MS Excel and·MS Access. American Wildlands GIS lab conducted the GIS analyses.

4. RESULTS

We contacted more than 50 individuals in Montana, Idaho, and Wyoming to request AVC data. Twelve people responded with relevant information. We produced two maps displaying the resulting AVC density polygons and color-coded STIPs; one map was underlain by land ownership (Figure 2) while the other displayed the least-cost-path corridor model and megasites under the AVC densities and STIPs (Figure 3). The maps are not intended for interpretation without the results reported here.

The results of each state's analyses are reported by individual road segments. Each road segment is briefly described geographically relative to the GYE and landmarks such as mountain ranges and towns. We created a table summarizing information for each road segment on the geographic range and distance of the given road segment, the source(s) of AVC data for that road segment, the range of dates that the AVC data covered, general observations about data quality, and the total number of AVC observations recorded, along with a break down of occurrences by individual animal species. We listed stretches of roads with higher AVC densities (defined and displayed on the maps as colored polygon representing ranges of the average number of AVCs per 3 miles of roads [double the 1.5 mile density search radius]). Stretches of roads without colored polygons do not represent areas without reported AVCs, but rather areas with the lowest relative densities of AVCs. Finally, we summarized the overlapping areas AVCs with areas of ecological concern (corridors and megasites) and upcoming STIP projects for each road segment.

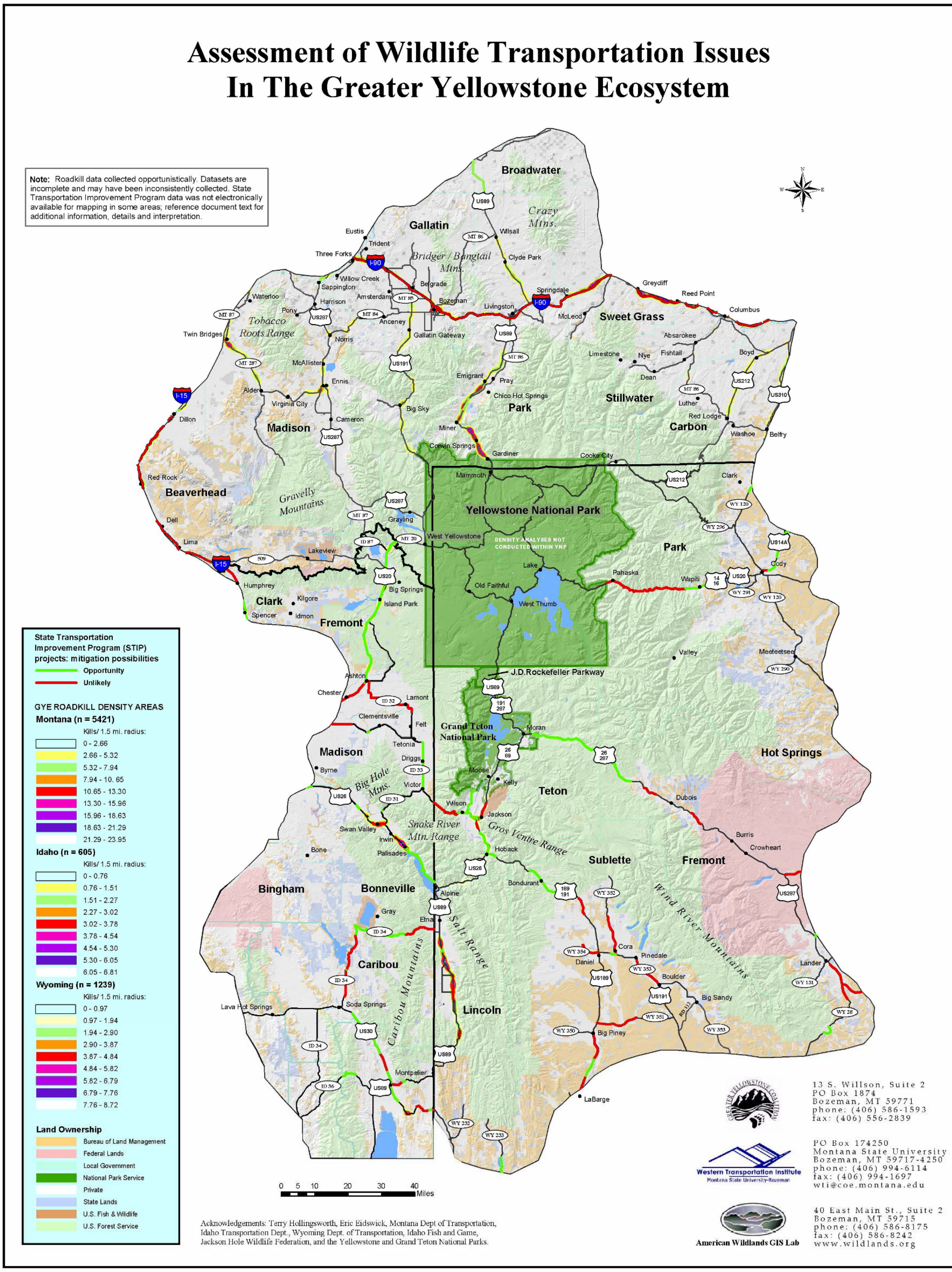

Figure 2: Reported animal-vehicle collisions (AVCs; referred to as "roadkill" in the key) on major roadways of the Greater Yellowstone Ecosystem. Concentric colored polygons along roads represent relatively higher densities of AVCs within a given state (density analyses were conducted separately for Montana, Wyoming, and Idaho). Upcoming highway construction projects, as identified in each state's State Transportation Improvement Programs (STIP), are color coded to indicate potential opportunities to incorporate mitigation. Priority megasites (the most vulnerable and or irreplaceable ecological sites) underlay land ownership jurisdictions.

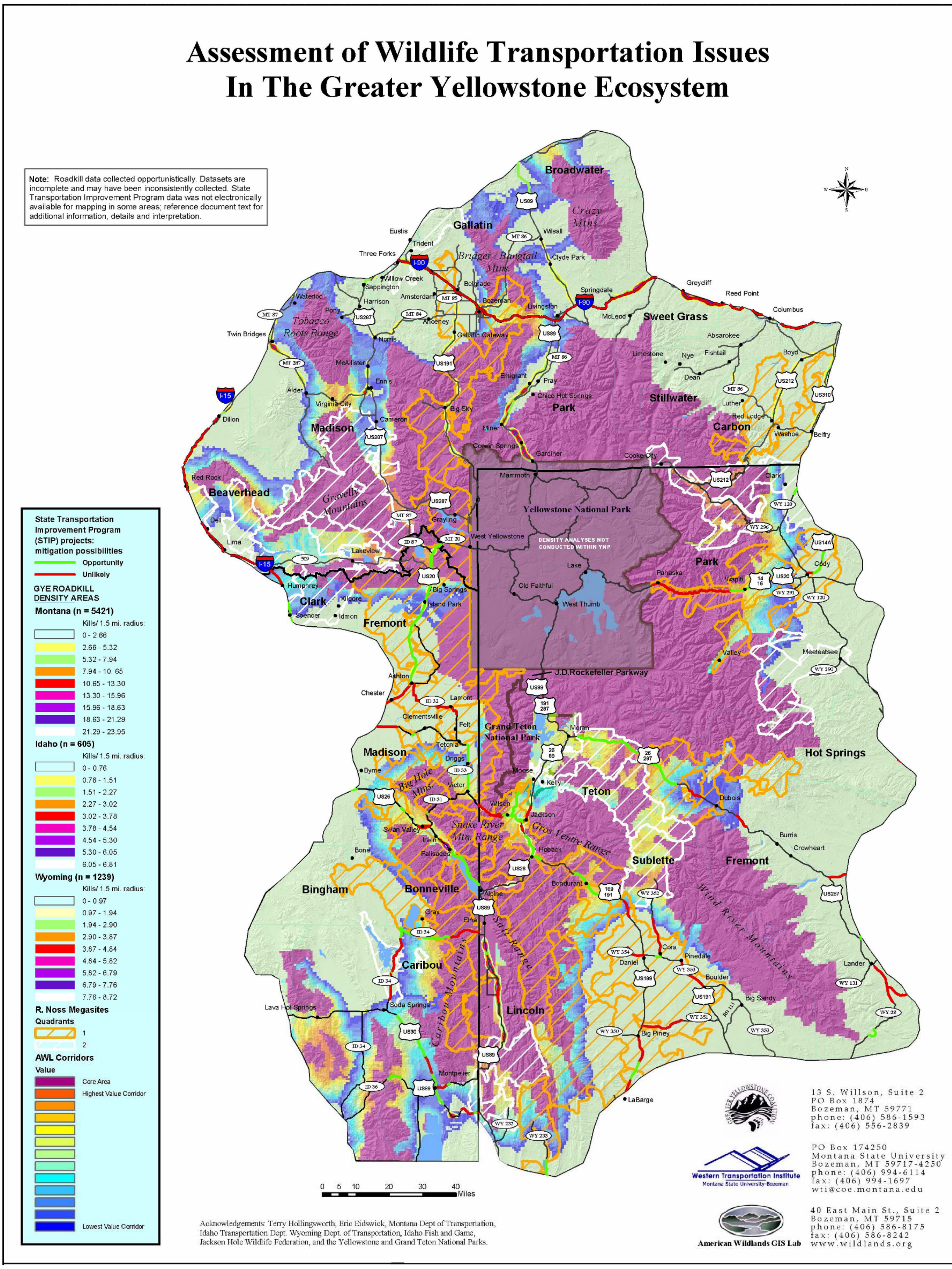

Figure 3: Reported animal-vehicle collisions (AVCs) on major roadways of the Greater Yellowstone Ecosystem. Concentric colored polygons along roads represent relatively higher densities of animal-vehicle collisions within a given state (density analyses were conducted separately for Montana, Wyoming, and Idaho). Upcoming highway construction projects, as identified in each state's State Transportation Improvement Programs (STIP), are color coded to indicate potential opportunities to incorporate mitigation. Priority megasites (the most vulnerable and or irreplaceable ecological sites) and least-cost path core and corridor habitats underlay AVC density polygons and STIP projects.

4.1. Montana Results

All Montana AVC data were obtained from the Montana Department of Transportation's (MDT) State Highway Traffic Safety Office. These data originated from two sources: Montana Highway Patrol (MHP) collision reports and MDT Maintenance records of carcass removals. The following statement was included with the data sent by MDT:

> "This information is not inclusive of all incidents of animal-vehicle collisions. All incidents are not reported. The Animal Incident Reporting System is an opportunistic collection and reporting system, initiated by a research project, with no guarantee of accuracy or statistical validity."

We combined the MHP and maintenance carcass removal records. After screening for and removing duplicate records, the remaining dataset consisted of 5,421 AVC observations between 1998—2002 (through November 12th, 2002). The data were located to the nearest even milepost. While we conducted only one density analysis with all 5,421 records, different segments of road had data that covered different spans of time. Datasets that cover shorter periods of time may yield density grid results that "wash out" relative to the other datasets that cover longer periods of time.

4.1.1. Interstate 90

Interstate 90 (I-90) runs through the northern region of the GYE, from milepost 278, near Three Forks, to milepost 427, east of Columbus. Sections of I-90 extend beyond the GYE border and are not visible on the map, but we present all AVC data for this 149 mile stretch.

4.1.1.1. AVC data summary

Table 1 summarizes AVC data recorded for I-90 between mileposts 278 to 427. On average, a minimum of 11.5 AVCs occurred per mile between 1998 and 2002 in this 149 mile stretch of I-90. The density analysis revealed areas with polygons of higher relative densities of AVCs, listed from west to east:

- Between Three Forks and Manhattan (up to 13.3 AVCs per 3 miles)
- Between Manhattan and Belgrade (up to 5.32 AVCs per 3 miles)
- Between Belgrade and Bozeman (up to 7.94 AVCs per 3 miles)
- Between Bozeman and Livingston (up to 13.3 AVCs per 3 miles)
- Between Springdale and Greycliff (up to 21.29 AVCs per 3 miles)
- Between Greycliff and Reed Point (up to 23.95 AVCs per 3 miles)
- Between Reed Point and Columbus (up to 13.3 AVCs per 3 miles)
- East of Columbus (up to 13.3 AVCs per 3 miles)

Table 1: Summary of animal-vehicle collisions reported between January 1998 and November 2002 for Interstate 90 between Columbus (milepost 427) and Three Forks (milepost 278), Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td>Interstate 90</td><td>Road segment length</td><td>149 miles</td></tr>
<tr><td colspan="2">Geographic & milepost range</td><td colspan="4">East of Columbus to Three Forks (mileposts 427-278)</td></tr>
<tr><td>Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports</td></tr>
<tr><td>Date range</td><td colspan="2">1/5/98 - 11/8/2002</td><td rowspan="12">Reported AVCs and carcasses removed</td><td>total:</td><td>1711</td></tr>
<tr><td rowspan="11">Data Quality</td><td colspan="2" rowspan="11">Data were opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. Occurrences were spatially correlated to whole mileposts, although some original data sources provide locations to the tenth of a mile. There are gaps in reporting over time and at some mileposts (295-297, 299, 335, 370-378) although it is not possible to know if this is due to no AVC occurrences or under-reporting (though it is more likely the latter).</td><td>Antelope</td><td>1</td></tr>
<tr><td>Black Bear</td><td>10</td></tr>
<tr><td>Deer</td><td>97</td></tr>
<tr><td>Elk</td><td>14</td></tr>
<tr><td>Moose</td><td>2</td></tr>
<tr><td>Mountain Lion</td><td>1</td></tr>
<tr><td>Mule Deer</td><td>1018</td></tr>
<tr><td>Other Domestic</td><td>7</td></tr>
<tr><td>Other Wild</td><td>20</td></tr>
<tr><td>Unknown</td><td>12</td></tr>
<tr><td>Whitetail Deer</td><td>528</td></tr>
</table>

4.1.1.2. Corridors and Megasites

The areas with the highest AVC densities on I-90 between Springdale and Reed Point did not occur in areas defined as ecologically important as defined by the corridor model or megasites results. The area between Three Forks and Manhattan with AVC densities up to 13.3 AVCs per 3 miles crosses through the Horseshoe Hills megasite which ranked 25th amongst all the megasites. East of Bozeman, near the Bear Canyon interchange, lies an area of AVC densities up to 13.3 AVCs per 3 miles within the Gallatin River megasite. This megasite was ranked fourth on the overall list of megasites, a ranking earned due to a high "vulnerability" score. This same area near Bozeman Pass lies on the eastern edge of lower value corridor habitats that link the Gallatin Mountains to the south and the Bridger and Bangtail Mountains to the north. Other areas on Bozeman Pass with up to 5.32 AVCs per 3 miles occur where habitat corridor values are higher; corridor habitat values across Bozeman Pass are highest about half way between Bozeman and Livingston.

4.1.1.3. Opportunities to mitigate via STIP

Seven STIP projects are scheduled for 2004—2006 on I-90 in the GYE (Table 2). Of these projects, two involve heavy construction to replace/improve structures, lending themselves to the possibility of incorporating mitigation measures such as fencing and landscaping to encourage animals to travel safely under I-90. Of the two projects with potential mitigation opportunities, the Montana Rail Link (MRL) Overpass project will occur in an area with higher densities of AVCs, within a megasite, between two areas of core habitat. This project includes about 0.8 mile of fencing to direct wildlife under I-90 via the MRL Overpass; MDT has contracted WTI to conduct a before-after evaluation of these measures (summary of preconstruction monitoring results anticipated summer 2006; post-construction monitoring and the final evaluation is projected to be completed by 2010). The other project, a "seismic retrofit" of a structure (presumably a bridge), occurs on the western edge of corridor habitat.

Table 2: Summary of highway improvement projects for Interstate 90 between Columbus and Three Forks, Montana. Source: Montana Department of Transportation, State Transportation Improvement Program 2004-2006.

Fiscal Year	MDT District	Project Name	Project Location	Milepost referenced	Project length (km)	Project Type	Project Cost ($mill)
2004	Butte	Bozeman - East	I-90	313.4	8.05	Pavement preservation	<1
2004	Butte	East Three Forks Interchange	I-90	278.3	n/a	Interchange	1 to 5
2005	Butte	MRL Overpass-7km east of Bozeman	I-90	314.08	n/a	Structure and approaches	>5
2005	Butte	Bozeman - Bear Canyon	I-90	307.2	9.49	Resurface	1 to 5
2005	Butte	Bozeman area seismic retrofit	I-90	303.59	n/a	Structure	1 to 5
2004	Billings	Boulder River - East	I-90	368.99	13.7	Resurface	1 to 5
2004	Billings	Springdale intch - East	I-90	354	9.6	Pavement preservation	1 to 5

4.1.2. Interstate 15

Interstate 15 (I-15) in Montana skirts the northwest boundary of the GYE, spanning 62 miles between the ID-MT border and milepost 62 near Dillon. Sections of I-15 extend beyond the GYE border and are not visible on the map, but we present data for the entire 62 miles between the state border and Dillon.

4.1.2.1. AVC data summary

Table 3 summarizes AVC data recorded between mileposts 0 to 62. On average, a minimum of 5.5 AVCs occurred per mile between 1998 and 2002 in this 62 mile stretch of I-15. The density analysis did not reveal areas with higher densities of AVC.

Table 3: Summary of animal-vehicle collision data reported between January 1998 and November 2002 for Interstate 15 between Monida (milepost 0) and Dillon (milepost 62), Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td>Interstate 15</td><td>Road segment length</td><td>62 miles</td></tr>
<tr><td colspan="2">Geographic & milepost range</td><td colspan="4">MT-ID border (Monida, MT) to Dillon (mileposts 0-62)</td></tr>
<tr><td>Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td>Date range</td><td colspan="2">1/22/98 - 11/12/2002</td><td rowspan="7">Reported roadkill</td><td>total:</td><td>341</td></tr>
<tr><td rowspan="6">Data Quality</td><td colspan="2" rowspan="6">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Antelope</td><td>1</td></tr>
<tr><td>Elk</td><td>7</td></tr>
<tr><td>Moose</td><td>2</td></tr>
<tr><td>Mule Deer</td><td>81</td></tr>
<tr><td>Other Wild</td><td>3</td></tr>
<tr><td>White tail Deer</td><td>247</td></tr>
</table>

4.1.2.2. Corridors and Megasites

Interstate 15 in the GYE in Montana bisects higher value corridor habitats near Red Rock and Monida. This stretch of road also crosses through the Red Rock/Centennial megasite.

4.1.2.3. Opportunities to mitigate via STIP

Only one STIP project for I-15 in the GYE and Montana was listed in the MDT STIP 2004-2006. The Lima rest area project (no further descriptors of this project were available), at milepost 15, is scheduled to occur in 2005 at a cost between $1-5 million to MDT. This project may provide an opportunity to install an interpretive education display highlighting Montana's wildlife and cautioning travelers to drive with increased alertness for animals crossing roads, especially in the late spring and fall, and when driving at dusk, dark, and dawn.

4.1.3. US Highway 89, North of Interstate 90

North of I-90, US Highway 89 (US 89 N) runs from Livingston to Wilsall and beyond up into Broadwater County. This road lies between the Bridger/Bangtail and Crazy Mountain ranges.

4.1.3.1. AVC data summary

Table 4 summarizes the AVC data collected from 1998 through 2002 for 37 miles of US 89 N. On average, a minimum of 6.3 AVCs occurred per mile from 1998 through 2002 in this 37 mile stretch of US 89 N. Higher relative AVC densities ranging from 2.66 to 10.65 AVCs per 3 miles occurred between Livingston and Wilsall.

Table 4: Summary of animal-vehicle collision data reported between January 1998 and November 2002 for US Highway 89 from Livingston (milepost 1) to milepost 37 (north of Wilsall) in Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td>US 89 north of I-90</td><td>Road segment length</td><td>37 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="3">Livingston to Wilsall (mileposts 1-37)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="4">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/7/1998 - 11/12/2002</td><td rowspan="7">Reported AVCs and carcasses removed</td><td>total:</td><td>232</td></tr>
<tr><td rowspan="6">Data Quality</td><td colspan="3" rowspan="6">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Moose</td><td>1</td></tr>
<tr><td>Elk</td><td>1</td></tr>
<tr><td>Mule Deer</td><td>47</td></tr>
<tr><td>Whitetail Deer</td><td>182</td></tr>
<tr><td>Unknown</td><td>1</td></tr>
</table>

4.1.3.2. Corridors and Megasites

There are no priority megasites identified along US 89 north of I-90. This highway runs directly between two areas of core habitat, the Bridger/Bangtail and the Crazy Mountains. Between Clyde Park and Wilsall, higher densities of AVCs (up to 5.32 AVCs per 3 miles) occurred on US 89 N in lower value corridor habitat that bridges these two mountain ranges. Further north, US 89 N crosses through another area of lower value corridor habitat that connects the northern ends of the same mountain ranges. These areas of lower value habitat values are the only two potential corridors identified between these ranges; both bridge the valley, cutting through areas with no designated habitat values.

4.1.3.3. Opportunities to mitigate via STIP

At the northern most stretch of US 89 N, MDT identified a "reconstruct and structure" project in its 2004-2006 STIP to occur in 2005 at a cost between $1-5 million. This project extends beyond the GYE border to the north, but the southern extent of this project will run through the corridor habitat that bridges the northern end of the Bridger/Bangtail Mountains and the Crazy Mountains. Additionally, a bridge was scheduled to be replaced across the Yellowstone River northeast of Livingston (no further detail) in 2004.

4.1.4. Montana Highway 86

The other primary road north of I-90 for which we were able to obtain AVC data was Montana Highway 86 (MT 86). This highway crosses the Bridger Mountains from Bozeman to US Highway 89, just north of Wilsall.

4.1.4.1. AVC data summary

Table 5 summarizes the AVC data collected from 1998 through 2002 for 37 miles of MT 86. Between Bozeman and US Highway 89 near Wilsall, a minimum of 2 AVCs per mile occurred on MT 86, on average. There were no areas with higher AVC densities.

Table 5: Summary of animal-vehicle collision data reported between June 1998 and November 2002 for Montana Highway 86 from Bozeman (milepost 0) to its intersection with US Highway 89 (milepost 37), north of Wilsall, Montana.

State	Montana	**Route**	MT 86	**Road segment length**	37
Geographic & milepost range			Bozeman to US 89 north of Wilsall (mileposts 1-37)		
Data source(s)		Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.			
Date range		6/10/1998 - 11/1/2002	**Reported AVCs and carcasses removed**	**total:**	**74**
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.			Black bear	2
				Elk	3
				Mule Deer	25
				Whitetail Deer	44

4.1.4.2. Corridors and Megasites

While the data revealed no areas with higher AVC densities, MT 86 crosses through high quality corridor habitats as well as core habitat in the Bridger Mountains. Additionally, this road travels through the Gallatin River megasite. This megasite was ranked fourth on the overall list of megasites, a ranking earned due to a high “vulnerability” score.

4.1.4.3. Opportunities to mitigate via STIP

The MDT STIP for 2004-2006 identifies cost between $1-5 million “structure and approaches” project planned for 2004 at mile post 3.13. As of 2003, MDT was planning on incorporating some features to encourage animals to follow the drainage under the reconstructed bridge. The only other project planned is a <$1 million reconstruction of Rouse Avenue, the stretch of MT 86 inside the Bozeman city limits.

4.1.5. Montana Highway 287

Montana Highway 287 (MT 287) enters the northwest corner of the GYE north of Twin Bridges and intersects with US Highway 287/Montana Highway 87 near Ennis. This 49 mile stretch of road cuts through the Tobacco Root and Gravelly Mountains to the north and south, respectively.

4.1.5.1. AVC data summary

Table 6 summarizes the AVC data recorded from 1998 through 2002 for 49 miles of MT 287. On average, a minimum of 8.6 AVCs occurred per mile between 1998 and 2002. The density analysis revealed areas with polygons of higher relative densities of AVCs, as follows:

- North of Twin Bridges to the GYE border (up to 7.94 AVCs per 3 miles)
- Between Twin Bridges and Sheridan (up to 21.29 AVCs per 3 miles)
- Between Sheridan and Alder (up to 10.65 AVCs per 3 miles)
- Between Virginia City and Ennis (up to 13.3 AVCs per 3 miles)

Table 6: Summary of animal-vehicle collision data reported between January 1998 and November 2002 for Montana Highway 287 from Twin Bridges (milepost 49) to its intersection with US Highway 287 (milepost 1) near Ennis, Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">MT 287</td><td>Road segment length</td><td>49 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">N of Twin Bridges to US 287 south of Ennis (mileposts 1-49)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/5/1998 - 11/12/2002</td><td rowspan="6">Reported AVCs and carcasses removed</td><td>total:</td><td>422</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Antelope</td><td>1</td></tr>
<tr><td>Elk</td><td>1</td></tr>
<tr><td>Unknown</td><td>4</td></tr>
<tr><td>Mule Deer</td><td>104</td></tr>
<tr><td>Whitetail Deer</td><td>312</td></tr>
</table>

4.1.5.2. Corridors and Megasites

The higher densities of AVCs identified on MT 287 north of Twin Bridges occurred within lower value corridor habitats between the Tobacco Root Mountains and the GYE border. Just west of Virginia City, MT 287 splits the highest valued corridor habitat that connects the Tobacco Root Mountains to the Gravelly Mountains. This area did not have higher AVC densities, but between Virginia City and the US Highway 287/Montana Highway 87 intersection near Ennis, corridor habitat values drop while AVC densities increase as the road approaches its terminus. There were no priority megasites along MT 287.

4.1.5.3. Opportunities to mitigate via STIP

There are no STIP projects for MT 287 in the GYE listed in the 2004-2006 MDT STIP.

4.1.6. US Highway 287/Montana Highway 87

Entering the GYE north of Sappington, US Highway 287/Montana Highway 87 (US 287/MT 87) extends 97 miles to the MT-ID border (this does not include the section of US Highway 287 that separates from Montana Highway 87 to continue on eastward to US Highway 191; we did not receive any data on that stretch of road). This highway lies between the Tobacco Roots and Gravelly Mountains to the west and the Madison Range to the east.

4.1.6.1. AVC data summary

Table 7 summarizes the AVC data recorded from 1998 through 2002 for 97 miles of US 287/MT 87. On average, a minimum of 3.4 AVCs occurred per mile between 1998 and 2002. The density analysis revealed areas with polygons of higher relative densities of AVCs, as follows:

- From the GYE border to Sappington (up to 7.94 AVCs per 3 miles)
- Just north of Norris (up to 5.32 AVCs per 3 miles)
- Just north of McAllister (up to 5.32 AVCs per 3 miles)
- Between McAllister and Ennis (up to 7.94 AVCs per 3 miles)
- Just south of Ennis (up to 5.32 AVCs per 3 miles)

Table 7: Summary of animal-vehicle collision data reported between January 1998 and November 2002 for US Highway 287/Montana Highway 87 from Sappington, Montana (milepost 97), to the Montana-Idaho border.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">US 287/MT 87</td><td>Road segment length</td><td>97 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">North of Sappington to MT-ID border (mileposts 1-97). NOTE: no data were available for US 287 from its junction with MT 87 to its junction with US 191)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/15/98 - 11/12/2002</td><td rowspan="8">Reported AVCs and carcasses removed</td><td>total:</td><td>326</td></tr>
<tr><td rowspan="7">Data Quality</td><td colspan="3" rowspan="7">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Antelope</td><td>6</td></tr>
<tr><td>Grizzly Bear</td><td>1</td></tr>
<tr><td>Elk</td><td>22</td></tr>
<tr><td>Moose</td><td>2</td></tr>
<tr><td>Mule Deer</td><td>176</td></tr>
<tr><td>Other wild</td><td>5</td></tr>
<tr><td>Whitetail Deer</td><td>114</td></tr>
</table>

4.1.6.2. Corridors and Megasites

There are no megasites or corridor habitats from Norris to the GYE border to the north along US 287/MT 87. From Norris to Cameron, this highway crosses lower value corridor habitat; there are three spots with higher densities of AVCs in this area as well. South of Cameron there are no areas of higher densities of AVCs but the road does pass through the Gravelly/Snowcrest megasite. As the road travels south, it cuts through corridor habitats that increase in value to high value corridor habitats that could provide passage between the southern end of the Gravelly Mountains and the Madison Range.

4.1.6.3. Opportunities to mitigate via STIP

The 2004-2006 MDT STIP identifies one highway project occurring on US 287/MT 87. In 2006, there are plans to reconstruct 2.74 kilometers of this road from milepost 88.3 near Sappington south.

4.1.7. Montana Highway 84

Intersecting with US 287/MT 87 at Norris, Montana Highway 84 (MT 84) travels 29 miles east to Four Corners. This road lies north of the Madison Range and south of I-90, serving as one of three primary routes (with I-90 and US 287/MT 87) that provide an east-west passage between Gallatin and Madison Counties.

4.1.7.1. AVC data summary

Table 8 summarizes the AVC data reported between January 1998 and November 2002 for MT 84. A minimum average number of 2.9 AVCs per mile occurred on MT 84 from 1998 to 2002. One grizzly bear death near Norris was accounted as an AVC on MT 84. The only area with higher densities of AVCs was found closer to the west end of MT 84 and had AVC density values up to 5.32 AVCs per 3 miles.

Table 8: Summary of animal-vehicle collision data reported between January 1998 to November 2002 for Montana Highway 84 from Norris (milepost 29) to Four Corners (milepost 0), Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">MT 84</td><td>Road segment length</td><td>29 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">US 287 intersection at Norris to Four Corners (mileposts 0-29)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/5/1998 - 11/12/2002</td><td rowspan="6">Reported AVCs and carcasses removed</td><td>total:</td><td>83</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Grizzly bear</td><td>1</td></tr>
<tr><td>Black bear</td><td>1</td></tr>
<tr><td>Mule Deer</td><td>46</td></tr>
<tr><td>Whitetail Deer</td><td>34</td></tr>
<tr><td>Other wild</td><td>1</td></tr>
</table>

4.1.7.2. Corridors and Megasites

Montana Highway 84 does not intersect any priority megasites. There is no identified core or corridor habitat along this road, although one grizzly bear was killed near Norris.

4.1.7.3. Opportunities to mitigate via STIP

There was only one project identified in the MDT STIP for 2004-2006 for MT 84. A “pavement preservation” project was scheduled for MT 84 in 2004.

4.1.8. Montana Highway 85

Montana Highway 85 (MT 85) covers 6 miles between I-90 at Belgrade and Four Corners. This road crosses a landscape that is developing at a rapid rate, hosting a mosaic of land uses including residential, ranching, and business.

4.1.8.1. AVC data summary

Table 9 summarizes the available AVC data for MT 85. From 1998 through October 2002, a minimum average of 10 AVCs occurred per mile.

Table 9: Summary of animal-vehicle collisions reported between January 1998 and October 2002 for Montana Highway 85 between Belgrade and Four Corners, Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">MT 85</td><td>Road segment length</td><td>6 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Belgrade to Four Corners (mileposts</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/29/1998 - 10/23/2002</td><td rowspan="5">Reported AVCs and carcasses removed</td><td>total:</td><td>60</td></tr>
<tr><td rowspan="4">Data Quality</td><td colspan="3" rowspan="4">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Antelope</td><td>1</td></tr>
<tr><td>Mule Deer</td><td>12</td></tr>
<tr><td>Whitetail Deer</td><td>45</td></tr>
<tr><td>Other wild</td><td>2</td></tr>
</table>

4.1.8.2. Corridors and Megasites

This road crosses through no corridors, core habitat, or priority megasites.

4.1.8.3. Opportunities to mitigate via STIP

The MDT STIP for 2004-2006 listed no upcoming projects for MT 85.

4.1.9. US Highway 191

From Main Street of Bozeman to Four Corners and south to West Yellowstone, US Highway 191 (US 191) is one of three Montana roads that access a Yellowstone National Park (YNP) entrance gate (the West Entrance, in West Yellowstone, Montana). This road follows the valley bottoms that divide the Gallatin Range from the Madison Range, and includes 20 miles that lie within YNP.

4.1.9.1. AVC data summary

Table 10 summarizes AVC data for US 191. The density analysis, summary of data in Table 10, and this summary do not include additional data reported by YNP; see Wyoming results under the YNP heading for a summary of the AVCs on US 191 in YNP. On average, a minimum of 5 AVCs per mile occurred along these 88 miles between 1998 and 2002. Notably, 6 bighorn sheep and 35 moose were killed on US 191 during that time. Higher densities of AVCs occurred at the following locations:

- From Four Corners south, past Gallatin Gateway (up to 7.94 AVCs per 3 miles)
- North of Big Sky, in Gallatin Canyon (up to 7.94 AVCs per 3 miles)
- Just north of Big Sky (up to 10.65 AVC per 3 miles)
- Big Sky south to YNP northwestern border (to 7.94 AVCs per 3 miles)

Table 10: Summary of animal-vehicle collisions reported from January 1998 to November 2002 on US Highway 191 (US 191) from Bozeman to West Yellowstone, Montana. Additional data recorded by Yellowstone National Park for the segment of US 191 that cuts through the park is not included in this summary.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">US 191</td><td>Road segment length</td><td>88 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Bozeman to Four Corners to West Yellowstone</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/29/1998 - 11/12/2002</td><td rowspan="10">Reported AVCs and carcasses removed</td><td>total:</td><td>445</td></tr>
<tr><td rowspan="9">Data Quality</td><td colspan="3" rowspan="9">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Bighorn Sheep</td><td>6</td></tr>
<tr><td>Black bear</td><td>1</td></tr>
<tr><td>Bison</td><td>4</td></tr>
<tr><td>Moose</td><td>35</td></tr>
<tr><td>Elk</td><td>100</td></tr>
<tr><td>Mule Deer</td><td>104</td></tr>
<tr><td>Whitetail Deer</td><td>187</td></tr>
<tr><td>Other wild</td><td>7</td></tr>
<tr><td>Unknown</td><td>1</td></tr>
</table>

4.1.9.2. Corridors and Megasites

US 191 travels through or skirts a significant length of the Gallatin River megasite. This megasite was ranked fourth on the overall list of megasites, a ranking earned due to a high "vulnerability" score. The site description of the Gallatin River megasite highlights the importance of the elk migration corridor that links YNP to the Taylor Fork area in the Madison Range to the west; US 191 bisects this migration corridor. This road passes through core habitat from the north end of Gallatin Canyon south to West Yellowstone.

4.1.9.3. Opportunities to mitigate via STIP

The MDT STIP for 2004-2006 shows numerous projects scheduled for this segment of US 191. Several pavement preservation projects were planned for various sections of US 191. The Gallatin Gateway area was slated for the construction of turn bays and a pedestrian tunnel under US 191. One reconstruction project for 2004 in Gallatin Canyon was listed under the projects in the incidental construction phase; it appears this is a slope flattening and widening project that is estimated to cost <$1million.

4.1.10. US Highway 89, South of Interstate 90

Serving one of three Montana entrances to Yellowstone National Park, US Highway 89 south of I-90 (US 89 S) connects Livingston to the "gateway" community of Gardiner. This north-south running road lies between the Gallatin Range to the west and the Absaroka Range to the east.

4.1.10.1. AVC data summary

Table 11 summarizes the reported AVCs from January 1998 to November 2002 for US 89 S between Livinston and Gardiner. A minimum average number of 14.6 AVCs per mile occurred on this road during this time. At the northern end of US 89 S, two short stretches had up to 5.32 AVCs per 3 miles. Almost all of the southern 75% (approximated) of US 89 S had up to 5.32 AVCs per 3 miles; shorter stretches with higher densities of AVCs within this area follow:

- Between Gardiner and Corwin Springs (up to 13.3 AVCs per 3 miles)
- Between Corwin Springs and Miner (up to 23.93 AVCs per 3 miles)
- Between Miner and Emigrant (3 areas with densities up to 13.3 AVCs per 3 miles)
- Between Emigrant and Livingston (up to 7.94 densities per 3 miles)

Table 11: Summary of animal-vehicle collision data reported between January 1998 and November 2002 for US Highway 89 from Livingston (milepost 57) to Gardiner (milepost 1), Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">US Highway 89 south of I-90</td><td>Road segment length</td><td>57 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Livingston to Gardiner (mileposts 1-57)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/2/98 - 11/8/2002</td><td rowspan="8">Reported AVCs and carcasses removed</td><td>total:</td><td>831</td></tr>
<tr><td rowspan="7">Data Quality</td><td colspan="3" rowspan="7">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Black Bear</td><td>1</td></tr>
<tr><td>Elk</td><td>33</td></tr>
<tr><td>Moose</td><td>1</td></tr>
<tr><td>Mule Deer</td><td>626</td></tr>
<tr><td>Domestic Cow</td><td>1</td></tr>
<tr><td>Other wild</td><td>1</td></tr>
<tr><td>Whitetail Deer</td><td>168</td></tr>
</table>

4.1.10.2. Corridors and Megasites

There are no priority megasites near US 89 south of I-90. Just south of Livingston, US 89 S parallels the Yellowstone River through a canyon known to locals as "the wine glass". This area has lower value corridor habitats that bridge the northern ends of the Gallatin and Absaroka Ranges. Traveling south to Miner, US 89 S lies in the valley bottom, where no corridor habitat of any value is identified. From Miner to Gardiner, US 89 S cuts through core habitat.

4.1.10.3. Opportunities to mitigate via STIP

Three transportation infrastructure improvement projects are listed to occur between Livingston and Gardiner according to the MDT STIP for 2004-2006. A reconstruction project of undefined length was slated to occur in 2004 at Cedar Creek, about 10 miles north of Gardiner, at a cost of <$1 million. About 9 miles south of Livingston, a turn bay "spot improvement" project was to occur in 2004. Finally, a bridge replacement across the Yellowstone River at Corwin Springs was scheduled for 2004; this bridge is not located on US 89 S but on a secondary side road that intersects with US 89 S at Corwin Springs.

4.1.11. Montana Highway 78

One of two direct routes from Red Lodge to I-90, Montana Highway 78 (MT 78) in the GYE stretches 47 miles from Columbus to Red Lodge. This highway crosses lower elevations that lie between the Beartooth Mountains and the Yellowstone River; the northern segment of MT 78 parallels the Stillwater River between Absarokee and Columbus.

4.1.11.1. AVC data summary

Table 12 summarizes AVC data for MT 78. The data available covered 2000 to 2002; this span of dates is shorter than datasets for most other road segments in Montana; therefore the results seen for MT 78 may comparatively underestimate the densities of AVCs. On average, a minimum of 3 AVCs occurred for every mile of MT 78 between January 2000 and November 2002. There were three areas with higher densities of AVCs on MT 78 as follows:

- Between Columbus and Absorokee (up to 5.32 AVCs per 3 miles)
- Two areas between Absarokee and Red Lodge (both with up to 5.32 AVCs per 3 miles)

Table 12: Summary of animal-vehicle collision data reported between January 2000 and November 2002 for Montana Highway 78 from Columbus to Red Lodge, Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">MT 78</td><td>Road segment length</td><td>47 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Columbus to US 212 intersection at Red Lodge (mileposts 1-47)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/24/2000 - 11/12/2002</td><td rowspan="6">Reported AVCs and carcasses removed</td><td>total:</td><td>144</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Black bear</td><td>1</td></tr>
<tr><td>Deer</td><td>24</td></tr>
<tr><td>Mule Deer</td><td>36</td></tr>
<tr><td>Whitetail Deer</td><td>81</td></tr>
<tr><td>Other wild</td><td>2</td></tr>
</table>

4.1.11.2. Corridors and Megasites

There is no designated corridor or core habitat crossing MT 78. Near Red Lodge, MT 78 cuts through the western side of the Rock Creek megasite.

4.1.11.3. Opportunities to mitigate via STIP

The MDT STIP for 2004-2006 included two "reconstruct and structure" projects between Columbus and Absarokee for a total of 25 kilometers, both at costs of more than $5 million. Another reconstruction project northwest of Red Lodge is planned for 2005, though it is a smaller project with an estimated cost of less than $1 million. There are several pavement preservation projects along MT 78 between Columbus and Red Lodge and one bridge replacement is slated for Sheep Creek near Absarokee.

4.1.12. US Highway 212

One of two direct routes from Red Lodge to I-90, US Highway 212 (US 212) travels through Boyd, Roberts, and Red Lodge, then climbs into the Beartooth Mountains until it reaches the Montana-Wyoming border. The Wyoming Department of Transportation manages the 35 miles across the highest elevations of US 212 as it crosses the Beartooth Plateau. The highway then reenters Montana for a short stretch to Cooke City, Silver Gate, and the Northeast Entrance of YNP.

4.1.12.1. AVC data summary

Table 13 summarizes AVC data for the 48 miles of US 212 that lie within the GYE and Montana (Wyoming data were not included). The data available covered 2000 to 2002; this span of dates is shorter than datasets for most other road segments in Montana; therefore the results seen for US 212 may comparatively underestimate the densities of AVCs. On average, a minimum of 7 AVCs occurred for every mile of US 212 between January 2000 and November 2002. Four areas between Red Lodge and the GYE border had AVC densities up to 5.32 per 3 miles and within those areas, one section north of Red Lodge and another north of Roberts had up to 7.94 AVCs per 3 miles.

Table 13: Summary of animal-vehicle collisions reported between January 2000 and November 2002 for US Highway 212 between Columbus and Red Lodge, Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">US 212</td><td>Road segment length</td><td>48 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">I-90 intersection east of Columbus to MT-WY border south of Red Lodge (mileposts 54-102)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/10/2000 - 11/6/2002</td><td rowspan="9">Reported AVCs and carcasses removed</td><td>total:</td><td>341</td></tr>
<tr><td rowspan="8">Data Quality</td><td colspan="3" rowspan="8">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>Black Bear</td><td>1</td></tr>
<tr><td>Deer</td><td>62</td></tr>
<tr><td>Elk</td><td>1</td></tr>
<tr><td>Moose</td><td>5</td></tr>
<tr><td>Mule Deer</td><td>45</td></tr>
<tr><td>Whitetail Deer</td><td>224</td></tr>
<tr><td>Other wild</td><td>2</td></tr>
<tr><td>Domestic dog</td><td>1</td></tr>
</table>

4.1.12.2. Corridors and Megasites

There is no designated corridor or core habitat crossing US 212 in Montana, although US 212 does follow (or create, depending on how you look at it) a path of higher value corridor habitat amid the core habitat found on the Beartooth Plateau. Near Red Lodge, US 212 cuts through the western side of the Rock Creek megasite.

4.1.12.3. Opportunities to mitigate via STIP

No projects were identified by MDT's 2004-2006 STIP for US 212 in Montana.

4.1.13. US Highway 310

This road borders the northeastern corner of the GYE and includes sections outside of the GYE. We summarized data for the entire 48 mile stretch south of I-90.

4.1.13.1. AVC data summary

Table 14 summarizes the reported AVCs for US 310. The data available were from 2000 to 2002; this span of dates is shorter than other datasets in Montana. Relative to datasets that cover longer periods, the dataset for this segment of road comparatively underestimated the densities of AVCs. On average, a minimum of 4 AVCs occurred per mile between 2000 and 2002 in this 48 mile stretch of US Highway 310. The density analysis revealed one polygon within the GYE with higher relative densities of AVCs, with up to 7.94 AVCs per 3 miles.

Table 14: Summary of animal-vehicle collisions reported from January 2000 to November 2002 on US Highway 310 from its intersection with US 212 to Belfry.

State	Montana	**Route**	US Highway 310	**Road segment length**	48 miles
Geographic & milepost range	US 212 intersection east of Boyd to Belfry (mileposts 3-51)				
Data source(s)	Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports				
Date range	1/3/2000 - 11/1/2002		**Reported AVCs & carcasses removed**	**total:**	**194**
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.			Deer	27
				Mule Deer	100
				Other Wild	4
				Eagle	1
				Whitetail Deer	62

4.1.13.2. Corridors and Megasites

There are no corridor or core habitats overlapping US Highway 310. The Rock Creek megasite overlays US 310.

4.1.13.3. Opportunities to mitigate via STIP

There are no STIP projects for US Highway 310 in the GYE listed in the MDT STIP 2004-2006.

4.1.14. Montana Highway 72

From its intersection with US 310, Montana Highway 72 (MT 72) skirts south along the northeastern border of the GYE, and leaves the GYE just north of the Montana-Wyoming border.

Much of this section of road falls outside the designated GYE boundary, but we report on the 21 mile stretch between Bridger (off the map, just outside the GYE) and the Wyoming border (mileposts 0-21).

4.1.14.1. AVC data summary

Table 15 summarizes AVC data reported for MT 72. The data available were from 2000 to 2002; this span of dates is shorter than other datasets in Montana. Relative to datasets that cover longer periods, the dataset for this segment of road comparatively underestimated the densities of AVCs. On average, a minimum of 5.2 AVCs occurred per mile between 2000 and 2002 in this 21 mile stretch of MT 72. The density analysis revealed one polygon within the GYE with higher relative densities of AVCs, with up to 7.94 AVCs per 3 miles.

Table 15: Summary of animal-vehicle collisions reported between January 2000 and November 2002 for Montana Highway 72 from Bridger to Belfry, Montana.

<table>
<tr><td>State</td><td>Montana</td><td>Route</td><td colspan="2">MT 72</td><td>Road segment length</td><td>21 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Bridger (off east side of map) to Wyoming border (mileposts 0-21)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Montana Department of Transportation's maintenance carcass removal reports and Montana Highway Patrol collision reports.</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/3/2000 - 11/2/2002</td><td rowspan="5">Reported AVCs and carcasses removed</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Data Quality</td><td colspan="3" rowspan="4">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates. It appears that there are gaps in reporting over time and at some milemarkers.</td><td>total:</td><td>109</td></tr>
<tr><td>Deer</td><td>19</td></tr>
<tr><td>Mule Deer</td><td>80</td></tr>
<tr><td>Whitetail Deer</td><td>10</td></tr>
</table>

4.1.14.2. Corridors and Megasites

There was no core or corridor habitat near MT 72. The Rock Creek megasite sits just west of MT 72.

4.1.14.3. Opportunities to mitigate via STIP

A widening and resurfacing project between Belfry and the state border (this segment of road falls outside the GYE) is scheduled to occur in 2005 at an estimated cost of more than $5 million.

4.2. Idaho Results

The AVC data for Idaho consisted of records of wildlife mortality and carcass removal observations from Idaho Department of Fish and Game (IDFG) and Idaho Transportation Department (ITD). One IDFG representative specifically stated that the data was not reliable due to the fact that it was inconsistently collected over time and between different field staff that contributed to the dataset. The staff from ITD also warned that the data on roadkill removals was “spotty” and that it under-represents the actual numbers of animals killed on roads. In addition, we were told that highway patrol does not report any accidents that result in less than $750 damage.

We obtained a total of 605 AVC reports for most primary Idaho routes in the GYE. The data span from 1982 to 2003, though the datasets for each individual road segment are inconsistent in terms of the dates that they cover. Because the data we received were sparse, we opted to not narrow down the data sets to a congruent time period (i.e., so that each dataset for each segments of road used only data from e.g., 1998 to 2003). Datasets for road segments that cover shorter periods of time or have very sparse data reported may yield density grid results that “wash out” areas of higher densities of AVCs within that given road segment compared to other road segments with more consistently recorded data over longer periods.

4.2.1. Interstate 15

Interstate 15 (I-15) makes only a brief appearance in the GYE in Idaho. We assessed a 12 mile stretch of I-15 from the Idaho-Montana border south to Spencer, Idaho.

4.2.1.1. Animal-vehicle collision (AVC) data summary

The data available for I-15 do not appear reliable. With only 12 AVC occurrences reported between 1985 and 1997, it is not surprising that no areas with higher densities of AVCs showed up in the density analyses. Table 16 summarizes the available data for I-15 in the GYE in Idaho.

Table 16: Summary of animal-vehicle collision data reported from 1985 to 1997 for Interstate 15 from the Idaho-Montana border to Spencer, Idaho.

<table>
<tr><td>State</td><td>Idaho</td><td>Route</td><td colspan="2">I-15</td><td>Road segment length</td><td>12 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">ID-MT border to Spencer, Idaho (mileposts 181-193)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Idaho Transportation Department and Idaho Game and Fish</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">6/9/1985 - 7/6/1997</td><td rowspan="3">Reported roadkill</td><td>total:</td><td>9</td></tr>
<tr><td rowspan="2">Data Quality</td><td colspan="3" rowspan="2">Data unreliable. Highly unlikely to accurately represent numbers of AVC occurrences.</td><td>Deer</td><td>3</td></tr>
<tr><td>Elk</td><td>6</td></tr>
</table>

4.2.1.2. Corridors and Megasites

Interstate 15 in the GYE in Idaho bisects lower value corridor habitats on the western edge of the GYE. This stretch of road also crosses through the Red Rock/Centennial megasite.

4.2.1.3. State Transportation Improvement Program projects

There were no projects identified for this segment of I-15 in the 2003-2005 STIP for Idaho.

4.2.2. US Highway 20

From the Idaho-Montana border west of West Yellowstone and south to Chester, Idaho, 54 miles of US Highway 20 (US 20) lie in the GYE. While there are technically no entrances to YNP in Idaho, US 20 could be considered the one primary route in Idaho leading to YNP.

4.2.2.1. Animal-vehicle collision (AVC) data summary

Table 17 summarizes the AVC data reported for US 20 in the GYE. On average, a minimum of 3 AVCs occurred per mile between 1982 and 2003 in this 54 mile stretch of US 20. The density analysis revealed areas with polygons of higher relative densities of AVCs, listed as follows, from north to south:

- Near the US 20-ID 87 intersection (up to 2.27 AVCs per 3 miles)
- North of Island Park (up to 2.27 AVCs per 3 miles)
- Island Park area to Ashton includes 5 separate areas with densities up to 1.51 AVCs per 3 miles, and within two of these areas (one just south of Island Park and the other north of Ashton) AVC densities reached 2.27 AVCs per 3 miles.

Table 17: Summary of animal-vehicle collision data reported from 1982 to 2003 for Idaho Highway 20 from the Idaho-Montana border to Chester, Idaho.

<table>
<tr><td>State</td><td>Idaho</td><td>Route</td><td>Hwy 20</td><td>Road segment length</td><td>54 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="3">ID-MT border to Chester (mileposts 352-406)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="4">Idaho Transportation Department and Idaho Game and Fish</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/17/1982-4/28/2003</td><td>total:</td><td>162</td></tr>
<tr><td rowspan="4">Data Quality</td><td rowspan="4" colspan="2">Data unreliable. Highly unlikely to accurately represent numbers of AVC occurrences.</td><td rowspan="4">Reported roadkill</td><td>Antelope</td><td>2</td></tr>
<tr><td>Deer</td><td>98</td></tr>
<tr><td>Elk</td><td>51</td></tr>
<tr><td>WhiteTail</td><td>11</td></tr>
</table>

4.2.2.2. Corridors and Megasites

From the Idaho-Montana border, US 20 cuts through core habitat, and as it loses elevation after crossing the continental divide, it follows a swath of corridor habitat that decreases in value until south of Island Park, where there is no longer any identified core or corridor habitat of value. US 20 cuts through the Henry's Fork megasite.

4.2.2.3. State Transportation Improvement Program projects

Table 18 lists the upcoming highway improvement projects scheduled for US 20 in the GYE. A total of 8 projects were identified for this stretch of road.

Table 18: Summary of highway improvement projects for US Highway 20 between the Idaho-Montana border and Chester, Idaho. Source: Idaho Transportation Department State Transportation Improvement Program 2004-2007.

Fiscal Year	Project Location	Milepost start	Milepost end	Project Type
2004	TWIN GROVES TO CHESTER, NB	349.012	353.05	RECONST/ REALIGN
2007	SOUTH OF ASHTON	353.05	360	PAVEMENT REHAB
PREL	CORRIDOR POE STUDY	309	360	PORT OF ENTRY
2007	CHESTER TO TWIN GROVES, SB	349.22	353.05	RESURFACING
PREL	INT IMPROVEMENTS, ASHTON	360.343	361.063	INTERSECTION IMPROVEMENT
2007	LAST CHANCE TO MT ST LN	372	406.3	MISCELLANEOUS
PREL	ISLAND PARK PASSING LANES	383.56	384.6	
PREL	ASHTON HILL PASSING LANES	372	373.5	

4.2.3. Idaho Highway 87

Idaho Highway 87 (ID 87) covers about 9 miles from the Idaho-Montana border to US 20. This road is the continuation of MT 87 from the north.

4.2.3.1. Animal-vehicle collision (AVC) data summary

The data available for ID 87 do not appear reliable. Only 19 AVC occurrences were reported (a minimum average of 2 AVCs per mile) between 1982 and 2000. There was one length of road with AVC densities up to 1.51 per 3 miles.

Table 19: Summary of animal-vehicle collision reports for Idaho Highway 87 between 1982 and 2000.

State	Idaho	**Route**	ID 87	**Road segment length**	9 miles
Geographic & milepost range			ID-MT border to US 20 (mileposts 0-9)		
Data source(s)		Idaho Transportation Department and Idaho Game and Fish			
Date range		7/7/1982 - 5/20/2000	**Reported roadkill**	**total:**	19
Data Quality	Data unreliable. Highly unlikely to accurately represent numbers of AVC occurrences.			Deer	15
				Elk	2
				White Tail	2

4.2.3.2. Corridors and Megasites

From the Idaho-Montana border, ID 87 cuts through corridor habitat that decreases in value until ID 87 intersects with US 20. ID 87 cuts through the Henry's Fork megasite.

4.2.3.3. Opportunities to mitigate via STIP

There were no projects identified for this segment of ID 87 in the 2003-2005 STIP for Idaho.

4.2.4. Idaho Highway 33

Idaho Highway 33 (ID 33) connects Victor, Driggs, Tetonia, and Clementsville, leaving the west boundary of the GYE before intersecting with US 20 south of Chester.

4.2.4.1. Animal-vehicle collision (AVC) data summary

We obtained only 6 deer and 1 elk AVC reports between mileposts 113 and 154 on ID 33 between 1983 and 2003. It is highly probable that these data severely under-represent actual numbers of AVC occurrences. No areas with higher densities of AVCs appeared in our analyses.

4.2.4.2. Corridors and Megasites

From Driggs to Victor, ID 33 crosses corridor habitats of increasing values. This road lies within the Teton River megasite.

4.2.4.3. State Transportation Improvement Program projects

One bridge replacement project on ID 33 at Canyon Creek was identified for construction in 2004 in the 2003-2007 Idaho STIP.

4.2.5. Idaho Highway 32

West of Tetonia, Idaho Highway 32 (ID 32) intersects with ID 33, travels north through Felt, Lamont, and Drummond, terminating on a secondary route just east of Ashton.

4.2.5.1. Animal-vehicle collision (AVC) data summary

Only 3 deer-vehicle collisions were reported on ID 32 between 1985 and 1997. It is highly probable that these data severely under-represent actual numbers of AVC occurrences. No areas with higher densities of AVCs appeared in our analyses.

4.2.5.2. Corridors and Megasites

No identified core or corridor habitats occur near ID 32. This road lies within the Teton River megasite south of Lamont and the Henry’s Fork megasite to the north.

4.2.5.3. State Transportation Improvement Program projects

A pavement rehabilitation project is scheduled for ID 32 in 2005 from Ashton to the Fremont County line.

4.2.6. Idaho Highway 31

Idaho Highway 31 (ID 31) connects Victor to US Highway 26 near Swan Valley, Idaho. This route is a State Scenic Byway over Pine Creek Pass and separates the Big Hole Mountains from the Snake River Mountain Range.

4.2.6.1. Animal-vehicle collision (AVC) data summary

Only 31 deer-vehicle collisions and one elk-vehicle collision were reported on ID 31 between 1984 and 2000 (Table 20). It is highly probable that these data severely under-represent actual numbers of AVC occurrences. No areas with higher densities of AVCs appeared in our analyses.

Table 20: Summary of animal-vehicle collisions reported between 1984 and 2000 for Idaho Highway 31 from Victor to US Highway 26 near Swan Valley, Idaho.

State	Idaho	**Route**	ID 31	**Road segment length**		15
Geographic & milepost range			Victor to US 26 near Swan Valley (mileposts 0-15)			
Data source(s)		Idaho Transportation Department and Idaho Game and Fish				
Date range		7/10/1984 - 10/5/2000	**Reported roadkill**	**total:**		32
Data Quality	Data unreliable. Highly unlikely to accurately represent numbers of AVC occurrences.			Deer		31
				Elk		1

4.2.6.2. Corridors and Megasites

The more remote stretches of ID 31 cross through core and high value corridor habitat. This route crosses the Teton River and Palisades megasites.

4.2.6.3. State Transportation Improvement Program projects

A “miscellaneous” project (no other descriptors) located at or near Pine Creek Bridge in Bonneville County (mileposts 5.1 and 5.2) was scheduled for 2007.

4.2.7. US Highway 26

From the Idaho-Wyoming border near Alpine, US Highway 26 (US 26) follows the north side of Palisades Reservoir and the Snake River until it crosses the river near Swan Valley.

4.2.7.1. Animal-vehicle collision (AVC) data summary

Table 21 provides an overview of the AVC data reported between 1985 and 2003 for US 26 in the GYE. It is likely that the dataset under-represents the number of AVCs that occurred. A minimum average of 5 AVCs per mile occurred on US 26 during this time period. There were two distinct areas with higher AVC densities, as follows:

- The entire stretch between Palisades and Irwin (up to 6.81 AVCs per 3 miles)
- From the ID 31 intersection past Swan Valley (up to 6.05 AVCs per 3 miles)

Table 21: Summary of animal-vehicle collisions reported between 1985 and 2003 for US Highway 26 from the Idaho-Wyoming border through Swan Valley and beyond to the Greater Yellowstone Ecosystem border.

<table>
<tr><td>State</td><td>Idaho</td><td>Route</td><td colspan="2">US Highway 26</td><td>Road segment length</td><td>48 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">GYE border through Swan Valley to ID-WY border (mileposts 354-402)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Idaho Transportation Department and Idaho Game and Fish</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">3/7/1985 - 5/7/2003</td><td rowspan="4">Reported roadkill</td><td>total:</td><td>241</td></tr>
<tr><td rowspan="3">Data Quality</td><td colspan="3" rowspan="3">Data opportunistically recorded and are not guaranteed to be consistently recorded.</td><td>Deer</td><td>230</td></tr>
<tr><td>Elk</td><td>5</td></tr>
<tr><td>White Tail</td><td>6</td></tr>
</table>

4.2.7.2. Corridors and Megasites

Along Palisades Reservior, US 26 crosses core habitat; from the reservoir dam down the Snake River, corridor habitat values decrease. This highway lies between the Palisades and Bear Creek megasites, and crosses through the north end of the Bear Creek megasite.

4.2.7.3. State Transportation Improvement Program projects

Table 22 lists the projects slated for US 26 in the GYE. It wasn't clear when these projects would occur ("prel" likely means "preliminary" but no further details were available).

Table 22: Summary of highway improvement projects for US Highway 26 between mileposts 354 and 402. Source: Idaho Transportation Department State Transportation Improvement Program 2004-2007.

Fiscal Year	Project Location	Milepost start	Milepost end	Project Type
PREL	SWAN VALLEY SLIDE MONITORING	374.1	374.5	PREL ENG
PREL	US 26 PASSING LANE EAST BOUND	364.7	366	MISCELLANEOUS
PREL	PALISADES TURNOUTS	386	402.5	SAFETY IMPROVEMENT
PREL	SWAN VALLEY WEST	368.52	376.95	PAVEMENT REHAB
PREL	CLARK HILL RA, BONNEVILLE CO	357.37	357.41	REST AREA IMPROVEMENT

4.2.8. US Highway 89

In the southern reaches of the GYE, US Highway 89 (US 89) runs west from the Idaho-Wyoming border then turns south and leaves the GYE.

4.2.8.1. Animal-vehicle collision (AVC) data summary

The only data we obtained for US 89 in the GYE were 3 deer-vehicle collisions that occurred in 2004 between mileposts 28 and 31.

4.2.8.2. Corridors and Megasites

This entire route follows lower value corridor habitats. Just west of the Idaho-Wyoming border, US 89 crosses through the Upper Smiths Fork megasite.

4.2.8.3. Opportunities to mitigate via STIP

Between mileposts 26 and 30, a sealcoat is scheduled to occur in 2005. The STIP also lists a reconstruction and realignment project in the same year between mileposts 30.3 and 31.1.

4.2.9. Idaho Highway 34

From the Idaho-Wyoming border, southwest of Etna, Wyoming, ID 34 travels west across the Caribou Mountain range, then south for 56 miles to intersect with US Highway 30 in Soda Springs, Idaho. West of Soda Springs, ID 34 branches off from US Highway 30 for 38 miles to its intersection with Idaho Highway 36 just outside the GYE boundary.

4.2.9.1. Animal-vehicle collision (AVC) data summary

Table 23 reviews the AVC data obtained for ID 34. The density analyses revealed one area with higher AVC densities (up to 1.51 AVCs per 3 miles) west of Soda Springs near the US Highway 30 intersection where ID 34 turns south. These results must be tempered by the fact that while the data were recent (2003-2004), they were limited to a 25 mile section (mileposts 34–59, west of Soda Springs) of this 94 mile length of road.

Table 23: Summary of animal-vehicle collisions reported between February 2003 and May 2004 on Idaho Highway 34 in the Greater Yellowstone Ecosystem.

<table>
<tr><td>State</td><td>Idaho</td><td>Route</td><td>Idaho Highway 34</td><td colspan="2">Road segment length</td><td>94 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">ID-WY border SW of Etna, WY south to US 30 and ID 36</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Idaho Transportation Department and Idaho Game and Fish</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">2/6/2003-5/4/2004</td><td rowspan="6">Reported roadkill</td><td>total:</td><td>13</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded. Only data recorded from mileposts 34 through 59 (25 of 94 miles).</td><td>deer</td><td>7</td></tr>
<tr><td>elk</td><td>1</td></tr>
<tr><td>skunk</td><td>2</td></tr>
<tr><td>raccoon</td><td>2</td></tr>
<tr><td>cat</td><td>1</td></tr>
</table>

4.2.9.2. Corridors and Megasites

From the Idaho-Wyoming border west, ID 34 cuts through core habitat as well the northern part of the Caribou Mountains megasite. This road navigates through corridor habitats of decreasing value further west, and then passes through the southern part of the Blackfoot River megasite near Soda Springs where no core or corridor habitats were identified. From Soda Springs west and then south, ID 34 continues through low value corridor habitats.

4.2.9.3. State Transportation Improvement Program projects

Seven highway improvement projects for ID 34 in the GYE are summarized in Table 24.

Table 24: Summary of highway improvement projects for Idaho Highway 34 between the Idaho-Wyoming border and the intersection with Idaho Highway 36. Source: Idaho Transportation Department State Transportation Improvement Program 2004-2007.

Fiscal Year	Project Location	Milepost start	Milepost end	Project Type
2005	BLACKFOOT RVR BR TO HENRY, CARIBOU CO	70.47	82	PAVEMENT REHAB
2005	NITER BENCH RD TO JCT US30, CARIBOU CO	40	50	SEALCOAT
2007	3RD ST RR BR, SODA SPRINGS	57.75	58.05	BRIDGE REHAB
2005	MONSANTO TO BLACKFOOT RIVER	60	70	SEALCOAT
2006	LOWER VOLUME CORRIDOR PLAN	7.62	113.6	PLANNING / TRANSP STUDY
2005	TIN CUP CR TO WYOMING ST LN	104	113.6	SEALCOAT
2005	HUBBARD CORRALS TO WAYAN	82	94	SEALCOAT

4.2.10. US Highway 30

The southern-most road crossing the Idaho-Wyoming state line in the GYE, US Highway 30 (US 30) traverses west from the state line, then heads northwest crossing US 89 to Soda Springs. From there US 30 heads west to the GYE boundary.

4.2.10.1. Animal-vehicle collision (AVC) data summary

We obtained AVC reports for US 30 covering about 15 months in 2003-2004. A total of 66 AVCs were reported between mileposts 372 and 446 (Table 25), while there were no reports for the final 8 miles of US 30 to the Wyoming border. Again, it is probable that these data underestimate the numbers of actual AVCs that occurred during this time, especially since there are no data for the western-most 8 miles of US 30. A total of 4 areas with higher densities of AVCs were revealed in the density analysis, as follows:

- Three small, distinct areas south of Montpelier had AVC densities up to 1.51 AVCs per 3 miles
- One longer stretch of road south of Montpelier had AVC densities up to 3.78 AVCs per 3 miles.

Table 25: Summary of animal-vehicle collisions reported between February 2003 and May 2004 for US Highway 30 in the Greater Yellowstone Ecosystem in Idaho.

<table>
<tr><td>State</td><td>Idaho</td><td>Route</td><td colspan="2">US Highway 30</td><td>Road segment length</td><td>84 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">ID-WY border to west of Lava Hot Springs (mileposts 372-456)</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Idaho Transportation Department and Idaho Game and Fish</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">2/9/2003-5/19/2004</td><td rowspan="13">Reported roadkill</td><td>total:</td><td>66</td></tr>
<tr><td rowspan="12">Data Quality</td><td colspan="3" rowspan="12">Data opportunistically recorded and are not guaranteed to be consistently recorded. Covering only 15 months of time and 84 miles, it is likely that the actual number of roadkills greater than reported. No observations recorded beyond milepost 446.</td><td>Badger</td><td>1</td></tr>
<tr><td>Bird</td><td>2</td></tr>
<tr><td>Cat</td><td>1</td></tr>
<tr><td>Deer</td><td>47</td></tr>
<tr><td>Elk</td><td>4</td></tr>
<tr><td>Fox</td><td>1</td></tr>
<tr><td>Moose</td><td>1</td></tr>
<tr><td>Muskrat</td><td>1</td></tr>
<tr><td>Rabbit</td><td>3</td></tr>
<tr><td>Raccon</td><td>2</td></tr>
<tr><td>Skunk</td><td>2</td></tr>
<tr><td>unknown</td><td>1</td></tr>
</table>

4.2.10.2. Corridors and Megasites

This entire route follows lower value corridor habitats, except for in the Lava Hot Springs area where habitat corridor values are higher between two areas of core habitat. Just west of the Idaho-Wyoming border, US 30 crosses through the southern end of the Upper Smiths Fork megasite.

4.2.10.3. State Transportation Improvement Program projects

Table 26 includes the highway projects planned for US 30 in the GYE. In addition, one “bridge construction and approaches” was identified for US 30*B* at the Portneuf River Bridge, Lava Hot Springs (mileposts 0.24-0.248).

Table 26: Summary of highway improvement projects for US Highway 30 between mileposts 372 and 456. Source: Idaho Transportation Department State Transportation Improvement Program 2004-2007.

Fiscal Year	Project Location	Milepost start	Milepost end	Project Type
2006	SODA CORRIDOR ENHANCEMENT, PH 2	405.5	406.8	LANDSCAPING
2007	LAVA HOT SPRINGS TO LUND	372	378.4	SEALCOAT
2006	THOMAS FORK CR, BEAR LAKE CO	454.3	454.8	MISCELLANEOUS
PREL	GEORGETOWN ALTERNATE ROUTE	422.4	424.6	NEW ROUTE
2005	BIG HILL TO WY ST LN	442	456	SEALCOAT
2004	BANKS VALLEY RD TO PEGRAM RD, BEAR LAKE CO	441.5	447.3	METAL GUARDRAIL
2004	TOPAZ TO LAVA HOT SPRINGS, BANNOCK CO	365.3	371.7	MAJOR WIDENING
2004	FISH CR PASS, NEAR LAVA HOT SPRINGS	372	377.5	PAVEMENT MARKING
2007	SODA SPRINGS SIDEWALK REPAIR	405.1	405.2	IMPROV DRAINAGE
2007	NOUNAN RD TO WRIGHT RD, NEAR GEORGETOWN	424.6	430	SEALCOAT
2007	LUND TO HEGSTROM RD, CARIBOU CO	378.3	382	MISCELLANEOUS
2005	TOPAZ TO LAVA HOT SPRINGS SEALCOAT	365.3	371.7	SEALCOAT
PREL	ECL SODA SPRINGS TO WYO LINE	406.8	455.5	SAFETY IMPROVEMENT
2008	HEGSTROM RD TO JCT SH 34	382	386.5	MISCELLANEOUS

4.3. Wyoming Results

Wildlife mortality and carcass removal observations from 1997 through February 2004 were obtained from Wyoming Department of Transportation (WYDOT) Highway Safety Program for primary Wyoming roads in the GYE. In addition, the Jackson Hole Wildlife Foundation provided their database of reported AVCs in Teton County alone; this database included AVCs from 2002 and 2003 that were collected from local volunteers, Grand Teton National Park staff, Teton County Sheriff, Wyoming Fish and Game, and WYDOT.

These two AVC data sets were combined and screened for duplicates, after which 1,245 AVC records remained for the density analysis. Datasets for individual road segments that cover shorter periods of time or have very sparse data compared to other individual road segments may yield density grid results that "wash out" areas of higher densities of AVCs within that given road segment compared to other road segments with more consistently recorded data over longer periods.

Yellowstone National Park provided AVC data from 1989-2003. The data provided did not include specific locations of AVCs that would allow these data to be included in the density analyses. We summarize these data separately and report on this information at the end of the Wyoming results section.

4.3.1. Wyoming Highway 354

Wyoming Highway 354 (WYO 354) intersects with US Highway 189 north of Daniel, Wyoming, and heads west for 6 miles of paved road that crosses the Green River. Beyond the pavement, WYO 354 becomes a "graded and earth road" that accesses Merna, Wyoming.

4.3.1.1. Animal-vehicle collision (AVC) data summary

Table 27 summarizes the AVC reports for WYO 354. There were very few reports and it is likely that these data underestimate the actual AVC occurrences. It is not clear if the data were reported only on the 6 miles of paved road or if reports included the gravel road as well. There were no areas with higher AVC densities.

Table 27: Summary of animal-vehicle collision reports for Wyoming Highway 354 west of US Highway 189 from February 2000 to September 2001.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td colspan="2">WY Highway 354</td><td>Road segment length</td><td>~6 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">west from US189/US 191 intersection north of Daniel</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Wyoming Department of Transportation</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">2/13/2000 - 9/20/2001</td><td rowspan="4">Reported roadkill</td><td>total:</td><td>5</td></tr>
<tr><td rowspan="3">Data Quality</td><td colspan="3" rowspan="3">Data opportunistically recorded, not guaranteed to be consistently recorded. Data likely under represent actual AVC occurrences.</td><td>Deer</td><td>4</td></tr>
<tr><td>Moose</td><td>1</td></tr>
<tr><td></td><td></td></tr>
</table>

4.3.1.2. Corridors and Megasites

This road does not cross any core or corridor habitat. WYO 354 lies within the Lower Green megasite.

4.3.1.3. State Transportation Improvement Program projects

The 2003 Wyoming STIP identified a right-of-way fence replacement project for 2004 on 6.17 miles, from mileposts 11.5-17.2, of WYO 354. There were no other projects identified in the 2005 Wyoming STIP.

4.3.2. Wyoming Highway 353

At the southern end of the GYE, Wyoming Highway 353 (WYO 353) intersects with US 191 just south of Boulder, Wyoming. This road heads east and then south and consists of paved and gravel sections for 16 miles to Big Sandy, Wyoming, at the western edge of the Wind River Mountains. There is an alternative route (unidentified) from WYO 353 and Big Sandy that cuts westward, returning to US 191. WYO 353 continues south of Big Sandy beyond the GYE boundary, eventually connecting to Wyoming Highway 28 near Farson.

4.3.2.1. Animal-vehicle collision (AVC) data summary

Two AVCs with deer were recorded in three years time, between 2000 and 2003, on WYO 353. These data offer no reliable indication of patterns of AVC occurrences.

4.3.2.2. Corridors and Megasites

This road does not bisect any core or corridor habitat, although the core habitat of the Wind River Range lies relatively close to the north and east of this route. Part of WYO 353 lies within the eastern side of the Lower Green megasite.

4.3.2.3. State Transportation Improvement Program projects

There were no projects identified in the 2003 or 2005 Wyoming STIP for WYO 353.

4.3.3. Wyoming Highway 352

From US Highway 191, Wyoming Highway 352 (WYO 352) heads 4 miles north to Cora, Wyoming. Beyond Cora, this paved road extends another 21 miles north along the northwest edge of the Wind River Mountains, between this range and the Gros Ventre Range, and eventually turns to a gravel road that reaches into the Wind River range, terminating near Green River Lakes.

4.3.3.1. Animal-vehicle collision (AVC) data summary

Table 28 shows a total of 24 reported animal-vehicle collisions for WYO 352 that occurred between July 1999 and April 2004; no areas with higher densities of AVCs appeared in the GIS analyses. It is difficult to judge the reliability of these data, though it is most likely that these data under-represent actual AVCs.

Table 28: Summary of animal-vehicle collisions reported between July 1999 and April 2003 for Wyoming Highway 352.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td>WY Highway 352</td><td colspan="2">Road segment length</td><td>25 miles paved</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">From US 191 north to Cora, WY, & into Wind River Range</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Wyoming Department of Transportation</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">7/16/1999 - 4/14/2003</td><td rowspan="6">Reported roadkill</td><td>total:</td><td>24</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded.</td><td>Antelope</td><td>3</td></tr>
<tr><td>Deer</td><td>10</td></tr>
<tr><td>Elk</td><td>2</td></tr>
<tr><td>Moose</td><td>4</td></tr>
<tr><td>Mule Deer</td><td>5</td></tr>
</table>

4.3.3.2. Corridors and Megasites

The remote reaches of WYO 352 extend into corridor habitat of increasing values as the road reaches its northern terminus. Core habitats in the Gros Ventre and Wind River ranges can be found on either side of this road. The southern end of WYO 352, near Cora, runs through the Lower Green megasite.

4.3.3.3. State Transportation Improvement Program projects

There was a grading, overlay, and chip seal project slated for 2003 between mileposts 4 and 11.7. Twelve miles of right-of-way fencing were scheduled for replacement in 2004 between mileposts 0 and 12 of WYO 352. No projects for WYO 352 were identified in the 2005 STIP.

4.3.4. Wyoming Highway 351

Wyoming Highway 351 (WYO 351) stretches 24 miles between US Highway 189 (US 189) and US Highway 191 (US 191) south of the junction where these two highways separate near Daniel, Wyoming. Big Piney, Wyoming lies a short distance south of the western end of WYO 351, where the road intersects with US 189. The eastern end of WYO 351 intersects with US 191, 11 miles south of Boulder, Wyoming.

4.3.4.1. Animal-vehicle collision (AVC) data summary

A total of 25 animal-vehicle collisions were reported across the 24 miles of WYO 351 between July 1999 and April 2003 (Table 29). The GIS analyses resulted in one area of higher densities of AVCs (up to 1.94 AVCs per 3 miles) on WYO 351. It is difficult to judge the reliability of these data, though it is most likely that these data under-represent actual AVCs.

Table 29: Summary of animal-vehicle collisions reported between July 1999 and April 2003 for the 24-mile long Wyoming Highway 351.

State	Wyoming	**Route**	WY Highway 351	**Road segment length**	24 miles
Geographic & milepost range			Between US 191 (n. of Big Piney) & US 189 (s. of Boulder)		
Data source(s)		Wyoming Department of Transportation			
Date range		7/16/1999 - 4/14/2003	**Reported roadkill**	**total:**	25
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded.			Antelope	5
				Deer	6
				Moose	1
				Mule Deer	13

4.3.4.2. Corridors and Megasites

This road does not cross any core or corridor habitat, though it does cross the Green River's upper reaches of the Fontenelle Reservoir. WYO 351 lies within the Lower Green megasite.

4.3.4.3. State Transportation Improvement Program projects

From mileposts 0 to 6.3, a leveling, overlay and chip seal project is scheduled to occur on WYO 351 in 2005. A mill, overlay, chip seal and guardrail project from milepost 6.3 to 12.9 is scheduled to occur in 2006.

4.3.5. Wyoming Highway 350

Wyoming Highway 350 (WYO 350) is a short paved route from US 189 at Big Piney west for 5 miles. Beyond here, a locally-maintained gravel road extends to meet with other unidentified gravel roads that traverse the Salt Range (only the paved stretch of WYO 350 is included on the maps).

4.3.5.1. Animal-vehicle collision (AVC) data summary

There was only one AVC record of an antelope hit on WYO 350 in 2000. This is very unlikely to be representative of the actual AVC activity.

4.3.5.2. Corridors and Megasites

The more remote reaches of WYO 350 (again, not represented on the maps) access areas of corridor habitats that lead to core habitat in the Salt Range. The five miles of paved highway just west of Big Piney lie within the Lower Green megasite, while the gravel road continues into the East Wyoming Range megasite further to the west.

4.3.5.3. State Transportation Improvement Program projects

There were no projects identified in the 2003 and 2005 Wyoming STIP for WYO 350.

4.3.6. Wyoming Highway 296

Wyoming Highway 296 (WYO 296), also known as the "Chief Joseph Scenic Highway" is a 46-mile route connecting Wyoming Highway 120 (WYO 120) to US Highway 212 (US 212; also know as the "Beartooth Highway"). This state-designated "Scenic Byway" crosses Dead Indian Summit (elevation 8060 feet) and the Clark's Fork River as it traverses remote areas of the Absoroka Mountains.

4.3.6.1. Animal-vehicle collision (AVC) data summary

Only 5 deer and 1 elk were reported involved in AVCs on WYO 296 between August 2000 and 2001. It is likely that these data under-represent actual AVCs.

4.3.6.2. Corridors and Megasites

This route perforates core habitat and the WYO 296 corridor follows higher value corridor habitats (or, depending on how you look at it, WYO 296's presence amidst the core habitat devalues these habitats, creating corridor habitat). Most of this route falls within the Upper Clark Fork megasite.

4.3.6.3. State Transportation Improvement Program projects

There was a pavement leveling project scheduled for 2003 between mileposts 26.41 and 32.98 on WYO 296, in the Dead Indian Creek area. No other projects were identified for this road in the 2003 or 2005 Wyoming STIPs.

4.3.7. Wyoming Highway 291

From Cody, Wyoming Highway 291 (WYO 291) heads southwest as a paved road for 9 miles, then becomes a gravel road that follows the Shoshone River, eventually reaching Valley, Wyoming. Both the river and road are features on the landscape that lie between the Carter and Absoroka Mountain ranges.

4.3.7.1. Animal-vehicle collision (AVC) data summary

A total of 10 deer were recorded on WYO 291 between 2000 and 2004. These data did not reveal any clusters of higher AVC densities, and probably do not accurately represent actual AVC occurrences.

4.3.7.2. Corridors and Megasites

Lower value corridor habitat, likely rated so due to the presence of WYO 291, penetrates core habitat up to and beyond the town of Valley. This road is found in the Upper Shoshone megasite.

4.3.7.3. State Transportation Improvement Program projects

No projects were identified in the 2003 or 2005 Wyoming STIPs for WYO 291.

4.3.8. Wyoming Highway 290

Wyoming Highway 290 (WYO 290) originates from Meteetsee and Wyoming Highway 120. From this point west, WYO 290 is a paved road for 11 miles, then a gravel road that ends at the town of Pitchfork, Wyoming (our map does not include the gravel road). Sections of this road follow the Greybull River.

4.3.8.1. Animal-vehicle collision (AVC) data summary

Only one AVC with a deer was reported in 2003 for WYO 290. No trends or reliable representation of AVCs on this road can be derived from a single report.

4.3.8.2. Corridors and Megasites

This highway does not cross any core or corridor habitats. It does lie within the Greybull megasite.

4.3.8.3. State Transportation Improvement Program projects

The Wood River bridge on WYO 290 was scheduled to be replaced (milepost 6.04) in 2003. No other projects were identified in the 2005 Wyoming STIP for WYO 290.

4.3.9. Wyoming Highway 28

In the southeastern corner of the GYE, Wyoming Highway 28 (WYO 28) branches east from US Highway 287 south of Lander and eventually, beyond the boundaries of the GYE, connects to US 191 in Farson, Wyoming. This route crosses the Continental Divide at South Pass (elevation 7660 feet) in the southern tip of the Wind River Mountains.

4.3.9.1. Animal-vehicle collision (AVC) data summary

Seven deer, two moose, and one elk were reported as AVCs on WYO 28 between May 2003 and January 2004. No areas of higher AVC density were revealed in the GIS analyses. It is likely that these data under-represent the actual number of AVC occurrences on this route.

4.3.9.2. Corridors and Megasites

This highway crosses no core or corridor habitat nor any priority megasites.

4.3.9.3. State Transportation Improvement Program projects

In 2005, Wyoming DOT is planning to relocate about 4.3 miles of WYO 28 between mileposts 46.7 and 51.0, east of South Pass. A remote weather information system will be installed in 2005 at South Pass. A 4.27 mile truck climbing lane will be constructed between mileposts 63.6 and 67.87 in the Little Popo Agie area in 2005.

4.3.10. Wyoming Highways 232/233

At the southern end of the GYE, Wyoming Highway 232 (WYO 232) begins at its intersection with US 89 near Cokeville (not on GYE map). From here, WYO 232 is a paved road that heads east and north for 12 miles. Beyond the pavement, a state-maintained gravel road (not on map) heads east and then south, eventually becoming Wyoming Highway 233 (WYO 233), which continues south, the last 17 miles as pavement that leads to US 189 near Frontier, Wyoming. The WYO 232 and WYO 233 routes are identified as a state-designated “Wyoming Backway”, passing near landscape features such as the Smiths Fork River, Commissary Ridge, and Lake Viva Naughton.

4.3.10.1. Animal-vehicle collision (AVC) data summary

Between November 1997 and January 2001, only 7 deer were reported as AVCs. No areas of higher AVC densities were identified through the GIS analyses. It is likely that these data under-represent the actual numbers of AVC occurrences on this route.

4.3.10.2. Corridors and Megasites

WYO 232 progressively infiltrates corridor habitat of increasing value, and crosses core habitat beyond where the pavement ends. As this road turns south, becoming WYO 233, the corridor habitat decreases in value, and the southern most 15 miles of pavement of WYO 233 cross landscapes with no identified corridor or core habitat. The Commissary Ridge megasite overlays the northern reaches of WYO 233’s pavement while WYO 232 crosses through the Upper Smiths Fork megasite.

4.3.10.3. State Transportation Improvement Program projects

Both the 2003 and 2005 Wyoming STIPs slated preliminary engineering for a reconstruction project on WYO 233 from milepost 1.5 to 17.2, with a bridge replacement at milepost 4.4. It was unclear when these projects might occur.

4.3.11. Wyoming Highway 22, Wilson to Jackson

Between Wilson and Jackson, Wyoming Highway 22 (WYO 22) traverses 7 miles. This stretch of road crosses the Snake River and lies to the east of Teton Pass.

4.3.11.1. Animal-vehicle collision (AVC) data summary

A total of 32 AVCs were reported (Table 30) by two sources, the Wyoming Department of Transportation and the Jackson Hole Wildlife Foundation, on WYO 22 between Jackson and Wilson from January of 2000 to the end of 2003. Higher densities of AVCs (up to 4.84 AVCs per 3 miles) occurred near the WYO 22 junction with US 26 near Jackson.

Table 30: Summary of animal-vehicle collisions reported from January 2000 to December 2003 on Wyoming Highway 22 between Wilson and Jackson, Wyoming.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td colspan="2">WY Highway 22</td><td>Road segment length</td><td>7 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">From Wilson to Jackson, Wyoming</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Wyoming Department of Transportation, Jackson Hole Wildlife Foundation</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/8/2000 - 12/31/2003</td><td rowspan="5">Reported roadkill</td><td>total:</td><td>32</td></tr>
<tr><td rowspan="4">Data Quality</td><td colspan="3" rowspan="4">Data opportunistically recorded and are not guaranteed to be consistently recorded. Data from different sources were combined and screened for duplicates.</td><td>Deer</td><td>16</td></tr>
<tr><td>Elk</td><td>13</td></tr>
<tr><td>Moose</td><td>2</td></tr>
<tr><td>Mule Deer</td><td>1</td></tr>
</table>

4.3.11.2. Corridors and Megasites

This short stretch of road crosses through corridor habitat of medium to high value. Both Wilson and Jackson, and therefore WYO 22 between the two towns, lie within the Grey's River megasite

4.3.11.3. State Transportation Improvement Program projects

The 7 miles of WYO 22 between Jackson and Wilson are scheduled to be reconstructed although neither the 2003 or 2005 Wyoming STIPs predicted when this project will occur. In 2005, all of WYO 22 between Jackson and the Idaho border (mileposts 0-17.5) is scheduled for Intelligent Transportation System (ITS) improvements including the installation of signs and gates.

4.3.12. Wyoming Highway 22, Wilson to WY-ID border

West of Wilson to the Idaho border, Wyoming Highway 22 (WYO 22) crosses Teton Pass (elevation 8431 feet). This 12-mile stretch of highway cuts between the Teton and Snake Mountain ranges.

4.3.12.1. Animal-vehicle collision (AVC) data summary

A total of 31 AVCs were reported for WYO 22 between Wilson and the WY-ID border from July 2000 to December 2003 (Table 31). One area, close to the border, had higher AVC densities (up to 1.94 AVCs per 3 miles). It is difficult to judge the reliability of these data although it is likely that this is an under representation of the actual AVC occurrences.

Table 31: Summary of animal-vehicle collision reports from July 2000 to December 2003 for Wyoming Highway 22, from Wilson to the Wyoming-Idaho border.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td colspan="2">WY 22</td><td>Road segment length</td><td>12 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">WY-ID border to Wilson, Wyoming</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Wyoming Department of Transportation, Jackson Hole Wildlife Foundation</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">7/11/2000 - 12/21/2003</td><td rowspan="4">Reported roadkill</td><td>total:</td><td>31</td></tr>
<tr><td rowspan="3">Data Quality</td><td colspan="3" rowspan="3">Data opportunistically recorded and are not guaranteed to be consistently recorded. Data from different sources were merged and screened for duplicates.</td><td>Deer</td><td>11</td></tr>
<tr><td>Elk</td><td>1</td></tr>
<tr><td>Moose</td><td>19</td></tr>
</table>

4.3.12.2. Corridors and Megasites

West of Wilson, WYO 22 travels through corridor habitat of increasing value, then ascends and crests in core habitat on Teton Pass to the Wyoming-Idaho border. This road lies within the Gray's River megasite.

4.3.12.3. State Transportation Improvement Program projects

Preliminary engineering for guardrail installation and an overlay were slated to occur between mileposts 6.7 and 17.5 of WYO 22 in 2004. In 2005, a runaway truck mitigation project will be installed at milepost 6.4 and all of WYO 22 between Jackson and the Idaho border (mileposts 0-17.5) is scheduled for Intelligent Transportation System (ITS) improvements including the installation of signs and gates.

4.3.13. Wyoming Highway 131

In the southeast area of the GYE, Wyoming Highway 131 (WYO 131) heads southwest from Lander, Wyoming. The paved road runs for 9 miles along the Popo Agie River until it accesses Sinks Canyon State Park, and then continues as a state-maintained gravel road that eventually connects to WY 28 to the south.

4.3.13.1. Animal-vehicle collision (AVC) data summary

Between September 2000 and November 2003, 6 deer were reported as AVCs; no areas of higher AVC densities resulted from the GIS analyses. It is likely these under-represent the actual number of occurrences on WYO 131.

4.3.13.2. Corridors and Megasites

This highway crosses no core or corridor habitat nor any priority megasites.

4.3.13.3. State Transportation Improvement Program projects

The 2003 Wyoming STIP showed that a reconstruction of this road was to occur in 2003 from mileposts 2.3 to 9.0. In addition, a 0.3 mile pathway project was scheduled to occur in the state park section of WYO 131 in the same year. No projects were planned for this road in the 2005 Wyoming STIP.

4.3.14. Wyoming Highway 120, south of Cody

Meeteetsee and Cody, Wyoming, are connected by 24 miles of Wyoming Highway 120 (WYO 120). This is accessed from US Highway 14/16/20 just southeast of Cody and continues south approximately 10 miles beyond Meeteetsee until it exits the GYE.

4.3.14.1. Animal-vehicle collision (AVC) data summary

Between June and December, 2003, 6 deer were reported as AVCs on WYO 120 south of Cody. It is difficult to judge the quality of these data, but it is likely these under-represent the actual number of occurrences.

4.3.14.2. Corridors and Megasites

This road does not transect any corridor or core habitat. A section of WYO 120 north and south of Meeteetsee lies in the Upper Shoshone megasite.

4.3.14.3. State Transportation Improvement Program projects

An infiltration and drainage correction project was scheduled to occur in 2003 on WYO 120 between mileposts 55.1 and 55.8, near Meeteesee. No other projects were identified for WYO 120 in the 2005 Wyoming STIP.

4.3.15. Wyoming Highway 120, north of Cody

North of Cody, Wyoming Highway 120 (WYO 120) extends about 30 miles before leaving the GYE. This road provides access to the Chief Joseph Scenic Highway (WYO 296) 17 miles north of Cody, and eventually crosses the Montana border and becomes MT 72.

4.3.15.1. Animal-vehicle collision (AVC) data summary

Between June 2003 and February 2004, 1 elk and 6 deer were reported as AVCs on WYO 120 north of Cody. No areas of higher AVC densities resulted from the GIS analyses. It is difficult to judge the quality of these data, but it is likely these under-represent the actual number of occurrences.

4.3.15.2. Corridors and Megasites

About half-way between Cody and the WYO 296 junction, WYO 120 penetrates corridor habitats that, as the road approaches and passes that junction, carry medium to high corridor habitat values. Past the WYO 296 junction, WYO 120 crosses corridor habitats that decrease in value as the highway navigates across the landscape to the north. Both ends of WYO 120, near Cody and the GYE border to the north, pass through habitats with no identified corridor values.

4.3.15.3. State Transportation Improvement Program projects

From milepost 127.9 to milepost 133.0, WYO 120 will be widened and resurfaced. Within that project's extent, a bridge will be replaced at milepost 128.9. The 2003 Wyoming STIP identified these projects as being in the preliminary engineering phase and predicted a completion date of 2008, but the 2005 STIP includes these projects on the construction list implying that this work will be done in 2005.

4.3.16. US Highways 89/26/191, Jackson to Hoback Junction

Following the Snake River, a concurrent segment of US Highways 89, 26 and 191 (US 89/26/191) stretches 12 miles between Jackson and Hoback Junction. The Snake Range lies to the west and the Gros Ventre Range to the east of this highway.

4.3.16.1. Animal-vehicle collision (AVC) data summary

From November 2002 to December 2003, a total of 79 AVCs were reported for US 98/26/191 between Jackson and Hoback Junction (Table 32), a minimum average of 6.6 AVCs per mile during that time. This entire stretch of road appears to be a high density AVC area (ranging from 0.97 to 1.94 AVC per three miles). Within this stretch, three areas have higher densities up to 2.9 AVCs per 3 miles. These data probably under-represent the actual numbers of AVCs, but given the efforts of local volunteers to report AVCs to the Jackson Hole Wildlife Foundation, these data are likely more reliable than other datasets in Wyoming.

Table 32: Summary of animal-vehicle collision reports for US Highways 89/26/191 from November 2002 and December 2003 between Jackson and Hoback Junction, Wyoming.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td>US 89/US 26/US 191</td><td>Road segment length</td><td>12 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="3">Jackson to Hoback Junction</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="4">Wyoming Department of Transportation, Jackson Hole Wildlife Foundation</td></tr>
<tr><td colspan="2">Date range</td><td>11/18/2002 - 12/31/2003</td><td rowspan="5">Reported roadkill</td><td>total:</td><td>79</td></tr>
<tr><td rowspan="4">Data Quality</td><td colspan="2" rowspan="4">Data opportunistically recorded and are not guaranteed to be consistently recorded. Data from two sources were merged and screened for duplicates.</td><td>Deer</td><td>57</td></tr>
<tr><td>Elk</td><td>14</td></tr>
<tr><td>Moose</td><td>1</td></tr>
<tr><td>Mule Deer</td><td>7</td></tr>
</table>

4.3.16.2. Corridors and Megasites

This highway follows a narrow swath of higher value corridor habitat that lies between the core habitat of the Gros Ventre and Snake mountain ranges. While the higher priority Gray’s River megasite practically surrounds US 89/26/191 between Jackson and Hoback Junction, the road does not cross through any high priority megasite.

4.3.16.3. State Transportation Improvement Program projects

The 2005 Wyoming STIP described two projects for US 89/26/191 between Jackson and Hoback Junction to be delivered in 2008. A reconstruction and transportation enhancement project with pathways and landscaping is planned between mileposts 142.5 and 148.6.

4.3.17. US Highways 89/26, Hoback Junction to Alpine to Idaho border

US Highways 89 and 26 (US 89/26) from Hoback Junction west to Alpine, Wyoming, navigate 23 miles along the Snake River. From Alpine, US 89 heads south (that section of road is reported on in the next section) while US 26 travels another 2 miles north to the Idaho border. The Salt Range lies to the south while the Snake Range lies to the north.

4.3.17.1. Animal-vehicle collision (AVC) data summary

Between January 2000 and December 2003, 79 AVCs were reported on the 25 miles of US 89/26 between Hoback Junction and the Idaho border, north of Alpine, Wyoming (Table 33). These data probably under-represent the actual numbers of AVCs, but given the efforts of local volunteers to report AVCs to the Jackson Hole Wildlife Foundation, these data are likely more reliable than other datasets in Wyoming. Three areas of higher AVC densities appeared in the GIS analyses. Two of these areas, one near Hoback Junction and the other approximately 5 miles from Alpine, had maximum densities of 1.94 AVCs per 3 miles. Between these two areas lies a longer segment with the same AVC densities except for one part where the density of AVCs is higher (maximum 2.90 AVCs per 3 miles).

Table 33: Summary of animal-vehicle collision reports from January 2000 and December 2003 for US Highways 89 & 26 between Hoback Junction and the Idaho border north of Alpine, Wyoming.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td>US Highway 89/26</td><td>Road segment length</td><td>25 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="3">Hoback Junction to Idaho border</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="4">Wyoming Department of Transportation, Jackson Hole Wildlife Foundation</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">1/1/2000 - 12/29/2003</td><td rowspan="7">Reported roadkill</td><td>total:</td><td>79</td></tr>
<tr><td rowspan="6">Data Quality</td><td colspan="3" rowspan="6">Data opportunistically recorded and are not guaranteed to be consistently recorded. Data from two sources were merged and screened for duplicates.</td><td>Antelope</td><td>1</td></tr>
<tr><td>Deer</td><td>25</td></tr>
<tr><td>Elk</td><td>12</td></tr>
<tr><td>Moose</td><td>11</td></tr>
<tr><td>Mule Deer</td><td>30</td></tr>
</table>

4.3.17.2. Corridors and Megasites

This route bisects core habitat and highly valued corridor habitats. The eastern extent of US 89/26 falls within the Gray's River megasite.

4.3.17.3. State Transportation Improvement Program projects

From mileposts 135 to 141 of US 89/26 between Hoback Junction and Alpine, a wall, slope, and pipe work project is planned although the delivery year was not yet determined in the 2005 Wyoming STIP. A reconstruction and enhancement project involving pathways and landscaping will occur in 2006 between mileposts 140.6 and 142.5, including, at milepost 141.1, a replacement of the Snake River Bridge.

4.3.18. US Highway 89, Alpine south to WY-ID border

US Highway 89 (US 89) traverses 63 miles from Alpine, Wyoming, south to the Idaho border. This highway lies between the Salt Range and the Caribou Mountains in Idaho.

4.3.18.1. Animal-vehicle collision (AVC) data summary

With 630 AVCs reported between 1999 and 2004, on average, a minimum of 10 AVCs per mile occurred on US 89 between Alpine, Wyoming and the Idaho border 63 miles south. Table 34 summarizes these data. South of Etna, a long section of US 89 showed higher AVC densities; at a minimum, 0.97 AVCs per 3 miles occurred throughout this stretch, with some spots incurred up to 8.72 AVCs per 3 miles.

Table 34: Summary of animal-vehicle collisions reported between October 1999 and January 2004 for US Highway 89, from Alpine, Wyoming, south to the Idaho border.

State	Wyoming	**Route**	US 89		**Road segment length**	63 miles
Geographic & milepost range			Alpine, Wyoming, South to Idaho border			
Data source(s)		Wyoming Department of Transportation				
Date range		10/14/1999 - 1/18/2004		**Reported roadkill**	**total:**	630
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded.				Antelope	9
					Deer	105
					Elk	4
					Moose	8
					Mule Deer	496
					White Tail	6
					Other	2

4.3.18.2. Corridors and Megasites

This road travels through core and highly valued corridor habitats for its entire length from Alpine south to the Idaho border. The Caribou megasite almost reaches US 89 about halfway along this route. The southern end of US 89 crosses through the Upper Smith's Fork megasite.

4.3.18.3. State Transportation Improvement Program projects

The only project currently scheduled for this segment of US 89 will add turn lanes and widen the east side of the road between mileposts 98.4 and 98.8 (between Afton and Thayne, Wyoming). This work is scheduled for construction in 2005.

4.3.19. US Highway 89, South Entrance of Yellowstone NP to Moran Junction

The northern extent of US Highway 89 (US 89) in Wyoming begins at the South Entrance to Yellowstone National Park. We address the segment of US 89 from this point south 23 miles to Moran Junction. The first 5 miles of US 89 south of Yellowstone are in the J.D. Rockefeller Parkway, while the remaining 18 miles lie within Grand Teton National Park. Much of this route follows the eastern shore of Jackson Lake.

4.3.19.1. Animal-vehicle collision (AVC) data summary

Table 35 summarizes the AVC data reported for US 89 between the South Entrance of Yellowstone National Park and Moran Junction from July 2000 and November 2003. During this time, a minimum average of 1.91 AVCs per mile occurred. No high density AVC areas were identified in the GIS analyses. It is difficult to judge the quality of the data, but it is likely that this under-represents actual AVC occurrences on this road.

Table 35: Summary of animal-vehicle collisions reported between June 2000 and November 2003 for US Highway 89 from the South Entrance of Yellowstone National Park to Moran Junction.

State	Wyoming	**Route**	US Highway 89 (segment)	**Road segment length**	23 miles
Geographic & milepost range			South Entrance of Yellowstone to Moran Junction		
Data source(s)		Wyoming Department of Transportation, Jackson Hole Wildlife Foundation			
Date range		6/1/2000 - 11/10/2003	**Reported roadkill**	**total:**	44
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded.			Bear	5
				Deer	22
				Elk	12
				Moose	4
				Other	1

4.3.19.2. Corridors and Megasites

This road cuts through core habitats just south of Yellowstone and medium value corridor habitats in Grand Teton National Park. This road does not traverse any priority megasites.

4.3.19.3. State Transportation Improvement Program projects

The 2005 Wyoming STIP includes tables of the Federal Lands Highway Program's Parkroads and Parkways Transportation Improvement Program. Along this segment of US 89 in Grand Teton National Park, a roadway rehabilitation project will occur between Jackson Lodge and Arizona Creek beginning 2006.

4.3.20. US Highways 89/26, south boundary of Grand Teton NP to Jackson

From the southern boundary of Grand Teton National Park (GTNP), a concurrent segment of US Highways 89 and 26 (US 89/26) runs about 12 miles south to Jackson, Wyoming. The National Elk Refuge lies on one side of this road, with a wildlife exclusion fence that runs along several miles of this route north of Jackson.

4.3.20.1. Animal-vehicle collision (AVC) data summary

Table 36 summarizes the AVC data reported for US 89/26 between the south boundary of GTNP and Jackson from March 2000 to December 2003. During this period, a minimum average of 4.5 AVCs per mile occurred. One high density AVC area (at a minimum, 0.97 AVCs per 3 miles) appeared just south of the park border. Animal-vehicle collision data sources included Jackson Hole Wildlife Foundation, Grand Teton National Park, Wyoming Department of Transportation, Teton County Sheriff and local volunteers. It is difficult to judge the quality of the data, but it is likely that this under-represents actual AVC occurrences on this road.

Table 36: Summary of animal-vehicle collisions reported between March 2000 and December 2003 for US Highway 89/26 from the south boundary of Grand Teton National Park to Jackson, Wyoming.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td>US Highways 89/26</td><td colspan="2">Road segment length</td><td>12 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">South boundary of Grand Teton National Park to Jackson Hole</td></tr>
<tr><td colspan="3">Data source(s)</td><td colspan="4">Teton County Sheriff, Wyoming Department of Transportation, Jackson Hole Wildlife Foundation, Grand Teton National Park</td></tr>
<tr><td colspan="3">Date range</td><td>3/21/2000 - 12/30/2003</td><td rowspan="5">Reported roadkill</td><td>total:</td><td>54</td></tr>
<tr><td rowspan="4">Data Quality</td><td colspan="3" rowspan="4">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates.</td><td>Deer</td><td>26</td></tr>
<tr><td>Elk</td><td>17</td></tr>
<tr><td>Moose</td><td>11</td></tr>
<tr><td></td><td></td></tr>
</table>

4.3.20.2. Corridors and Megasites

Medium-value corridor habitats lie between Grand Teton National Park and Jackson. This route does not fall inside any priority megasites, although it does skirt along the Gray's River Megasite, and Jackson itself is in that megasite.

4.3.20.3. State Transportation Improvement Program projects

Preliminary engineering is occurring for a 3.75 mile mill/overlay/pathway project north of Jackson between mileposts 155 and 158. The 2005 Wyoming STIP didn't predict when that project might occur.

4.3.21. US Highway 30

In the southern region of the GYE, US Highway 30 (US 30) crosses from Idaho to Wyoming before leaving the GYE to the south. About 11 miles of US 30 connect the state border to the highway's junction with WYO 232, then US 30 leaves the GYE and further south joins WY 89 east to Kemmerer, Wyoming.

4.3.21.1. Animal-vehicle collision (AVC) data summary

Three deer and one elk were reportedly involved in AVCs between September and December 2003. These data may significantly under represent the actual numbers of AVCs occurring.

4.3.21.2. Corridors and Megasites

This highway bisects medium- to low-value corridor habitats. In addition, US 30 crosses the Upper Smiths Fork megasite.

4.3.21.3. State Transportation Improvement Program projects

We found no projects planned for the segment of US 30 in the GYE in the 2003 and 2005 Wyoming STIPs. However, preliminary engineering is occurring for the 2006 installation of 6.5 miles of deer exclusion fencing and underpasses on US 30 in Nugget Canyon, between Sage and Kemmerer, just south of the GYE.

4.3.22. US Highways 26/287, Moran Junction to Dubois

A state-designated "Scenic Byway", the concurrent segment of US Highways 26 and 287 (US 26/287) navigates 55 miles between Moran Junction in Grand Teton National Park, and through the Bridger Teton National Forest to Dubois, Wyoming. This highway crests the continental divide at its namesake (?) landmark, Togwotee Pass (elevation 9658 feet).

4.3.22.1. Animal-vehicle collision (AVC) data summary

A total of 20 AVCs were reported between January and October 2003 on US 26/287 across Togwotee Pass (Table 37). During that time, an average minimum of 0.36 AVCs occurred per mile on this 55 mile segment of road. No areas with higher densities of AVCs appeared in the GIS analysis; this could be due to the fact that the dataset is relatively small compared to other Wyoming road segments, covering less than one year.

Table 37: Summary of animal-vehicle collision data on US Highway 26/287 between Moran Junction and Dubois, Wyoming from January to October 2003.

State	Wyoming	**Route**	US Highways 26/287	**Road segment length**	55 miles
Geographic & milepost range		Moran Junction to Dubois, Wyoming			
Data source(s)		Wyoming Department of Transportation, Jackson Hole Wildlife Foundation			
Date range		1/22/2003 - 10/18/2003	**Reported roadkill**	**total:**	20
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded. Reports from different sources were merged and screened for duplicates.			Antelope	2
				Deer	12
				Elk	4
				Moose	2

4.3.22.2. Corridors and Megasites

This segment of road lies almost entirely within corridor habitat. As US 26/287 climbs in elevation up both sides of Togwotee Pass, it bisects corridor habitats of increasing value. West of Togwotee Pass, this road segment lies within the Upper Wind River megasite; east of the pass, US 26/287 bisects the Upper Snake megasite.

4.3.22.3. State Transportation Improvement Program projects

A number of projects are planned for US 26/287 across Togwotee Pass (Table 38).

Table 38: Summary of highway improvement projects for US 26/287 between Moran Junction and Dubois, Wyoming. Source: 2003 and 2005Wyoming Department of Transportation State Transportation Improvement Program.

Year	Project Location	Milepost start	Milepost end	Project Type
2005	BROOKS LAKE SECTION	30.90000	40.65000	WIDEN & OVERLAY
2005	WEST OF DUBOIS	45.66000	50.00000	LEVEL/OVERLAY/CHIP SEAL
2006	BUFFALO FK RIVER SECTION	3.00000	7.83000	RECONSTRUCTION/BRDGS/SLIDE RPR
2007	4 MILE MEADOWS SECTION	14.47000	21.28000	RECONSTRUCTION
2008	TOGWOTEE PASS SECTION	21.28000	30.90000	RECONSTRUCTION
2009	ROSIES RIDGE SECTION	7.83000	14.47000	RECONSTRUCTION

4.3.23. US Highway 212, the "Beartooth Highway"

Making a brief jaunt south of the Montana-Wyoming border, US Highway 212 (US 212) crosses the high elevation Beartooth Plateau. This 35-mile route is designated by Wyoming as a "Scenic Byway" and crosses Beartooth Pass at 10,947 feet in elevation. We report on the Wyoming section here, but US 212 continues from Wyoming to Cooke City and Red Lodge, Montana, situated to the western and eastern ends of the Beartooth Pass, respectively.

4.3.23.1. Animal-vehicle collision (AVC) data summary

The Wyoming Department of Transportation reported a deer and a moose AVCs on US 212 in Wyoming on August 7, 2003. It appears that no other dates were monitored. This information is insufficient for our purposes.

4.3.23.2. Corridors and Megasites

This route perforates core habitat and the follows higher value corridor habitats (or, depending on how you look at it, US 212's presence amidst the core habitat devalues these habitats, creating corridor habitat). The entire route falls within the Upper Clark Fork megasite.

4.3.23.3. State Transportation Improvement Program projects

The 2005 Wyoming STIP includes a "project application for the STIP/TIP" for reconstructing the Beartooth Highway starting 2005. The Central Federal Lands Highway Division is responsible for carrying out this project. No further details were available in the STIP.

4.3.24. US Highways 20/14/16, Cody to Yellowstone NP East Entrance

As one of the 5 routes to Yellowstone National Park, the concurrent segment of US Highways 20, 14, and 16 (US 20/14/16) scales 52 miles between Cody, Wyoming, and the East Entrance to the Park. As it traverses the landscape westward from Cody, US 20/14/16 climbs up the North Fork of the Shoshone River through Shoshone National Forest.

4.3.24.1. Animal-vehicle collision (AVC) data summary

Between July 2000 and December 2001, Wyoming Department of Transportation reported 8 deer involved in AVCs. It is likely these data under-represent the actual numbers of AVCs.

4.3.24.2. Corridors and Megasites

US 20/14/16 accesses corridor habitats of increasing values as it approaches Yellowstone Park. Core habitats lie to the north and south of the highway. This road is found in the Upper Shoshone megasite.

4.3.24.3. State Transportation Improvement Program projects

A number of projects are planned for US 20/14/16 across Togwotee Pass (Table 39).

Table 39: Summary of highway improvement projects for US 20/14/16 between Cody and Yellowstone National Park, Wyoming. Source: 2005 Wyoming Department of Transportation State Transportation Improvement Program.

Year	Project Location	Milepost start	Milepost end	Project Type
2005	NORTH FORK CANYON	27.6	27.6	RE-VEGETATE AREAS
2007	WAPITI EAST SECTION	36.4	4.4	WIDEN/OVERLAY/ISO-RECONSTR
2009	WAPITI WEST SECTION	32.0	4.5	RECONSTRUCTION
2003	CODY WEST/ SHOSHONI CANYON	48.9	3.0	RECONST/3R/RETAINING WALL
2003	CODY WEST/ SHOSHONI RIVER	46.7	0.0	BRIDGE WIDEN & REHAB

4.3.25. US Highways 191/189, Hoback Junction to junction north of Daniel

Heading east from Hoback Junction to Daniel, Wyoming, US Highway 191/189 (US 191/189) is a designated Wyoming “Scenic Byway”. This 53-mile stretch of road traverses the Gros Ventre Range, following the Hoback River upstream to cross “The Rim” (elevation 7921) before descending into the Green River watershed.

4.3.25.1. Animal-vehicle collision (AVC) data summary

Table 40 summarizes the AVC data for this segment of US 191/189. Across this 53-mile stretch, a minimum average of 0.28 AVCs occurred per mile between May and December 2003. No areas with higher densities of AVCs appeared in the GIS analysis; this could be due to the fact that the dataset is relatively small compared to other Wyoming road segments, covering less than one year.

Table 40: Summary of animal-vehicle collisions reported between May and December 2003 for US Highway 189/191 from Hoback Junction to the junction north of Daniel, Wyoming.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td colspan="2">US Highway 189/191</td><td>Road segment length</td><td>53 miles</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Hoback Junction to Daniel, Wyoming</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Wyoming Department of Transportation, Jackson Hole Wildlife Foundation</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">5/20/2003 - 12/17/2003</td><td rowspan="6">Reported roadkill</td><td>total:</td><td>15</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded. Carcass and collision reports were merged and screened for duplicates.</td><td>Antelope</td><td>1</td></tr>
<tr><td>Deer</td><td>9</td></tr>
<tr><td>Elk</td><td>4</td></tr>
<tr><td>Moose</td><td>1</td></tr>
</table>

4.3.25.2. Corridors and Megasites

The western section of US 191/189 near Hoback Junction bisects highly valued corridor habitats surrounded by core habitats. The western extent of US 191/189 falls within the Gray's River megasite, while the remaining eastern portion of this segment of highway lies in the Lower Green megasite, crossing low value corridor habitats for a short distance, before descending to Daniel through an area with no designated value as corridor habitat.

4.3.25.3. State Transportation Improvement Program projects

A number of projects are planned for US 20/14/16 across Togwotee Pass (Table 41).

Table 41: Summary of highway improvement projects for US 191/189 between Hoback Junction and Daniel, Wyoming. Source: 2005 Wyoming Department of Transportation State Transportation Improvement Program

Year	Project Location	Milepost start	Milepost end	Project Type
2005	PFISTERER CREEK SECTION	136.4	142.8	RECONSTRUCTION
2006	NORTH BEAVER CR SECTION	123.5	128.8	HPMBP LEVEL/OVERLAY/CHIP SEAL
2007	DELL CREEK SECTION	142.8	147.6	RECONSTRUCTION
2009	HOBACK JCT SOUTHEAST	160.8	163.7	RECONSTRUCTION

4.3.26. US Highway 191, from junction just north of Daniel, Wyoming, south to GYE boundary

Just north of Daniel, Wyoming, US 189/191 splits and US Highway 191 (US 191) travels about 52 miles in the GYE. From the junction, US 191 heads east to Pinedale, then south beyond Boulder where it leaves the GYE, stretching another 18 miles to Farson, Wyoming, south of the

GYE. Running parallel to the Continental Divide, this valley road is the first major highway encountered west of the Wind River Range.

4.3.26.1. Animal-vehicle collision (AVC) data summary

Table 42 summarizes the AVC data for this segment of US 191. Across this 52-mile stretch, a minimum average of 0.69 AVCs occurred per mile between June 2003 and January 2004. No areas with higher densities of AVCs appeared in the GIS analysis; this could be due to the fact that the dataset is relatively small compared to other Wyoming road segments, covering less than one year.

Table 42: Summary of animal-vehicle collisions reported between June 2003 and January 2003 for US Highway 191 from Daniel Junction to the southern boundary of the Greater Yellowstone Ecosystem.

State	Wyoming	**Route**	US Highway 191	**Road segment length**	~52 miles in GYE
Geographic & milepost range			Daniel Junction to Pinedale, Boulder, and southern GYE border		
Data source(s)		Wyoming Department of Transportation			
Date range		6/30/2003 - 1/20/2004	**Reported roadkill**	**total:**	36
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded.			Antelope	7
				Deer	26
				Moose	3

4.3.26.2. Corridors and Megasites

There are no core or corridor habitats directly affected by this stretch of US 191. This segment of highway lies in the Lower Green megasite.

4.3.26.3. State Transportation Improvement Program projects

The 2005 Wyoming STIP includes plans for an 1.5 mile animal-detection/driver warning system to be installed on US 191 near Trapper's Point between Pinedale and the Daniel Junction (mileposts 105-107). South of Pinedale a mill/overlay/chip seal project is planned for a 10 mile stretch between mileposts 88 and 98.

4.3.27. US Highways 189, junction north of Daniel to south of Big Piney

Just north of Daniel, Wyoming, US 189/191 splits and US Highway 189 (US 189) travels about 44 miles in the GYE, passing through Big Piney and leaving the GYE near LaBarge, Wyoming. South of the GYE, US 189 runs along the west side of the Green River above the Fontenelle Reservoir.

4.3.27.1. Animal-vehicle collision (AVC) data summary

Table 43 summarizes the AVC data for this segment of US 189. Seven AVCs with animals were reported between August 2003 and January 2004. It is likely these data under represent the actual numbers of AVCs. No areas with higher densities of AVCs appeared in the GIS analysis; this could be due to the fact that the dataset is relatively small compared to other Wyoming road segments, covering less than one year.

Table 43: Summary of animal-vehicle collisions reported on about 44 miles of US Highway 189 south of Daniel Junction between August 2003 and January 2004.

State	Wyoming	**Route**	US 189	**Road segment length**	~44 miles in GYE
Geographic & milepost range			Daniel Junction south to Big Piney and southern GYE boundary		
Data source(s)		Wyoming Department of Transportation			
Date range		8/17/2003 - 1/14/2004	**Reported roadkill**	**total:**	7
Data Quality	Data opportunistically recorded and are not guaranteed to be consistently recorded.			Antelope	2
				Deer	5

4.3.27.2. Corridors and Megasites

There are no core or corridor habitats directly affected by this stretch of US 189. This segment of highway lies mostly in the Lower Green megasite, with a bit of highway crossing the East Wyoming Range megasite before crossing the GYE boundary near Labarge.

4.3.27.3. State Transportation Improvement Program projects

Three projects were identified for this segment of US 189 in the 2005 Wyoming STIP. An 8.5 mile overlay will occur south of Big Piney between mileposts 97 and 106 in 2005. A 6 mile widening and overlay project is planned for 2006 between mileposts 91 and 97, and a 5.8 mile overlay is scheduled for 2010 between mileposts 85 and 91.

4.3.28. US Highway 14 Alternate, from Cody northwest to GYE border

From Cody, US Highway 14 Alternate route heads northwest (northeast?)about 15 miles to the GYE border. This road runs parallel to the railway and the Shoshone River.

4.3.28.1. Animal-vehicle collision (AVC) data summary

A total of 21 deer were reported involved in AVCs on US 14A by Wyoming DOT between July 2003 and Februrary 2004. This count may have included animals killed on US 14A beyond the GYE. No areas with higher densities of AVCs appeared in the GIS analysis; this could be due to the fact that the dataset is relatively small compared to other Wyoming road segments, covering less than one year.

4.3.28.2. Corridors and Megasites

There are no core or corridor habitats directly affected by this stretch of US 14A. This road is found in the Upper Shoshone megasite.

4.3.28.3. State Transportation Improvement Program projects

Several projects have been identified in the 2005 Wyoming STIP for US 14A (Table 44).

Table 44: Summary of highway improvement projects for US Highway 14 Alternate between Cody and Powell, Wyoming. Source: 2005 Wyoming Department of Transportation State Transportation Improvement Program

Year	Project Location	Milepost start	Milepost end	Project Type
2004	RALSTON SECTION	13.9	22.2	RECONSTRUCTION/5 LANE
2005	16TH STREET	0.0	2.2	RECONSTRUCTION/DRNGE/IRRIGAT
2005	16TH STREET/CIRCLE DR PARK	0.0	2.2	SIDEWALKS/LIGHTING
2006	CODY NORTHEAST	7.5	13.9	RECONSTRUCTION/5 LANE
2010	CODY EAST	2.2	5.6	RECONSTRUCTION

4.3.29. Grand Teton National Park

Grand Teton National Park (GTNP) has 159 miles of paved roads and 62 miles unpaved roads. Paved roads include US Highways 89, 26, 191, and 287 and Wyoming Highway 390 (locally referred to as the "Teton Village Road"), along with local GTNP roads that access trailheads and other attractions.

4.3.29.1. Animal-vehicle collision (AVC) data summary

Data here include information from a variety of sources and were compiled by the Jackson Hole Wildlife Foundation. These data may have been reported upon earlier in this report when summarizing data from US highways inside GTNP. Between April 2002 and September 2003, GTNP reported a total of 266 AVCs on park roads (Table 45). Two areas with higher densities of AVCs (up to 1.94 AVCs per 3 miles) appeared near Moose, Wyoming and near the southern boundary of the park, both on US 89/26.

Table 45: Summary of animal-vehicle collisions reported by Grand Teton National Park employees for internal park roads between April 2002 and September 2003. Some data reported on here were also reported for US Highway routes (US 89, US 26, US 287, US 191) inside Grand Teton National Park.

<table>
<tr><td>State</td><td>Wyoming</td><td>Route</td><td colspan="2">GTNP roads</td><td>Road segment length</td><td>Uncertain</td></tr>
<tr><td colspan="3">Geographic & milepost range</td><td colspan="4">Roads within Grand Teton National Park</td></tr>
<tr><td colspan="2">Data source(s)</td><td colspan="5">Data from many sources compiled by Jackson Hole Wildlife Foundation. Sources include GTNP, Wyoming Game and Fish, Wyoming Department of Transportation, Teton County Sherriff, and local volunteers</td></tr>
<tr><td colspan="2">Date range</td><td colspan="2">4/29/2002 - 12/31/2003</td><td rowspan="6">Reported roadkill</td><td>total:</td><td>266</td></tr>
<tr><td rowspan="5">Data Quality</td><td colspan="3" rowspan="5">Data opportunistically recorded and are not guaranteed to be consistently recorded. Data were merged and screened for duplicates.</td><td>Bear</td><td>5</td></tr>
<tr><td>Deer</td><td>174</td></tr>
<tr><td>Elk</td><td>65</td></tr>
<tr><td>Moose</td><td>22</td></tr>
</table>

4.3.29.2. Corridors and Megasites

The Teton Mountains provide north-south running contiguous core habitat on the west side of GTNP and the Jackson Hole valley. This mountain range is steep and more or less inaccessible to motor vehicles; there are no roads directly penetrating this core habitat. In the valley bottoms, GTNP roads cross medium to low value corridor habitats.

4.3.29.3. State Transportation Improvement Program projects

The Federal Lands Highway Program oversees transportation improvement projects on federally owned and managed lands, including GTNP. Table 46 summarizes the planned projects reported by Federal Lands Highway Program in the 2005 Wyoming STIP.

Table 46: Summary of highway improvement projects for Grand Teton National Park roads. Source: Federal Lands Highway Program, as reported in the 2005 Wyoming Department of Transportation State Transportation Improvement Program.

		Milepost		
Year	**Project Location**	**start**	**end**	**Project Type**
2005	Signal Mountan Boat Launch Road	0	0.6	Rehab roadway (3R)
2005	Spaulding Bay to Jackson Lake	12	20.8	Rehab roadway (3R)
2005	North Park Road Phase II	20.2	27.1	Reconstruction (4R)
2005	Moose Jct/Entrance to Craighead Hill	n/a	n/a	Rehab roadway (3R)
2006	North Park Rd Jackson Ldge to Arizona Ck	n/a	n/a	Rehab roadway (3R)
2006	Craighead Hill to Cunn. Cabin	n/a	n/a	Rehab roadway (3R)
2007	Snake River Bridge at Flagg	n/a	n/a	Reconstruction (4R)

4.3.30. Yellowstone National Park

Yellowstone National Park (YNP) has 268 miles of paved roads, including "interior" park roads and US Highway 191, which skirts along the western border of the park, north of West Yellowstone, Montana. Posted speed limits vary from 15 mph to 55 mph, with most park roads posted for a 45 mph speed limit. The only 55 mph stretch is on US Highway 191.

About 3 million people visit YNP annually, mostly in the summer months. In winter, the road between Canyon and Tower Junction is closed to all motorized travel a few miles north of Canyon, while Mammoth south to West Thumb, the South and East Entrance roads, West Thumb north to Canyon Village, and Canyon Village to Norris are groomed for over-snow vehicle travel. These roads are plowed after the winter season ends and before the spring opening to public vehicular travel. The roads between Gardiner and the Northeast Entrance and US Highway 191 are open year-round and plowed for wheeled vehicle travel during the winter.

There are periods in the early spring and late fall when the park's interior roads are closed to public vehicular traffic, but open to non-motorized travel. Spring bear management restrictions include closures of some roads, trails and areas to all public travel (motorized and non-motorized). Employees and contractors working in YNP are allowed motorized access on all YNP roads year round, although speed limits are reduced from 45 mph to 35 mph on many interior park roads during those times.

4.3.30.1. Animal-vehicle collision (AVC) data summary

We were not able to obtain precise spatial locations for the AVC data in YNP; therefore no density analysis occurred for YNP roads. However, YNP staff did provide a collection of internal reports and three conference proceedings papers that summarize and analyze AVC data for a variety of research and management questions (Chin & Gunther 2002, Gunther & Biel 1994a, Gunther & Biel 1994b, Gunther & Biel 1996, Gunther et al. 1998, Gunther et al. 1999, Gunther & Biel 2000a, Gunther et al 2000, Gunther & Biel 2000b, Gunther 2004 pers. comm., Yellowstone Center for Resources 2003). We briefly synthesize general information from these papers and discussions here.

Given the clear directives to staff to report AVCs and park staff awareness of the resources, the YNP AVC data are likely to be highly reliable. This statement is tempered by the fact that YNP does not have a systematic AVC monitoring protocol (i.e., regularly scheduled survey efforts) but rather an opportunistic reporting system. In addition, the data recorded include only animals that were killed in the immediate vicinity of the road; if an animal was hit but not found near where the collision occurred, the data was not reported. Nonetheless, daily presence of park staff on park roads probably renders a high reporting rate of AVC deaths.

The most current data available show a total of 1,549 large mammal vehicle collisions reported on YNP's primary paved roads between 1989 and 2003, an average of 103 large mammals a year (K. Gunther 2004, pers. comm.). A peak of 148 AVC reports was recorded in 1994 and the lowest annual tally of 83 AVCs was reported in 2000. Table 47 summarizes the large mammals (species with adult weights greater than 30 kg) reported killed by vehicles between 1989 and 1999 by road segments. Table 48 shows the species of large mammals hit by vehicles each year between 1989 and 2003. Data include AVCs resulting from over-snow vehicle collisions, but do not include reports of incidents where an animal may have been hit by a vehicle and did not die immediately but rather disappeared from the road corridor.

Making up only 7.5% of park roads, the 20.2 miles of US 191 in YNP carried 40.7% of the total road-kills reported from 1989 to 1996 in YNP. Comparatively, over the same period of time, 178.3 miles (66.6%) of park roads with posted speeds of 45 mph carried 44.5% of the total road-kills reported in YNP (Gunther et al. 2000)

Table 47: Summary of large mammals (species in which adults weigh 30 lbs or greater) reported killed in vehicle collisions on Yellowstone National Park's primary paved roads between 1989 and 1999, by road segment[1]. Source: Gunther, K. A. and M. J. Biel. 2000. Evaluation of Road-killed wildlife on the Dunraven Road, Yellowstone National Park, 1989-1999. National Park Service Report, Yellowstone Center for Resources, Mammoth, Wyoming. 18 pp.

Road Section	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Gardiner - Mammoth (5 miles)	1	1	8	1	3	2	7	8	3	3	1	38
Mammoth - Tower (18 miles)	1	2	5	4	6	6	5	4	2	5	3	43
Tower - Northeast Entrance (29 miles)	1	5	2	8	5	14	7	14	7	6	11	80
Mammoth - Norris (21 miles)	1	3	6	7	8	4	4	5	5	3	2	48
Tower - Canyon (19 miles)	2	2	0	5	0	2	1	4	0	3	0	19
Norris - Canyon (12 miles)	6	2	5	9	3	11	8	5	2	9	6	66
Canyon - Fishing Bridge (16 miles)	6	4	9	8	4	7	4	8	5	1	8	64
Fishing Bridge - East Entrance (27 miles)	6	4	5	9	3	4	4	3	4	2	2	46
Fishing Bridge - West Thumb (21 miles)	3	7	6	5	4	7	2	2	4	2	2	44
West Thumb - South Entrance (22 miles)	8	7	7	6	14	9	11	10	10	8	8	98
Norris - Madison (14 miles)	2	1	3	1	3	3	2	3	3	1	2	24
Madison - West Entrance (14 miles)	3	8	10	7	18	16	10	8	6	11	10	107
US Highway 191 (20 miles in YNP)	54	54	52	36	34	58	48	47	21	27	30	461
Madison - Old Faithful (16 miles)	3	2	3	4	3	4	1	6	3	6	1	36
Old Faithful - West Thumb (17 miles)	0	0	0	0	2	1	5	4	5	1	1	19
Bechler Road (uncertain of length)	0	0	0	0	0	0	0	0	0	0	0	0
Total	**97**	**102**	**121**	**110**	**110**	**148**	**119***	**131***	**80**	**88**	**87**	**1193**

[1] *Tables 47 and 48 report data as presented from original sources. The 1995 and 1996 data here in Table 47 do not include an animal hit on the gravel county road each year between Gardiner and the park boundary to the north near Reese Creek.

Table 48: Summary of large mammals (species in which adults weigh 30 lbs or greater) reported killed in vehicle collisions on Yellowstone National Park's primary paved roads from 1989 through 2003, by species[2]. Source: K. Gunther 2004. Personal communication.

Species	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
Antelope	1	4	6	2	1	2	1	2	2	1			1		1	24
Beaver	1	1	1	3	1		2	2		2				1	3	17
Bighorn Sheep					1		3	1						1		6
Bison	7	5	12	7	11	11	11	16	15	13	7	9	17	28	23	192
Black Bear		1		2		1	1			3	1		1	1	1	12
Bobcat					1			1					1			3
Coyote	1	9	3	5	10	19	9	10	5	7	16	14	8	6	13	135
Elk	50	35	54	34	37	49	52	64	24	32	37	28	24	18	28	566
Grizzly Bear		1						1						2	1	5
Lynx																0
Moose	11	10	5	11	9	12	10	8	6	3	4	5	8	5	5	112
Mtn. Goat																0
Mtn. Lion												1		1		2
Mule Deer	26	35	40	44	37	51	28	25	25	24	23	22	33	14	19	446
Raccoon						1			1	2		1		1	2	8
Whitetail Deer		1		2	2	2	2						1			10
Wolf							1	2	2	1		3	1	1		11
Wolverine																0
Total	**97**	**102**	**121**	**110**	**110**	**148**	**120***	**132***	**80**	**88**	**88**	**83**	**95**	**79**	**96**	**1549**

[2] *Tables 47 and 48 report data as presented from original sources. The 1995 and 1996 data here in Table 47 do not include an animal hit on the gravel county road each year between Gardiner and the park boundary to the north near Reese Creek.

4.3.30.2. Corridors and Megasites

All of YNP is considered high value core habitat. Yellowstone National Park was not included in the megasite analysis.

4.3.30.3. State Transportation Improvement Program projects

The Federal Lands Highway Program oversees transportation improvement projects on federally owned and managed lands, including YNP. Table 49 summarizes the planned projects reported by Federal Lands Highway Program in the 2005 Wyoming STIP.

Table 49: Summary of highway improvement projects for Yellowstone National Park roads. Source: Federal Lands Highway Program, as reported in the 2005 Wyoming Department of Transportation State Transportation Improvement Program.

		Milepost		
Year	Project Location	start	end	Project Type
2005	Gibbon Falls to Tanker Curve	n/a	n/a	Reconstruction (4R)
2006	Chittenden Road to Tower	121.9	n/a	Reconstruction (4R)
2006	North & South Rim and Canyon Village Roads	n/a	n/a	Rehab (3R)
2007	NE Entrance to Beartooth Hwy gate	n/a	n/a	Reconstruction (4R)
2007	Norris to Golden Gate	n/a	n/a	Reconstruction (4R)
2007	Lamar River Bridge	n/a	n/a	Reconstruction (4R)

5. DISCUSSION

The purpose of this report is to serve as a preliminary assessment of wildlife-transportation issues in the GYE based on available AVC data overlapping regional ecological analyses of corridor habitats and priority ecological areas at risk. We do not prioritize specific conflict areas or make explicit mitigation recommendations, although we do outline upcoming transportation projects (STIPs) as potential opportunities to include mitigation measures. This report is a first step to understanding where conflicts may be occurring and where future research, monitoring, or mitigation efforts may be best applied.

Results in this report can be presented with or without the maps, although the maps are excellent tools for illustrating where wildlife may be at odds with transportation infrastructure in the GYE. The maps should not be presented without the report—it is important that the limitations of our analysis be acknowledged openly in order to build credibility and trust with audiences. We address these limitations below.

5.1. Animal-vehicle collision density analysis

Quality of data was an issue for the datasets. All data was opportunistically collected and were not guaranteed of any consistency of effort. Even with daily systematic roadkill surveys, it has been estimated that survey observations underestimate numbers of animals killed during daylight hours by a factor of 12-16 (Slater 2002). As emphasized throughout the results, the data under-represent reality and, unfortunately, it is impossible to gauge how far off the data may be from truth. We reinforce that these data can only be considered an indicator of AVC occurrences.

The GIS density analysis is a relative comparison of densities of AVCs on all roads within a given analysis area (in this case, each state was analyzed separately). Due to the potential lack of consistency in reporting efforts between routes or counties or districts, the densities of AVCs in some areas may appear to be greater simply because one observer was more vigilant than another. Consider "route A" with 100 AVCs in one mile reported over 10 years, and "route B" with 50 AVCs in one mile reported over only one year; "route A" will appear to have higher densities of AVCs relative to "route B" if you simply glance at the density polygon results on the map. But in reality, "route A" had a rate of 10 AVCs/mile/year while "route B" had a rate of 50 AVCs/mile/year. Ideally, one would use data consistently collected over the same period of time, but in this case, we were not able to do that within our schedule and budget. While this is the "best available information", we emphasize that few final conclusions can be drawn from the density analyses and that the information compiled in this report should only be considered as an indicator of AVC activity.

5.2. State Transportation Improvement Program

Montana Department of Transportation also provided this disclaimer with their 2004-2006 State Transportation Improvement Program (STIP):

> "While the projects and dates shown are official departmental objectives, it is important to bear in mind that this program is only tentative. Execution 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 cause a given project to be rescheduled."

Each state's STIP lists preliminary engineering and planned construction for transportation improvement projects, typically forecasting three years ahead. These listings include a general description of the type of project, location, estimated timeline and cost for each project. Any STIP is subject to change at any point due to changing priorities or availability of resources. Some projects listed here are from a most recent STIP but may be "past due" (2003 and 2004 projects). We listed all projects since we did not follow up with the DOTs about each project's progress, and it is not uncommon for projects to be delayed. For specific information about a project, it will be necessary to contact the DOT directly.

Most ecological mitigation measures are incorporated into transportation construction projects that have been proposed for reasons unrelated to ecological concerns. In only a few cases have there been "stand alone" mitigation efforts (Florida DOT has installed under-crossings for wildlife outside of any other "purpose and need" for a project; there may be a few other examples, but it is safe to say such occurrences are rare). The STIP allows us to look for the opportunities to avoid, mitigate or compensate for negative impacts to the ecosystem.

We classified STIP projects in the GYE as "likely to incorporate mitigation" vs "less likely to incorporate mitigation". This was a subjective judgment based on the author's experiences and should not be considered the final word. Ultimately, the DOTs determine what considerations they want to incorporate into their projects.

5.3. Corridors and Megasites

The core habitat used in the least-cost path corridor model was defined for grizzly bears. While these omnivores likely need many of the same habitat qualities that other terrestrial wildlife requires, we must consider other species habitat needs that may not be represented in the model used here. For example, aquatic species will have different habitat and landscape needs; mule deer and pronghorn antelope may have specific movement patterns that the corridor model does not identify as core or corridor habitat; and wildlife that depend on rugged and steep terrain (bighorn sheep, avian nesting habitats) may not be properly accounted for in this model.

The corridor model is a regional model and does not provide specific landscape-level (smaller scale) locations for wildlife crossings. In addition, the corridor model is theoretical and has not been rigorously validated in the field (this would be a huge long-term undertaking, although it could be done). The corridor model should be considered a "rough cut" of important areas for wildlife and further analyses is needed to address other species-specific needs and other landscape scales.

We only considered the presence or absence of priority megasites (the top 25 defined areas with the highest vulnerability and irreplaceability) in our assessment. We did not provide a detailed evaluation of the megasites and how transportation infrastructure may be affecting the resources within megasites.

6. RECOMMENDATIONS

We recommend that the GYC disseminate this report to transportation agencies and stakeholders discuss of these findings and to work together regarding future impacts and mitigation options. We recommend stakeholders (any interested organizations or individuals) ask transportation agencies to assess, avoid, mitigate, or compensate for impacts when and where:

- roads intersect core or corridor wildlife habitats;
- AVCs rates are higher than expected if AVCs were randomly located along roads (both ecological and safety concerns);
- species of special concern are being killed in AVCs or isolated due to habitat fragmentation as a result of roads; and/or
- traffic volumes are at or are projected to increase to 4,000 vehicles a day or more (Ruediger et al. [2000] suggests that 4,000 vehicles/day can form a "barrier" to animal movements and can cause significant levels of animal mortalities; this level of traffic may be more or less of a barrier depending on the species and other conditions. Additional research is needed to address this topic.).

This report does not comprehensively address all the points above, but can be used as a "starting point" for discussing these issues with transportation agencies and interested stakeholders. There are many other sources of information and data that may be useful in further discussions, e.g., the Jackson Hole Wildlife Foundation's report (Biota Research and Consulting 2003) on wildlife and transportation issues in Teton County, Wyoming. Appendix A summarizes other potential resources and efforts that may be helpful.

Further, we offer additional suggestions to GYC and other stakeholders:

- Improve AVC data collection protocols either by working with the agencies that collect these data or by establishing independent efforts to collect these data (Note: appropriate permits are required prior to collecting these data)[3].
- Further define "conflict areas" and develop a prioritization tool to help both stakeholders and transportation agencies perform triage and concentrate on the most urgent or severe problems.
- Re-analyze subsets of AVC data in areas of concern to better hone the spatial aggregation of AVC occurrences.
- Assess priority megasite threats relative to transportation issues.
- Compile supporting data on species of special concern.

[3] The WTI has created a prototype handheld computer and Global Positioning System (GPS) with customized software for collecting standardized, spatially-accurate AVC data that allows for simple data collection, management and more rigorous analyses; field testing of these units began in 2006 and WTI is looking for opportunities to work with concerned citizen groups, non-government organizations and agencies to test and adapt the tool to meet their institutional and technological needs.

- Garner and maintain good relationships with DOT staff, county planners, and state game and fish agencies. This is essential and requires time, but goes a long way to building trust, an essential ingredient for working together.
- Form collaborations and pool funds for researching specific areas/animals of concern. Transportation agencies may be more apt to contribute funding to monitoring efforts if they see there are matching funds and outside interest.
- The data synthesized here is subject to change as the landscape and transportation planning and budgets change over time; therefore we recommend this exercise be repeated in 5 years.

As the GYE region continues to experience growth and development (Hernandez 2004), it is becoming increasingly important to consider how this progression is and will continue to affect wildlife and their habitats. Transportation infrastructure is only one of many pieces of the complex puzzle that affects the landscape, habitats, wildlife, and communities' quality of life in the GYE. Both transportation agencies and land use planners need to proactively and holistically plan for the perpetuity of healthy wildlife habitat and populations in the GYE. We hope this report will lead to further discussions and relationship building that will work toward the goal of protecting this region's habitats and wildlife while maintaining the quality of life that safe and efficient transportation brings to our communities.

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8. APPENDIX A: ADDITIONAL INFORMATION RELATED TO WILDLIFE-TRANSPORTATION ISSUES IN THE GYE

This project was initiated by an intern at GYC in 2003. Significant effort had already gone into collecting information prior to our undertaking this project the following year. Some of this information was synthesized in the main report; additional information compiled by GYC intern Terry Hollingsworth in 2003 is provided here. WTI did not collect this information and therefore can not vouch for its accuracy, but we do provide additional information if we could provide an update or contribute to the usefulness of this information. Citations included here have been included in the bibliography (prior to the Appendix) to the best of our ability.

8.1. Proposed road projects of concern

8.1.1. Wyoming

Location: WY22 (S2000) Jackson-Wilson, milepost 0.00-7.00

Type of project: Reconstruction

STIP reference number: 1240

Project year: not assigned

This seven mile section of WY 22 is slated for reconstruction although the project has not yet been designated for any particular program year. It is fairly safe to assume that construction will not begin in the next three years. However, it is these upcoming years that will be critical for influencing the design of the project. This area is of particular concern because of the high rate of wildlife mortality on this section of road. In fact, WYDOT lists the section between mile 0.00 and mile 6.80 as the highest density (five crashes per mile) area of reported wild animal crashes in Wyoming (Stout personal communication June 6, 2003).

Currently, The Wyoming Department of Transportation is forming a team to discuss the future of this project. The Jackson Hole Wildlife Foundation has expressed interest in joining this team. It is unclear whether WYDOT will include JHWF in the planning process. Fortunately, Teton County, as a Cooperating Agency, will be a member of this team. Teton County has been supportive of the JHWF and recognizes the foundation as the experts on wildlife/road issues in the region. The Jackson Hole Wildlife Foundation expects that even if they are not invited to participate, Teton County will seek their input (Cheramy personal communication August 28, 2003 [this citation is not listed in the bibliography; WTI was unable to find further information on this exchange]).

8.1.2. Idaho

Location: US 20 Last Chance - Montana state line, milepost 372.0 - 406.3

Type of Project: Major Widening / Miscellaneous

STIP project numbers: 8624 (construction) 8459 (corridor study)

Fiscal year: study 2003, construction 2007

This stretch of US 20 passes through Island Park on its way North to Targhee Pass. It is of special concern for a number of reasons. First of all, this region has been identified as one of the most important areas in the Greater Yellowstone Ecosystem in terms of vulnerability and irreplaceability (Noss et al. 2001). Additionally, a significant amount of road kill has been documented along the existing road (Naderman unpublished data [this citation is not listed in the bibliography; WTI was unable to find further information on this exchange, although Naderman did provide AVC data to us for the density analyses]).

The planning phase of this project has just begun. At this point it is unclear exactly what types of changes will be made to the existing road. The 2003-2007 STIP lists the project type as “major widening”. A draft of the 2004-2008 STIP lists the project type as “miscellaneous”.

The Idaho Transportation Department (ITD), in an effort to include the public in the planning process, has initiated The US 20 Corridor Plan. Though it is called a plan, it is actually a process that will be used to develop a long term (twenty year) plan for the US 20 corridor. ITD has indicated that public meetings will be held during four phases of the planning process prior to the release of the draft plan in June of 2004. During the initial round of public meetings, held during the summer of 2003, it became clear that reducing the environmental impact of the road was a high priority for many local residents. Reducing road kill and providing for the migration of animals were specifically mentioned as important factors in any design. At this time no date has been set for the next round of public meetings and proposed alternatives have not been released.

8.2. Who else is looking at wildlife-transportation issues in the GYE?

8.2.1. Jackson Hole Wildlife Foundation

Teton County contains four of the fifty highest density wild animal crash areas in the State of Wyoming. One of these sections, Wyoming Highway 22, between Jackson and Wilson, has the highest number of animal/vehicle crashes per mile in the entire state (WYDOT 2001 [this citation is not listed in the bibliography; WTI was unable to find further information on this exchange]). In response to the high number of animals killed on Teton County roads the Jackson Hole Wildlife Foundation has recently completed a two year study of road kill in Teton County.

Actually, The Jackson Hole Wildlife Foundation has been investigating road kill in Teton County, Wyoming, for more than a decade. They began by analyzing road kill data collected by the Wyoming Department of Transportation (WYDOT) and the Wyoming Department of Game and Fish (WGF). These records indicated that road kill rates were high in Teton County, but did not tell the whole story. Since WYDOT only tracks reported accidents, and WGF does not have a comprehensive road kill monitoring program, the Jackson Hole Wildlife Foundation decided to collect the information themselves (Cheramy personal communication August 28, 2003 [this citation is not listed in the bibliography; WTI was unable to find further information on this exchange]).

Twelve years ago the Foundation developed a data collection sheet that was distributed to volunteers. These volunteers, all of whom drive a particular stretch of road in Teton County at least five times per week, started documenting all of the carcasses they found on the road (Mader personal communication, June 6, 2003[this citation is not listed in the bibliography; WTI was unable to find further information on this exchange, although Mader did provide AVC data to us for the density analyses]). Over the years, the JHWF has used the information gathered by these volunteers to create a map of road kill "hot spots" in Teton County. The foundation has also attempted to educate the drivers of Teton County about the dangers of wildlife on the roads by distributing brochures and using radio announcements (www.jhwildlife.org).

Two years ago the Jackson Hole Wildlife Foundation began an ambitious road kill and wildlife crossing study. The study included wildlife tracking surveys, an economic analysis, habitat analysis, and a literature review of mitigation efforts used in other areas (Mader, personal communication, June 6, 2003 [this citation is not listed in the bibliography; WTI was unable to find further information on this exchange]). The goal of the study was to identify potential means of mitigating the problem of road kill in Teton County. The results of the study will be presented at the International Conference on Ecology and Transportation in September of 2003 (Cheramy personal communication August 28, 2003 [this citation is not listed in the bibliography; WTI was unable to find further information on this exchange]).

[The Sept 15, 2003 report from Biota is an excellent review of the data, specific projects and issues related to AVCs in Teton County. It provides a good overview of the transportation planning process and potential mitigation measures as well. Additionally, Wells (2003) contributed significantly to this report with her thesis research on evaluation criteria for mitigation measures; her research was presented as a poster at the 2003 International Conference on Ecology and Transportation. We recommend stakeholders working in the Teton County area refer to this report and contact the Jackson Hole Wildlife Foundation for further details and information regarding these issues.]

8.2.2. Bozeman Pass Working Group

The Bozeman Pass transportation corridor between Bozeman and Livingston, Montana, includes I-90, frontage roads, and the MRL railroad. The highway and its 8,000-12,000 daily vehicles during the winter and 10,000 to 15,000 daily vehicles during the summer are a likely barrier and hazard to animal movements in the Bozeman Pass area. Elk, moose, black bear, mountain lion and deer are known to reside in and move across the landscape in the Bozeman Pass area; all of these species have been killed on the interstate during either local or seasonal movements. In anticipation of increasing traffic, serious accidents, and blockage of wildlife movement, the Bozeman Pass Working Group (BPWG) formed to collaboratively address ways to protect and improve wildlife connectivity and human safety on Interstate 90 in the Bozeman Pass area.

The BPWG is a "multi-disciplinary working group" organized to focus on transportation and land management issues that affect wildlife movements in the Bozeman Pass area. The group is led by American Wildlands (AW), a science-based conservation advocacy non-profit organization, and is made up of representatives from the following organizations and agencies: the Craighead Environmental Research Institute (CERI); Western Transportation Institute (WTI) at Montana State University; Gallatin Valley Land Trust; Trust for Public Lands; Montana Department of Transportation (MDT); U.S. Forest Service; Montana Fish, Wildlife and Parks and Montana Rail Link. The goals of the working group are to enhance wildlife movement over the Pass and improve human safety on Interstate-90. The BPWG has worked together to support a study to collect site-specific field data and best available information in order to suggest and, in some cases, commit to implementing and evaluating, mitigation techniques that have the potential to realize the group's goal. The MDT has provided funding for two projects related to these goals.

The Western Transportation Institute at Montana State University (WTI) is currently conducting two different but related wildlife research projects on Interstate 90 at Bozeman Pass between Bozeman and Livingston, Montana. The first project, **"Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study"** will evaluate the effectiveness of wildlife fencing that will be installed at the Montana Rail Link (MRL) overpass on I-90 near Bear Canyon. Data on wildlife crossings and animal-vehicle collisions will be collected before and after installation of the fencing in order to evaluate if the fencing reduces animal-vehicle collisions, as well as if animals maintain movements across the transportation corridor by traveling under I-90 through existing culverts and the MRL overpass. Preconstruction monitoring results were summarized in conjunction with the final report for the following study; post-construction monitoring is anticipated to occur from 2007 through 2009 with final results to be reported in spring 2010.

The objective of the second project is to test the use of Intelligent Transportation Systems (ITS) in addressing wildlife-vehicle conflicts on Bozeman Pass (Intelligent Transportation System Deployment Program Project Identification Number VIL.H.24, entitled **"Bozeman Pass Wildlife Channelization ITS Project"**). ITS are advanced technologies (such as highway advisory radio or electronic message signs) that can be installed on roads to improve safety or address other transportation issues that affect drivers. This project addressed whether wildlife advisories on automated roadside message signs may cause drivers to respond and reduce speeds in an effort to avoid collision with wildlife. This effort included a speed study and driver survey to quantify potential effects that wildlife advisory messages may have on speed and driver behavior. In addition, a driver simulator study tested how drivers respond to wildlife advisory messages, as well as how their speed influences the occurrence of an animal-vehicle collision.

The final report for the ITS project, including a summary of the preconstruction wildlife monitoring results, is available at the following web address (last accessed December 18, 2006): http://www.coe.montana.edu/wti/wti/pdf/425539_Final_Report.pdf

8.3. Case studies

8.3.1. Highway 30 – Wyoming

A fifteen-mile stretch of U.S. Highway 30 through Nugget Canyon between Kemmerer and Cokeville, Wyoming bisects the migration route of a subunit of the Wyoming Range mule deer herd. Consequently this highway is crossed by approximately 14,000 mule deer each fall and spring as they migrate between their winter range in Red Eye Basin and their summer range in the Wyoming Mountains. An average of 130 mule deer per year have been killed in deer-vehicle collisions since 1990. An underpass was installed in association with 8-foot-high deer-proof fence at milepost 30.5 in the summer of 2001 in an attempt to mitigate this problem (Gordon and Anderson 2003).

This project was facilitated by the Nugget Canyon Wildlife Migration Project Act which was passed by the Wyoming state legislature in 1986. This act called for state agencies to work together in attempting to mitigate the problem of deer/vehicle collisions in Nugget Canyon. Prior to construction of the underpass, several other mitigation efforts were attempted. In 1989 a seven mile long eight-foot high deer-proof fence was erected with a gap for mule deer crossing at mile 30.5. Signs warning motorists of migratory deer crossings were installed in association with the fence, but deer mortality remained high. Swareflex reflectors were tested but were found to be ineffective in reducing deer/vehicle collisions (Reeve & Anderson 1993, cited by Gordon 2003). Traditional “Deer Crossing” signs, as well as a system designed to detect deer as they moved across the road, and warn motorists of their presence, also proved to be ineffective at causing motorists to slow down (Gordon and Anderson 2001).

During the summer of 2001, an underpass was constructed at the deer crossing at milepost 30.5 to facilitate the movement of deer safely across the highway. A study, funded by WDOT, evaluating this underpass commenced in the fall of 2001. The researchers investigated patterns of deer movement through the underpass, deer response to size manipulations of the underpass, and potential future sites of underpasses in Nugget Canyon (Gordon & Anderson 2003).

Nearly five thousand road crossings through the underpass were documented from fall of 2001 to spring of 2003. However, it is not clear whether deer are more likely to cross at that location than they were before the underpass was in place. The spring 2002 underpass migration was significantly smaller than the spring 2001 road crossing migration. Gaps in the monitoring data, combined with an unknown variation in overall migration make it difficult to determine the cause of the discrepancy (Gordon & Anderson 2003).

A comparison of deer mortality rates on Highway 30 before and after construction of the underpass reveals that the underpass has been successful in reducing mortality at milepost 30.5. However, it is not clear that the underpass has been effective in reducing overall deer mortality in Nugget Canyon. The number of deer killed at milepost 35, near the eastern end of the fence, actually increased after the underpass was installed. In fact, the mortality rate increased at every mile marker between mileposts 39 and 45. However, throughout Nugget Canyon there was a slight decrease in deer road kill after the underpass was constructed. It is not clear if the decrease is a result of the underpass or an unrelated factor such as a reduction in herd size (Gordon & Anderson 2003).

During the study researchers used plywood dividers to manipulate the size of the underpass. Infrared video cameras were used to document deer responses to the various size configurations. Their findings may be valuable in the design of future deer undercrossings. The researchers suggested that future underpasses in Nugget Canyon should have an openness ratio (Openness= Height (m) * Width (m) / Length (m)) of 0.8 or greater. They also recommend that underpasses should be at least 8 feet tall and 20 feet wide (Gordon & Anderson 2003).

8.3.2. Banff National Park

The Trans-Canada Highway (TCH), as it passes through the Bow Valley in Alberta’s Banff National Park, is the site of one of the most famous, and intensely studied, collection of crossing structures in the world. It includes twenty-two under-crossings, two over-crossings, and many kilometers of wildlife-exclusion fencing. This system of structures is unique because, unlike most crossing structures, it was designed for multi-species use.

1980 marked the start of construction on a major upgrade to the Trans Canada Highway (TCH) through the Bow valley in Alberta’s Banff National Park. The project involved creating a four lane divided road where there had previously been a two lane highway. Due to the importance of the region to wildlife, and the already high rate of road kill, a series of underpasses (phases 1 & 2) were incorporated in to the construction plan. During a later phase of construction (phase 3a), two wildlife overpasses were added to the project (Leeson 1996). Since 1980, 45 km of the TCH have been converted from two lanes to divided four lane highway. Twenty-two underpasses and two overpasses have been constructed for wildlife in this area. The road is bordered on both sides by a wildlife exclusion fence. Plans exist to upgrade another 30 km (phase 3b) of two lane road to four lanes with fencing in the future (Clevenger and Waltho 2000).

Monitoring of these structures has shown that all mammal species expected to use the structures have indeed used them to cross the highway. As of October 1999, more than 20,000 individual wildlife passages had been detected at the 23 crossing structures. Grizzly bears accounted for only 15 passes while elk, the most commonly recorded animal, added more than 13,000 crossings to the total. Deer crossings were documented more than 4,000 times, sheep had 613 passes, cougars were counted 377 times, black bears 360 times, wolves 287 times, and coyotes over 1,600 times (Clevenger 1999).

Analysis of the road kill record suggests that the crossing structures, in conjunction with wildlife-exclusion fencing, have significantly reduced road kill in the area. Banff National Park has experienced a 96% reduction in road kill of ungulates and an 80% reduction among all species (Clevenger et al. 2001).

The extensive monitoring of these structures has also been used to gather information valuable to designers of future projects. Between January of 1995 and June of 1998, eleven of these underpasses were monitored in an effort to identify factors affecting the effectiveness of wildlife underpasses in Banff National Park. Tracking sections were used at both ends of each underpass to record evidence of underpass use. Data was collected from 1 January 1995 – 31 March 1996 and again from 1 November 1996 - 30 June 1998 (Clevenger and Waltho 2000).

Underpass use was analyzed at three different scales. At each level of ecological resolution, fourteen underpass attributes were ranked in order of their importance. At the species level, each group reacted differently to the fourteen attributes. For example, underpass distance from the east gate was the most important factor affecting black bear use of the underpasses, whereas underpass length was the most significant attribute affecting elk performance ratios (Clevenger and Waltho 2000).

The second level of resolution was species groups. The two groups identified at this level were large predators/omnivores (carnivores) and ungulates. For carnivores the most significant underpass attribute was distance to townsite, followed by human activity. Ungulates however, were more effected by structural and landscape factors. Specifically, the rank order was 1, underpass openness, 2, noise level (positively correlated), and 3, underpass width (Clevenger and Waltho 2000).

At the third scale of ecological resolution, large mammals (i.e. all species together), structural openness was the most significant attribute. Distance to townsite was the second most significant attribute followed by human activity (Clevenger and Waltho 2000).

8.3.3. Glenn Highway, AK

Alaska’s Glenn Highway (SR 1) provides an example of a place where a wildlife crossing structure was created by modifying an existing feature. The project, known as the Glenn Highway Moose Funnel Fence and Retrofitted Bridge, was designed to reduce moose/vehicle accidents while maintaining moose movement across the Glenn Highway. The project site, an

11.3km section of the Glenn Highway near Anchorage, passes through moose winter range and was known for its high incidence of moose/vehicle collisions. This stretch of road is also the only highway connecting Anchorage to many outlying communities (www.wildlifecrossings.info)

The project, completed in 1990, included the installation of moose-proof fencing, a moose underpass, one-way gates, and highway lighting. The underpass was created by lengthening and raising an existing bridge over Ship Creek to accommodate a moose pathway underneath. The result was an underpass that was 3m wide and 3.2m high. Since Ship Creek sometimes flooded the path, a retaining wall was installed to keep the pathway dry and ice free. The use of overcrossings was considered for this project but rejected due to a lack of documentation on their cost effectiveness. Modification of the Ship Creek Bridge was chosen because of documented road kill in that location and the relatively low cost (www.wildlifecrossings.info).

Due to budget constraints only portions of the project area were fitted with moose-proof fencing. The fence was designed to keep moose off the road and direct them to the crossing structure. One-way gates were installed in several locations to allow moose that entered the fenced area to escape from the road corridor. In addition, a funnel fence was used at one intersection to direct moose away from the roadway (see diagram at www.wildlifecrossings.info).

Road kill records indicate that the project has been effective in reducing moose mortality in the area. Between 1976 and 1987 (preconstruction) an average of 38 moose were killed each year in vehicle collisions. After construction the mortality dropped to about twelve moose per year (1987-1990). The combination of fencing, one-way gates, lighting, and bridge modification achieved a 70% decrease in moose mortality on the road. Additionally, analysis of moose movements around the study site showed no significant change in seasonal distribution relative to the highway before and after construction. This suggests that permeability was not significantly affected by the mitigation structures (McDonald 1991).

Approximately 50% (5.5km) of the roadway that underwent widening was fitted with fences, one-way gates, and a bridge modification. The entire length of the construction area had a lighting system installed. The lighted area with fences showed a 95% decrease in moose/vehicle collisions. The lighted area without fences showed a 65% decrease in collisions. It has not been determined whether the lighting system discouraged moose from entering the roadway or if it simply made them more visible and allowed drivers to take evasive action to avoid collisions (McDonald 1991).

Though there was a significant reduction of road kill in the fenced areas, frequent use of the one way gates indicated that moose were gaining access to the highway via the openings at the end of the fencing system. Almost 30% of the post construction road kills occurred near these end points or inside the fence (McDonald 1991). The frequent use of the one-way gates also seems to indicate their effectiveness in allowing moose to exit the roadway.

Land use adjacent to the project site should be noted. The majority of the study area occurs on Elmendorf Air Force Base and Fort Richardson Army Base. The project area also includes a portion of Chugach State Park and some of the land is in the city of Anchorage.

8.3.4. Snoqualmie Pass, WA

Snoqualmie Pass is significant not for its road kill mitigation measures but for a habitat linkage assessment that was conducted there. From January 1998 to March of 2000 the region surrounding Snoqualmie Pass was studied to determine the barrier effect of a major interstate highway (I-90).

[Singleton et al. (2001) conducted a large-scale carnivore habitat connectivity analysis for this area. As of the spring of 2005, Dr. Tony Clevenger from WTI has been contracted by Washington Department of Transportation to advise on specific details regarding the incorporation of mitigation measures into the reconstruction plans for I-90.]

8.3.5. Florida

The state of Florida has set the bar for wildlife-friendly transportation planning. The 1994 report "Closing the Gaps in Florida's Wildlife Habitat Conservation System" set the stage by identifying lands that must be conserved in order to sustain declining wildlife species and natural communities. The report mapped two categories of land: areas that already had some sort of protection and areas that needed additional protection. Closing the Gaps led to the first statewide conservation plan of its kind. Since publication in 1994, the state has acquired twenty percent of the previously-unprotected strategic habitat areas (White and Ernst 2003).

In 1996 the Florida Department of Transportation (FDOT) published its Environmental Policy which officially stated the department's role in protecting wildlife. The policy requires FDOT to "cooperate in the State's efforts to avoid fragmentation of habitat and wildlife corridors through a comprehensive Greenways Program of land acquisition and management with the identification and prioritization of important habitat connections." The policy also states that "consideration of habitat connectivity and wildlife crossings will take place on existing facilities as well as in the development of planned projects." (Evink 1996)

In light of the existing environmental policy, as well as the 1998 adoption of new federal regulations regarding road projects, FDOT began investigating ways to expedite projects and still comply with all state and federal environmental regulations. FDOT teamed up with the Federal Highway Administration (FHWA) and other government agencies to create a new methodology for making transportation decisions. The result is FDOT's Efficient Transportation Decision Making Process (ETDM), which will redefine how the state plans and builds transportation projects (White & Ernst 2003).

White and Ernst, in their 2003 report Second Nature: Improving Transportation Without Putting Nature Second, describe FDOT's ETDM as follows:

Each of the seven FDOT regions has an Environmental Technical Advisory Team (ETAT) composed of representatives from the relevant planning, consultation, and regulatory agencies. Proposed road projects are screened by the ETAT, based upon a checklist of criteria, including social and environmental impacts. Data from Geographic Information Systems (GIS) are used to perform evaluations, and are accessible to all agencies, as well as to the public through the Florida Geographic Data Library (FGDL).

The goal of ETDM, which is scheduled for implementation in the 2004, is to identify and resolve serious environmental problems before considerable time and money have been invested. By utilizing a computerized system, ETDM allows planners to review detailed information about wetlands, endangered species, wildlife-mortality hotspots, inventories of ecologically significant habitat, as well as social data such as distributions of elderly and minority populations. Because all of this information is easily accessible in the GIS, it is available to planners at the earliest stages of the design process. Citizens, too, will be able to visit the ETDM website and access this data and comments from reviewing agencies (McMurtray 2003).

Even without the ETDM, Florida has been a leader improving highway permeability for wildlife. For example, when State Road 84, known as “Alligator Alley”, was converted to I-75, 24 underpasses were constructed to allow wildlife passage. These crossings were designed for use by the endangered Florida panther, but use by all medium-sized to large animals that occur in southwest Florida has been documented (Land & Lotz 1996).

Florida has not focused all of its energy on panthers. In 1994 a crossing structure was built under S.R. 46 to allow passage for Florida black bears (*Ursus americanus floridanus*). The Florida black bear is listed by the State of Florida as a threatened species and is a candidate for listing by the U.S. Fish and Wildlife Service as a threatened species (Gilbert & Wooding 1996 [citation not listed in bibliography]).

One explanation for the attention that Florida has given to wildlife crossings is the impact of road kill on wildlife populations there. The Florida panther is one of the rarest mammals in the world. With approximately eighty cats in existence, each individual killed on the highway is a significant loss. When seven cats are killed by vehicles in a three month period of time, as was the case in 2001, road kill becomes a major factor in the survival of the population (White & Ernst 2003). Though Florida black bears are far more common than panthers, dead bears on the road are also more common. Between 1976 and 1995, 463 road kills were documented in Florida. In 1995 alone nearly sixty black bears died on Florida Roads.

8.3.6. US 93 on the Flathead Reservation, Montana

In December 2000, the Confederated Salish and Kootenai Tribes (CSKT), the Federal Highway Administration (FHWA), and the Montana Department of Transportation (MDT) agreed to reconstruct 90km of US Highway 93 on the Flathead Indian Reservation, Montana. Driver safety and the natural and cultural heritage of the CSKT were a primary concern in the reconstruction plans.

The plans include 42 wildlife crossing structures and 24 km of wildlife exclusion fencing, at an estimated cost of $9 million for these installations. This effort is unprecedented in North America. It provides an opportunity to study the effectiveness of wildlife crossing and fencing structures in a landscape that accommodates not only wildlife, but also agricultural, residential, business, recreational and cultural activities.

The Western Transportation Institute (WTI) at Montana State University is evaluating the effectiveness of the US 93 wildlife crossing structures and developing best management practices that can be applied to future projects. WTI is investigating the effect the mitigation efforts have on animal-vehicle collisions and wildlife movements across US 93, with a focus on deer species and black bear. Effectiveness will be defined *a priori* and will be determined based on comparisons of pre- and post-construction rates of animal-vehicle collisions and animal crossings.

Pre-construction measurements of wildlife crossings began in 2002; WTI is quantifying wildlife approaches and crossings of US 93 by monitoring sand tracking beds randomly placed along sections of road that will have the most concentrated wildlife fencing and crossing structures. In addition, MDT continues to collect data on US 93 wildlife mortalities to add to the existing 10-year dataset.

Construction will occur in phases from 2004 to 2008. Comparable data collection will continue for at least 3 years post-construction with the earliest reporting of results anticipated in 2010.