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Wildlife Technical Reports

Final Environmental Impact Statement

US-95 Thorncreek Road to Moscow

Project No. DHP-NH-4110(156);Key No 09294

Assessment of potential big game impacts and mitigation associated with highway alternatives from Thorncreek Road to Moscow

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Overview:

Western Ecosystems Technology (WEST), Inc. was contracted by the Idaho Transportation Department (ITD) in June 2010 to provide with an independent assessment of potential big game impacts associated with highway reconstruction proposed along US 95, between Thorncreek Road and Moscow. This project has a long history of wildlife concerns, including a legal decision (Civ. No. 03-0156-S-BLW) in 2003 that concluded the Environmental Assessment (FHA & IDT 2002) was not adequate. The court enjoined highway construction until an environmental impact statement (EIS) could be completed. Following the court decision and in preparation for the EIS, ITD initiated two independent assessments of big game impacts that were conducted by Dr. Wayne Melquist (Melquist 2005) and Dr. Bill Ruediger (Ruediger 2007). Both assessments concluded that the project area, including all three alternatives, did not bisect critical big game (i.e., moose, elk, and white-tailed deer) habitat or known migration corridors, and that population-level impacts from highway construction were unlikely. Both assessments also concurred that, although the potential for big game impacts were relatively low compared to other highway projects, the eastern (E-2) alternative posed the largest concern for big game among the three alternatives being considered because of its proximity to small patches of native habitats (i.e., Ponderosa pine, Palouse prairie remnants) not yet converted to agriculture. WEST was tasked with providing an independent evaluation of these conclusions and more specifically, to qualitatively evaluate the quality of habitat affected by each alternative (W-4, C-3, and E-2; Fig. 1) and indicate whether potential impacts warrant mitigation. Because empirical data on big game abundance, distribution, and movement through the project area do not exist, this evaluation was, by necessity, qualitative and based upon discussions with key personnel, existing reports, a site visit, and my experience with big game resource use and impact assessment. The fact that no empirical data of big game abundance or distribution are available for this area likely reflects the relatively low quality habitat and suggests the area is a low management priority.

The following criteria were used to rank the habitat directly affected by each alternative for each big game species (i.e., white-tailed deer, elk, and moose):

Poor – does not provide basic habitat components (e.g., forage, cover, water) preferred by big game. Poor habitat does not support big game on a year-around or seasonal basis (e.g., winter or parturition range) and is not needed to sustain big game populations in the region.

Marginal – provides some basic habitat requirements (e.g., forage, cover, water) that are limited in quantity and quality; unlikely to support measureable numbers of big game on a year-around or seasonal basis (e.g., winter or parturition range). Marginal habitat is unlikely to facilitate movement and/or migration of big game.

Moderate – provides reasonable habitat or component of habitat (e.g., forage, cover, water) and has the potential to support big game on year-around or seasonal basis (e.g., winter or parturition range). Moderate habitat may facilitate movement and/or migration of big game.

Excellent – provides an abundance of high-quality habitat or a component of habitat (e.g., forage, cover, water) and supports big game on year-around or seasonal basis (e.g., winter or parturition range). Excellent habitat may be critical to movement and/or migration of big game.

Mitigation was defined as any action designed to minimize potential impacts to big game. For big game, highway mitigation can range from modifying a right-of-way fence to constructing multi-million dollar crossing structures. Typically, mitigation is determined by policy (e.g., no net loss of wetlands) that state or federal agencies have adopted (e.g., WGFC 2010), but in this case there is no policy to determine whether mitigation is warranted. With wildlife impacts, the level or type of mitigation is often determined through negotiations among stakeholders and agencies, and the type of mitigation is commensurate to the potential impact. This assessment of whether potential impacts of highway alternatives justified mitigation were restricted only to big game concerns.

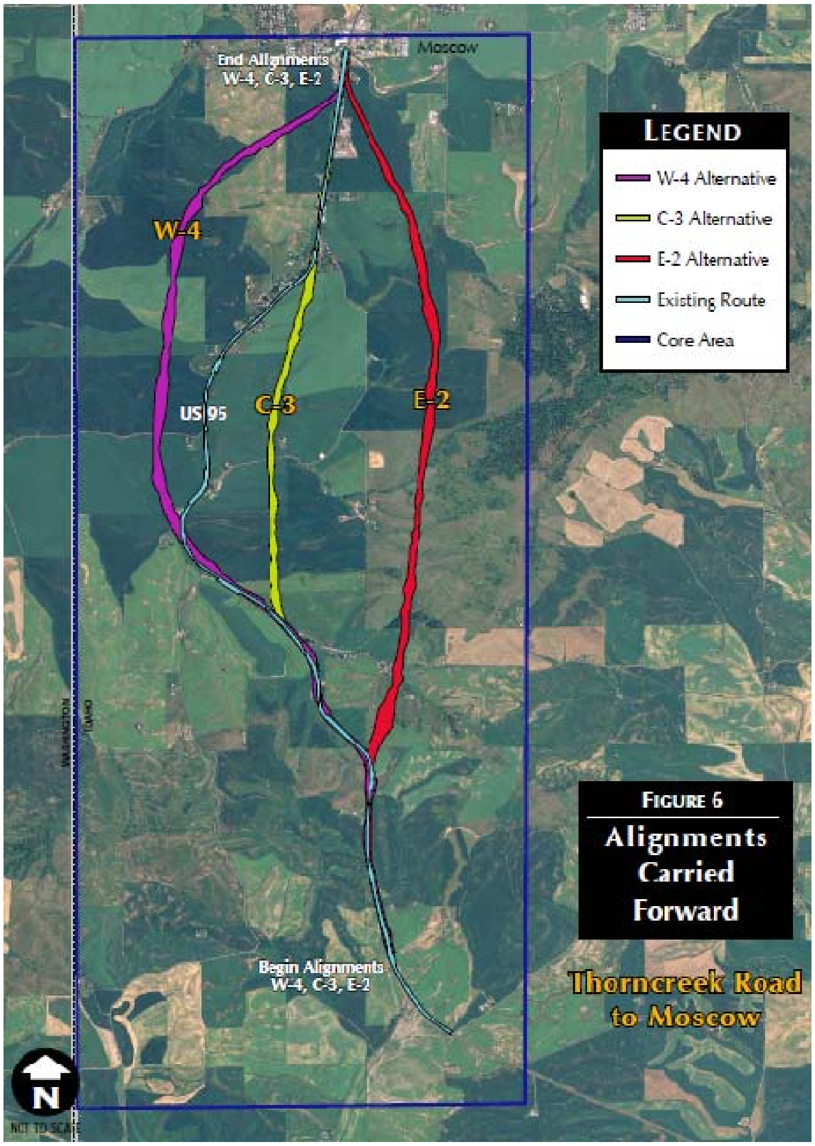

Figure 1. Location of W-4, C-3, and E-2 alternatives along US 95, between Thorncreek Road and Moscow.

Western Alignment (W-4)

Habitat Assessment for Moose, Elk, and White-tailed Deer

The western alignment (W-4) corridor is characterized by gentle to rolling topography, agricultural fields, and sparse rural residences (Fig.1).

Moose– Moose diets consist primarily of woody browse regrowth (e.g., willow, aspen, fir) in early successional stages that follow disturbances such as fire, floods, and logging (Franzmann 2000). Because the W-4 corridor does not provide any forage requirements (e.g., woody browse and aquatic vegetation) of moose, it was considered to be poor moose habitat.

Elk – Although the agricultural fields may provide seasonal foraging opportunities for elk, the W-4 corridor does not support any measurable amount of structural vegetation, shrub, or forest communities to provide escape and thermal cover. Elk rely heavily on forest cover and rugged terrain for avoiding human disturbances (Skovlin et al. 2002) and predators (Creel et al. 2005, Kauffman et al. 2007). Although elk can thrive in non-forested regions, they rely on mature shrub communities and topography to provide adequate security cover (McCorquodale et al. 1986, Sawyer et al. 2007). The absence of both forest and shrub cover limits the potential value of agricultural fields in the W-4 corridor to elk, and landowner tolerance of elk in the agricultural fields can be low because of crop depredation. Additionally, elk avoidance of roads and human disturbance is well-documented (Grover and Thompson 1986, Rowland et al. 2000, 2005) and is exacerbated in open habitats (Sawyer et al. 2007). Accordingly, the W-4 corridor was considered to be poor elk habitat.

White-tailed deer– Compared to elk and moose, white-tailed deer are less affected by human disturbances and are often associated with agricultural areas. White-tailed deer thrive in agricultural and forested areas that contain adequate amounts of woody cover and herbaceous forage (Demarais et al. 2000). Although agricultural fields and bottomlands can provide excellent food sources, white-tailed deer need some structural cover adjacent to them in order to take full advantage of their foraging opportunities (Compton et al. 1988, Dusek et al. 1989, Vercauteren and Hygnstrom 1998). Given the lack of structural cover in the form of wooded areas, tall crops (e.g., corn), or riparian draws, the W-4 corridor was considered to be marginal white-tailed deer habitat.

Big Game Abundance and Distribution

No empirical data of moose, elk, or white-tailed deer abundance or distribution exists for the W-4 corridor. Idaho Department of Fish and Game (IDFG) personnel have occasionally observed moose and elk in the general vicinity, but there is no evidence that they utilize the W-4 corridor on a regular basis. White-tailed deer are believed to utilize the area on a year-around basis (R. Hennekey, IDFG, pers. commun.). There is no evidence that the W-4 corridor bisects migration routes of any big game species.

Potential Impacts and Mitigation

The potential impacts of roadway construction on big game include direct habitat loss, indirect habitat loss (i.e., displacement), loss of connectivity (i.e., barrier effects), and mortality associated with vehicle collisions (Forman et al. 2003). Given the poor quality habitat and limited observations of moose and elk in the area, there is no evidence that the W-4 alternative would have measurable impacts on either species. Accordingly, mitigation for moose or elk is not warranted. Although W-4 is only marginal white-tailed deer habitat and deer numbers are relatively low, the divided highway design of W-4 would likely increase the risk of white-tailed deer – vehicle collisions. Melquist (2006) reports 10-15 deer collisions per year on the existing roadway and it is reasonable to expect this number to increase under the W-4 alternative. Whether this risk to animals and driver safety warrants mitigation is debatable, especially since the project is located on private lands where future land-use is uncertain. With no knowledge of existing travel corridors or deer-vehicle collision hotspots, mitigation specific to deer is not warranted.

Central Alignment (C-3)

Habitat Assessment for Moose, Elk, and White-tailed Deer

The central alignment (C-3) corridor is characterized by rolling topography, agricultural fields, and sparse rural residences (Fig.1).

Moose– Moose diets consist primarily of woody browse regrowth (e.g., willow, aspen, fir) in early successional stages that follow disturbances such as fire, floods, and logging (Franzmann 2000). Because the C-3 corridor does not provide any forage requirements (e.g., woody browse and aquatic vegetation) of moose, it was considered to be poor moose habitat.

Elk– Although the agricultural fields may provide seasonal foraging opportunities for elk, the C-3 corridor does not support any measurable amount of structural vegetation, shrub, or forest communities to provide escape and thermal cover. Elk rely heavily on forest cover and rugged terrain for avoiding human disturbances (Skovlin et al. 2002) and predators (Creel et al. 2005, Kauffman et al. 2007). Although elk can thrive in non-forested regions, they rely on mature shrub communities and topography to provide adequate security cover (McCorquodale et al. 1986, Sawyer et al. 2007). The absence of both forest and shrub cover limits the potential value of agricultural fields in the C-3 corridor to elk, and landowner tolerance of elk in the agricultural fields can be low because of crop depredation. Additionally, elk avoidance of roads and human disturbance is well-documented (Grover and Thompson 1986, Rowland et al. 2000, 2005) and is exacerbated in open habitats (Sawyer et al. 2007). Accordingly, the C-3 corridor was considered to be poor elk habitat.

White-tailed deer– Compared to elk and moose, white-tailed deer are less affected by human disturbances and are often associated with agricultural areas. White-tailed deer thrive in agricultural and forested areas that contain adequate amounts of woody cover and herbaceous forage (Demarais et al. 2000). Although agricultural fields and bottomlands can provide excellent food sources, white-tailed deer need some structural cover adjacent to them in order to take full advantage of their foraging opportunities (Compton et al. 1988, Dusek et al. 1989, Vercauteren and Hygnstrom 1998). Given the lack of structural cover in the form of wooded areas, tall crops (e.g., corn), or riparian draws, the C-3 corridor was considered to be marginal white-tailed deer habitat.

Big game abundance and distribution

No empirical data of moose, elk, or white-tailed deer abundance or distribution is available for the C-3 corridor. Idaho Department of Fish and Game (IDFG) personnel have observed moose and elk in the general vicinity, but there is no evidence that they utilize the C-3 corridor on a regular basis. White-tailed deer are believed to utilize the area on a year-around basis (R. Hennekey, IDFG, pers. commun.). There is no evidence that the C-3 corridor bisects migration routes any big game species.

Potential Impacts and Mitigation

The potential impacts of roadway construction on big game include direct habitat loss, indirect habitat loss (i.e., displacement), loss of connectivity (i.e., barrier effects), and mortality associated with vehicle collisions (Forman et al. 2003). Given the poor quality habitat and limited observations of moose and elk in the area, there is no evidence that suggests the C-3 alternative would have measurable impacts on either species. Accordingly, mitigation for moose or elk is not warranted. Although C-3 is only marginal white-tailed deer habitat and deer numbers are relatively low, the divided highway design of C-3 would increase the risk of white-tailed deer – vehicle collisions. Melquist (2006) reports 10-15 deer collisions per year on the existing roadway and it is reasonable to expect this number to increase under the C-3 alternative. Whether this risk to animals and driver safety warrants mitigation is debatable, especially since the project is located on private lands where future land-use is uncertain. With no knowledge of existing travel corridors or deer-vehicle collision hotspots, mitigation specific to deer is not warranted.

Eastern Alignment (E-2)

Habitat Assessment for Moose, Elk, and White-tailed Deer

The eastern alignment (E-2) corridor is characterized by rolling topography, agricultural fields, several wooded draws, several small ponds, and sparse rural residences (Fig.1). Importantly, the E-2 corridor is located in close proximity to Paradise Ridge, which supports a Ponderosa pine community and various shrubs that provide the best big game habitat within the project area.

Moose– Moose diets consist primarily of woody browse regrowth (e.g., willow, aspen, fir) in early successional stages that follow disturbances such as fire, floods, and logging (Franzmann 2000). The wooded draws extending from the west side of Paradise Ridge may provide limited amounts of foraging habitat for moose (e.g., woody browse and aquatic vegetation), but given the large quantities of forage required by moose (Franzmann 2000), the E-2 corridor was considered to be marginal moose habitat.

Elk– Elk rely heavily on forest cover and rugged terrain for avoiding human disturbances (Skovlin et al. 2002) and predators (Creel et al. 2005, Kauffman et al. 2007). Additionally, elk avoidance of roads and human disturbance is well-documented (Grover and Thompson 1986, Rowland et al. 2000, 2005). Although the agricultural fields may provide seasonal foraging opportunities for elk, the limited amount of security cover provided by the wooded draws, and their proximity to rural residences, likely restricts their value to elk. Further, landowner tolerance of elk in the agricultural fields can be low because of crop depredation. Accordingly, the E-2 corridor was considered to be marginal elk habitat.

White-tailed deer–White-tailed deer thrive in agricultural and forested areas that contain adequate amounts of woody cover and herbaceous forage (Demarais et al. 2000). Although agricultural fields and bottomlands can provide excellent food sources, white-tailed deer need some structural cover adjacent to bottomlands or agricultural fields in order to take full advantage of their foraging opportunities (Compton et al. 1988, Dusek et al. 1989, Vercauteren and Hygnstrom 1998). The agricultural fields and wooded draws in E-2 contain both forage and cover requirements for white-tailed deer, but the narrow wooded draws that bisect the E-2 are limited in numbers and size. Accordingly, the E-2 corridor was considered to be moderate white-tailed deer habitat.

Big game abundance and distribution

No empirical data of moose, elk, or white-tailed deer abundance or distribution is available for the E-2 corridor. Idaho Department of Fish and Game (IDFG) personnel have observed moose and elk on Paradise Ridge, but the extent to which they use the E-2 corridor is unknown. Most big game abundance estimates are derived from aerial surveys, typically flown during the winter months while animals are congregated and more visible. The project area has not been included in moose or deer surveys conducted by IDFG. The area is part of a larger elk unit that is stratified into high, medium, and low-density strata and flown each year. However, survey emphasis is placed on the high and medium-density strata and E-2 and Paradise Ridge are part of a low-density strata (J. Crenshaw, IDFG, pers. commun.), so there is no elk abundance data specific to the E-2 corridor. Regarding movement and distribution data, the standard approach for big game is to capture a sample of animals and equip them with GPS-collars. GPS collars can collect frequent locations 24 hours per day year-around and provide precise, unbiased measures of animal movement and distribution. Provided a representative sample of collared animals, GPS data can then be used to make inferences about the larger population in the area (e.g., Sawyer et al. 2006, 2007). However, in this case it appears that the number of moose and elk that utilize Paradise Ridge is so low, and use is so unpredictable, that capturing an adequate sample of animals is not feasible. Nonetheless, moose and elk use is more likely to occur in the E-2 corridor compared to other highway alternatives. White-tailed deer utilize the area on a year-around basis (R. Hennekey, IDFG, pers. commun.). Although big game likely travel along the wooded draws that extend west from Paradise Ridge, the draws do not extend beyond the current alignment and do not connect Paradise Ridge with other patches of high quality habitat. There is no evidence that the E-2 corridor bisects migration routes any big game species.

Potential Impacts and Mitigation

The potential impacts of roadway construction on big game include direct habitat loss, indirect habitat loss (i.e., displacement), loss of connectivity (i.e., barrier effects), and mortality associated with vehicle collisions (Forman et al. 2003). Given the marginal quality habitat and limited observations of moose and elk in the area, there is no evidence that suggests the E-2 alternative would have measurable impacts on either species. Accordingly, mitigation for direct habitat loss, indirect habitat loss, or loss of connectivity for moose or elk is not warranted. Relative to the other highway alternatives (W-4 and C-3), the risk of animal-vehicle collisions with moose and elk is higher in E-2. However, based on the lack of moose and elk observations in the area, the risk remains low and does not warrant mitigation. Impacts to white-tailed deer would include direct loss of habitat, increased risk of vehicle collisions, and possible loss of connectivity to marginal habitats between E-2 and the existing alignment. Melquist (2006) reports 10-15 deer collisions per year on the existing roadway and given the better quality habitat in E-2, this number would likely increase. Whether this risk to animals and driver safety warrants mitigation is debatable, especially since the project is located on private lands where future land-use is uncertain. It is my opinion that the relatively small amounts of habitat loss and potential loss of connectivity to marginal habitats do not warrant mitigation. However, some level of mitigation may be justified to minimize the risk of deer-vehicle collisions in areas where E-2 intersects with wooded or riparian draws.

Summary

Relative to other highway projects across the Intermountain West that bisect critical ranges (e.g., winter, parturition) or migration routes on public lands, the potential impacts to big game associated with reconstruction of US 95 from Thorncreek Road to Moscow are minimal. The southern half of the highway corridor was recently ranked as a low priority wildlife linkage in a report prepared for ITD and IDFG (Geodata Services 2008) and the project area does not contain any critical habitat for moose, elk, or white-tailed deer. Nonetheless, the potential impacts of big game vary among the proposed alternatives, although none are likely to result in population-level impacts. Consistent with Melquist (2005) and Ruediger (2007), the E-2 corridor contains the highest quality habitat among the proposed alternatives (Table 1) and potential impacts to big game are greatest under this alternative.

Typically, mitigation is determined by policy (e.g., no net loss of wetlands) that state or federal agencies have adopted (e.g., WGFC 2010), but in this case there is no policy to determine whether mitigation is warranted. With wildlife impacts, the level or type of mitigation is often determined through negotiations among stakeholders and agencies, and the type of mitigation is commensurate to the potential impact. Here, I offered an expert opinion of whether the potential impacts (e.g., habitat loss, vehicle collisions, etc.) of each alternative warranted mitigation for moose, elk, or white-tailed deer. Among the three highway alternatives, E-2 was the only alternative where big game mitigation may be warranted, based on white-tailed deer – vehicle collisions that may occur in areas where E-2 bisects wooded or riparian draws that extend west from Paradise Ridge. However, this report offers no opinion regarding highway safety issues which are the domain of ITD and its safety experts. While it was beyond the scope of this document to identify design or construction-phase mitigation options, wildlife-vehicle collisions should be carefully monitored following construction to determine if mitigation measures are effective or if additional measures are needed.

Table 1. Rankings (poor, marginal, moderate, or excellent) of moose, elk, and white-tailed deer habitat for each highway alternative.

Highway Alternative	Habitat Ranking		
	Moose	Elk	White-tailed deer
W-4	Poor	Poor	Marginal
C-3	Poor	Poor	Marginal
E-2	Marginal	Marginal	Moderate

References

Compton, B. B., R. J. Mackie, and G. L. Dusek. 1988. Factors influencing distribution of white-tailed deer in riparian habitats. Journal of Wildlife Management 52:544-548.

Creel, S., J. Winnie Jr., B. Maxwell, K. Hamlin, and M. Creel. 2005. Elk alter habitat selection as an antipredator response to wolves. Ecology 86:3387-3397.

Demarais, S., K. V. Miller, and H. A. Jacobson. 2000. White-tailed deer. Pages 601-628 *in* S. Demarais and P. R. Krausman, editors. Ecology and Management of Large Mammals in North America, Prentice-Hall, Inc., Upper Saddle River, New Jersey.

Dusek, G. L., R. J. Mackie, J. D. Herriges, and B. B. Compton. 1989. Population ecology of white-tailed deer along the lower Yellowstone River. Wildlife Monographs 104.

Foreman, R. T. T., D. Sperling, J. A. Bissonette, A. P. Clevenger, C. D. Cutshall, V. H. Dale, L. Fahrig, R. France, C. R. Goldman, K. Heanue, J. A. Jones, F. J. Swanson, T. Turrentine, and T. C. Winter. 2003. Road Ecology – Science and Solutions. Island Press, Washington DC.

Franzmann, A. W. 2000. Moose. Pages 578-600 *in* S. Demarais and P. R. Krausman, editors. Ecology and Management of Large Mammals in North America, Prentice-Hall, Inc., Upper Saddle River, New Jersey.

Geodata Services. 2008. Idaho Department of Fish and Game, Idaho Transportation Department - District 2, Fish and Wildlife Linkage Area Project, Final Technical Report. Geodata Services, Inc., Missoula, MT.

Grover, K. E., and M. J. Thompson. 1986. Factors influencing spring feeding site selection by elk in the Elkhorn Mountains, Montana. Journal of Wildlife Management 50:466–470.

Kauffman, M. J., N. Varley, D. W. Smith, D. R. Stahler, D. R. MacNulty, and M. S. Boyce. 2007. Landscape heterogeneity shapes predation in a newly restored predator-prey system. Ecology Letters 10:690-700.

McCorquodale, S. M., K. J. Raedeke, and R. D. Taber. 1986. Elk habitat use patterns in the shrub-steppe of Washington. Journal of Wildlife Management 50:664–669.

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and J. G. Kie. 2000. Elk distribution and modeling in relation to roads. Journal of Wildlife Management 64:672–684.

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2005. Effects of roads on elk: Implications for management in forested ecosystems. Pages 42–52 *in* M. J. Wisdom, technical editor, The Starkey Project: a synthesis of long-term studies of elk and mule deer. Alliance Communications Group, Lawrence, Kansas, USA.

Sawyer, H., R. M. Nielson, F. Lindzey, and L. L. McDonald. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management 70:396-403.

Sawyer, H., R. M. Nielson, F. Lindzey, L. Keith, J. Powell, and A. Abraham. 2007. Habitat selection of Rocky Mountain elk in a non-forested environment. Journal of Wildlife Management 71:868-874.

Skovlin, J. M., P. Zager, and B. K. Johnson. 2002. Elk habitat selection and evaluation. Pages 531–555 *in* D. E. Toweill and J. W. Thomas, editors. North American Elk: ecology and management. Smithsonian Institution Press, Washington, D.C., USA.

Vercauteren, K. C., and S. E. Hygnstrom. 1998. Effects of agricultural activities and hunting on home ranges of female white-tailed deer. Journal of Wildlife Management 62:280-285.

Wyoming Game and Fish Commission (WGFC). 2010. Policy Manual. Wyoming Game and Fish Department, Cheyenne, Wyoming.

FINAL
Review of Wildlife Mitigation for the Thorncreek Road to Moscow Highway Development Project (US 95)

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Looking West Across The Thorncreek Road to Moscow Project Towards The Bald Butte Area

INTRODUCTION

The following is from Chapter 1, Purpose and Need of the Thorncreek Road to Moscow highway project on US 95. It briefly describes the project:

"In 1999, ITD began developing an Environmental Assessment (EA) for the Top of Lewiston Hill to Moscow project on U.S. 95. The EA was approved in May 2002. In 2003, the Top of Lewiston Hill to Moscow project was litigated. The result of the legal challenge was a change to the approved project limits. Two projects were defined, the Top of Lewiston Hill to Genesee and Genesee to Thorncreek Road. Construction on these projects began in October 2004.

Idaho District court found that an EIS would be required for the Thorncreek Road to Moscow project. Work on the EIS began when the Notice of Intent to prepare an EIS was published on the Federal Register on November 13, 2003. Volume 68 No. 219. Environmental evaluation of the project began in the spring of 2004."

There are three basic alternatives: A "western route" which would require building a new portion of the highway west of the current route. A "center route" that would closely follow the current alignment, taking out some of the present curves and elevation changes. And, an "eastern route" that would require a new highway alignment to the east of the current highway. The eastern route was the original preferred route when the project was approved in the 2002 Environmental Analysis.

Regardless of which route is taken, the design for the highway would be based on AASHTO standards (October 1999) to construct a four-lane divided highway with 36-foot lanes in both directions. The design year is 2023 and the project has a design speed of 70 mph."

Several resource agencies have indicated that their "preferred alternative" is the center route, which follows the current highway alignment. The resource agencies involved in the project include Idaho Department of Fish and Game (IFG), US Fish and Wildlife Service (FWS), Environmental Protection Agency (EPA) and the Corps of Engineers (Corps). The author agrees from an environmental perspective that the center alternative has the least impacts on wildlife, wildlife habitat and plant communities. Both the western and eastern alternatives would require significant new construction and right-of-way (ROW) and the current alignment would also have to be maintained to allow for resident access to existing homes. However, there are other factors that Idaho Transportation Department (ITD) must consider such as cost, safety and many other environmental factors.

EFFECTS OF HIGHWAYS ON WILDLIFE

Prior to discussing the specific effects and mitigation proposed for the Thorncreek to Moscow project, it is important to describe the effects highways have on wildlife. The effect of the highway on wildlife, plus highway safety issues (collisions with wildlife), should form the basis of mitigation measures. One of the premises the author makes is that the mitigation should be commensurate with the significance of impacts to wildlife and wildlife habitat. Highway projects that have major and significant impacts should require more measures and cost to mitigate these impacts than projects that have minimal or insignificant impacts.

The effects on wildlife and wildlife habitat caused by roads and highways have been described in various papers (Forman et al. 2003, Ruediger and Wall 2005, Ruediger 2004, Ruediger 1996). These effects can be generalized into the following categories:

***Habitat Fragmentation* –** Forman (2002) defines habitat fragmentation as “the breaking of a habitat into pieces (with the consequent loss of connectivity).” Habitat fragmentation can also occur when individuals or meta-populations are disassociated from critical habitat components such as seasonal ranges, water, cover or security. It can also affect dispersal of young animals, access to breeding by some individuals and use or configuration of a species home range (Ruediger 2004).

***Direct and Indirect Habitat Loss* –** As affected by highways can be defined in various ways: the direct loss of acres, the indirect loss caused by reduction in habitat quality or avoidance (see displacement below). Ruediger (2005) defined the direct effects of habitat loss on elk of a two-lane highway as 18.18 acres/mile of highway and for a four lane highway as 36.36 acres/mile. These are based on 150 foot ROW’s for two-lane highways and 300 feet for four-lane highways. For most other wildlife species the effects would be much less.

***Displacement of Wildlife* –** Is the response by wildlife to use habitat near highways or roads less than similar habitat without roads. For elk, which are a species that appear to be severely disrupted by roads and highways, Ruediger (2004) estimated the reduced use to be equivalent to the loss of approximately 732.18 acres of habitat. The effects of displacement are complex and likely influenced by the species of animal, terrain, vegetation, harassment factors (like hunting), traffic volume and how the highway is designed.

***Highway-Caused Wildlife Mortality* –** Is mostly related to animals that find their way onto the highway and are struck by vehicles. However, in some situations wildlife mortality might be caused by pollution factors such as fuel or oil contamination. Mostly, animals are hit trying to cross highways. When large animals are hit by cars, such as moose, elk, deer and bears, the result is a serious human safety hazard. Traffic volume has a direct impact on the severity of wildlife mortality on highways (Bank et al 2002).

***Associated Human Developments* –** results when highways are improved and commute times and ease of access by humans is increased. The result can be housing commercial developments, which have their own set of adverse effects to wildlife.

WILDLIFE AND HIGHWAY SAFETY

The presence of wildlife on highways can significantly affect human safety. Large animals such as elk, mule deer, moose, bear and other species can cause collisions either by direct impact with vehicles or by motorists trying to avoid collisions with wildlife. In many situations the hazards of wildlife on highways is adequate reason to provide wildlife fencing and crossings.

HISTORICAL BASIS FOR PROVIDING WILDLIFE MITIGATION ON HIGHWAYS

Highway mitigation has evolved in the United States and elsewhere. Legally required mitigation of wildlife has usually been associated with impacts to wetland habitat and adverse effects to federally listed threatened or endangered species. Although the author is not an expert with what are commonly called 4(f) lands (National Parks, wildlife refuges and other specific public lands), there may be legally required mitigation measures required for highway projects that have impacts to 4 (f) resources.

There are other situations where mitigation can or may occur. These include situations where wildlife presents serious road hazards, or where a land manager or owner requires mitigation for ROW acquisition. In the author’s experience, these would normally be for situations where high value big game winter range is present, when other rare or limited wildlife habitats are impacted, or for species recognized by state or federal agencies as sensitive or species of concerns. In these situations, there is a great deal of DOT latitude as to whether or not mitigation is warranted.

SPECIFIC EFFECTS OF THE THORNCREEK ROAD TO MOSCOW PROJECT ON WILDLIFE

The author made a thorough review of the information prepared by Idaho Fish and Game (two reports undated and December 2006), Dr. Tony Clevenger (undated), Dr. Wayne Melquist (December 2005) and information from the project environmental documents. After reviewing the specific effects of the Thorncreek Road to Moscow highway project on-site wildlife and wildlife habitat within or adjacent to the ROW, the following effects are evident:

General description of wildlife habitat effected by the Throncreek Road to Moscow project. The primary habitat affected by all three of the Throncreek Road to Moscow project alternatives is plowed and cultivated agricultural fields or agricultural fields presently in the Conservation Reserve Program (CRP). Native wildlife habitat, mostly what is referred to as Palouse Prairie in various documents, was converted to agricultural lands perhaps one hundred years ago. In the draft Idaho Fish and Game Terrestrial Wildlife Assessment of the project, it is stated that 89 percent of the Ponderosa Pine communities have been lost in Latah County (Idaho) and that the Palouse Prairie has seen nearly a 100 percent conversion to cultivated agricultural lands.

Figure 1. Most of the right-of-way for all alternatives is agricultural lands, either cultivated fields, like the above or lands placed in the CRP program.

The native Palouse Prairie biome is rightly defined as one of the rarest and most endangered prairie ecosystems in North America (Idaho Fish and Game, undated and Noss et al 1995). The eastern route affects one Ponderosa Pine stand and the central and western routes do not impact either native Ponderosa Pine or Palouse Prairie habitats. The removal of a few Ponderosa Pine trees is not a significant impact.

The following are how the proposed project alternatives (western, central and eastern routes) affect wildlife and wildlife habitats:

Habitat Fragmentation. All three of the Thorncreek Road to Moscow project alternatives have a similar impact on habitat fragmentation. They fragment existing agricultural lands, including CRP. The eastern route comes closer to Paradise Ridge and thus could affect some local deer and elk winter range and other seasonal or year-round habitat. The Bald Butte area, a few miles west of the present Highway 95 has limited amounts of coniferous habitat and remnant Palouse Prairie, however the amount of habitat is very limited and it is already disjunct from Paradise Ridge and other similar habitat. Melquist mentions in his 2005 report (page 5) that an Idaho Fish and Game employee had observed elk east of Highway 95, but these animals “were never observed crossing the highway in the direction of Tomer Butte.”

Based on the author’s experiences evaluating and mitigating wildlife habitat fragmentation in Idaho and several other states, there seems little evidence that significant habitat fragmentation will occur with any of the three Thorncreek Road to Moscow project alternatives, even the proposed eastern route that comes closest to Paradise Ridge. There is an identified wildlife habitat linkage (ID2-056) in the Highway/Wildlife Linkage Mapping (Idaho & Montana (see http://geodataservicesinc.com/linkage/pdf/ITD2_Crossings_1.pdf). Based on the author’s experience at mapping wildlife habitat linkages in many western states, this wildlife linkage (056) would likely rate as low priority on a regional basis and certainly so on a statewide basis.

There will be some fragmentation of habitat, mostly along drainages and draws for small-sized wildlife such as raccoon, skunks, coyotes, small mammals, amphibians and reptiles.

The present traffic volume on Highway 95 of approximately 6,100 vehicles is considered problematic for wildlife. Highways with traffic volumes of 2,000 to 4,000 vehicles per day are considered to have adverse effects on all wildlife species (with as much as 50 percent mortality for some species). Traffic volumes exceeding 4,000 vehicles per day were considered to be causing significant habitat fragmentation and wildlife mortality (Evink et al 1999). In Europe highways with 10,000 vehicles per day are considered complete barriers, with little or no wildlife surviving crossing attempts (Bank et al 2002). The predicted traffic volume in 20 years on Highway 95 is approximately 9,400 vehicles per day, which is very close to being a complete barrier.

One of the problems of assigning a high significance to wildlife habitat fragmentation on the Thorncreek Road to Moscow project is that native habitat and many of the species that occurred with it have long ago been lost to agricultural conversion. What remains are mostly non-native species and habitat generalist species like raccoon, white-tailed deer and a variety of other common species. These species, while important locally, are mainly species already adaptable to habitat modifications, fragmentation and high levels of human use. Elk and moose are exceptions to the situation and are somewhat more specific as to habitat and human use patterns. Regardless, the habitat for elk and moose is limited in quantity and quality and confined to the Paradise Ridge vicinity. Since nearly all of the elk and moose habitat is on Paradise Ridge and eastward, habitat fragmentation for these species is minimal (not significant).

Direct and Indirect Habitat Loss. The direct habitat loss would be the habitat affected by the new four-lane highway, which is approximately 158 acres for the western or eastern routes. The center route would be somewhat less (101 acres) since some of the ROW would exist on the present location and some would be built off the present location. The direct loss of habitat is almost all on agricultural land and there is no basis to provide mitigation for this wildlife habitat. The direct loss of wetlands would be required for all alternatives. There is no direct habitat loss for federally listed species (as confirmed by Clay Fletcher, USFWS, Boise, Idaho – phone call 8/10/07).

Displacement of Wildlife. Displacement of wildlife by project activities is always difficult to assess. If elk are used for analysis purposes (which are the species for which the greatest likely impact would occur) the displacement would be none or negligible for the western and central routes, since almost all of the impacts would be on agricultural fields (some displacement on CRP lands impacted on birds and small mammals).

On the eastern route, the exact amount of habitat could be determined using aerial photographs and topography maps and appears to be the two miles in length (along Paradise Ridge), with a calculated effect of 714 acres (see Ruediger 2005). This assumes that the displacement for elk extends 1.10 miles out, only on the east side of the highway. The east side of this route is where Paradise Ridge is located and where most of the habitat of concern exists. This process assumes a habitat effectiveness of .25 for the first .45 mile from the ROW and a habitat effectiveness of .67 for habitat from .45 miles to 1.10 miles of the ROW. As mentioned before, the impact is calculated for elk but would certainly be inclusive of whitetail deer, moose and virtually all other wildlife species. The actual amount of displacement for whitetail and mule deer would be less, and it is unknown for moose. Paradise Ridge does not appear to be an important winter habitat for elk, deer or moose; rather it is an appendage of more extensive habitat to the east and north. The 714 acres of potential habitat loss does not take into consideration whether the habitat is considered critical, average or marginal in quality.

The effects of displacement described above come from the paper entitled The Effects of Highways on Elk (*Cervus elaphus*) Habitat in the Western United States and Proposed Mitigation Approaches (Ruediger 2005). The following is from the section dealing with displacement of elk: “Elk responses to highways and roads vary by a number of factors such as topography, vegetation, traffic volumes, how the highway is designed and whether or not elk are hunted. Elk have been shown to use habitat adjacent to roads less than similar habitat that is not affected by roads (Rowland et al. 2004, Wisdom 1998, Johnson et al. 2000, Ager et al. 2003, Perry and Overly 1977, Lyon 1979). Generally, elk use decreases as the proximity to roads and highways increases. Rowland et al. (2000) found that there was a measurable decline in elk use up to 1.8 kilometers (5,500 feet)) from roads. Roloff (1998) and Rowland et al. (2000) suggest assessing elk habitat using distance band approaches. Using distance band approaches from the Roloff (1998) and Rowland et al (2000) and habitat effectiveness (HE) equations from Hitchcock and Ager (1992), the Wallow-Whitman National Forest calculated values of .17 to .83 for five distance bands of habitat moving from the roadside outward. Each of the five bands was 1,182 feet wide (394 yards) and exists on each side of the highway (Rowland et al. 2004). The authors of this paper simplified the Wallow-Whitman elk HE information into three zones as follows. Zone 1, highway right-of-way with HE = 0; Zone 2, roadside to 0.45 miles with HE = 0.25 and Zone 3, 0.45 – 1.1 mile with HE = .67. Note: Zones 2 and 3 extend on both sides of the highway, so the total corridor of highway effects to elk is approximately 2.26 miles for a four-lane road, slightly less for a two-lane road.”

It is the author's opinion that the amount of elk habitat affected on Paradise Ridge is OVERSTATED using the above model. The reason for this is that elk habitat on Paradise Ridge is peripheral to the primary habitat to the east and north and has a very limited carrying capacity for elk. Discussions with Dr. Jim Peek, University of Idaho (9/10/07) confirm that Paradise Ridge is secondary habitat for elk and moose, at best.

Highway Caused Mortality to Wildlife. Melquist (2006) mentions that 10-15 deer per year are killed near Tomer Butte on Highway 8 and that in some years moose are also killed. There is no mention of elk being struck by vehicles. These collisions are not within the Thorncreek Road to Moscow project. Idaho Transportation Department told the author that reported collisions with wildlife were not common in the Thorncreek Road to Moscow section and that they considered the number of large animal collisions "low" compared to many other sections of highways within District 2, or elsewhere in Idaho.

A high number of collisions with deer, elk or moose would indicate that there is serious habitat fragmentation occurring and that there is a significant human safety issue. In the case of the present relative collision information for the Thorncreek Road to Moscow project there seems to be little to suggest that either highway mortality or habitat fragmentation is significant. As noted by Melquist (2005) "none of these alignments (eastern route) would have a detrimental impact on resident deer, elk or moose populations." Although still at relatively low levels, this author believe collisions with wildlife would be more prevalent on the eastern route compared with either the center or western alternatives. The reason for this is that the main attraction for deer, elk and moose is the Paradise Ridge complex and the nearer a highway is to this habitat, the more likely that collisions with large and smaller wildlife will occur. Also, if wildlife must cross the highway to access water, this would be a strong stimulus. Even though there are some ponds to provide water on both sides of the eastern route, the author has recommended that additional measures be taken to increase water sources on the Paradise Ridge side of the eastern route (see Recommendation #2 Wildlife Crossing Mitigation Measures, number 3, pages 10 and 11 of this report).

Associated Human Developments. There are already indications of dispersed housing along the existing highway corridor and the side roads. There are proposed subdivisions near the western route and new houses along Paradise Ridge. This development is occurring regardless of the highway and is mostly a factor to the areas in proximity to the City of Moscow. This development is problematic for future wildlife, especially along Paradise Ridge. There seems to be little land use control of housing and other developments specific to protecting wildlife habitat. The future developments must be considered when spending public funds for wildlife mitigation. If the land is private and there is no conservation easements or acquisition plan (for open space or wildlife habitat protection), then wildlife mitigation measures may be ineffective over time.

RECOMMENDATION FOR WILDLIFE MITIGATION ON THE THORNCREEK TO MOSCOW PROPOSED HIGHWAY DEVELOPMENT

The following recommendations are based on:

1. Review of wildlife impacts and mitigation proposed by Idaho Department of Fish and Game (2006) and Melquist (2005).
2. A field review of the Thorncreek to Moscow Project site on 8/1/07.
3. Interviews with ITD, FHWA, IFG, EPA and FWS personnel.
4. Experience with previous highway mitigation, including assessments of habitat fragmentation and wildlife crossings.

Recommendation #1. Mitigation for direct and indirect habitat loss (including displacement of animals).

There is a legal basis to provide all necessary habitat replacement of wetlands in any of the Highway 95 alternatives. There is no conflict over this element. Impacted wetlands will be mitigated as required.

There are no significant effects to federally listed threatened or endangered species, so no habitat replacement mitigation is proposed or recommended.

On the west, central and east routes there will be approximately 159, 101 and 158 acres respectively of agriculture lands directly lost as a result of the proposed highway. There is no legal requirement for wildlife habitat replacement mitigation of these lands. See the following comment on “optional mitigation measures.”

On the eastern route there is approximately 714 acres of elk habitat impact based on displacement caused by this proposed ROW on the Paradise Ridge side of the highway. There are likely other species also impacted, such as deer, moose and birds, but these effects were not separated from, and are part of, the elk displacement impact. There is no legal requirement to mitigate for wildlife habitat loss. The significance of this loss of habitat is likely low on either the species involved (at a population level) or on the total amount of habitat available in Latah County, the Region or State. See optional mitigation measures.

Optional Mitigation Measures. Idaho Department of Fish and Game, Environmental Protection Agency and US Fish and Wildlife Service have voiced support for mitigation of direct and indirect wildlife habitat lost or adversely affected by the proposed highways. In discussions the author had with these agencies, and Wayne Melquist, all were aware that there is no legal requirement for the proposed loss of habitat, except for wetlands. Based on other highways reviewed by the author in Idaho and other western states, the Thorncreek Road to Moscow project has relatively minor effects on wildlife.

The question for all agencies is: Where should the limited amount of highway mitigation funding be applied? Should it be applied to relatively low impact and low priority situations? Reason would suggest that “optional mitigation” should be applied only to situations where the habitat impacts, including loss, displacement and fragmentation are significant, serious and of moderate or high priority to resource agencies – and that the general public supports these uses of highway funds. There could be situations where wildlife habitat of local importance would be replaced, but probably through a partnership with the community or other conservation entity where there has been shown to be a high level of concern through land use planning, purchases of open space or other significant contributions. San Diego County, California and Tucson, Arizona have had such programs where DOT’s have contributed either land or wildlife crossings to support community wildlife habitat protection programs. Citizens in Missoula, Montana and Vail, Colorado have gone to Congress and successfully obtained federal funding for wildlife crossings or wildlife crossing studies that state DOT’s could not afford.

Without similar community support for wildlife habitat protection, the author does not see a strong rationale why ITD should fund wildlife habitat replacement mitigation for the Thorncreek Road to Moscow highway project on-site in the Paradise Ridge vicinity. The small amount of acreage for mitigation would not adequately protect the Paradise Ridge area or wildlife habitat linkages to and from core habitats to the north and east. Home building would eventually consume or adversely affect much of the present habitat, especially for larger species. Mitigation could provide a small remnant of natural habitat for plants and small animals, however, these species are minimally impacted by the project. If Paradise Ridge is an important ecological area it should be protected from the major sources of impact, those being rural housing development and subdivision. This responsibility should be born by the county government, local conservation groups or the state heritage or park system.

A second option would to provide funding for habitat off-site as Idaho Transportation Department deems appropriate. This is consistent with recent recommended FHWA direction, which included participation from the US Fish and Wildlife Service, Environmental Protection Agency and other Federal agencies. See Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects (Brown 2006).

Recommendation #2. Wildlife Crossing Mitigation Measures. Support was expressed by several agencies for wildlife crossings. Where the author found general agreement was:

1. For small animal wildlife crossings at drainage crossings, draws and other places where wildlife is known to need habitat or population connectivity. The recommended structures would be 36” to 48” round or box culvert. These would require wing-fencing to funnel animals into the culverts. Thirty six inch high 4”x 2” page wire is recommended for animals down to skunk size. If small reptiles or amphibians are target species, small-mesh wire must be placed along the bottom of the wing fencing. Cement

Figure 2. Badger tunnel with small animal fencing (Netherlands). Suitable for small mammals, reptiles or amphibians. Author recommends 36” or 48” box culverts for common mid-sized species.

box culverts are recommended over galvanized steel or cement round pipes. If round pipes are used, cement pipes are recommended. Thirty six inch box culverts or pipes are recommended for species smaller than coyotes and bobcats. If coyote passage is desired, 48” structures are recommended (see Ruediger and DiGeorgio. 2007). The length of wing-fencing should be determined in the field with Idaho Fish and Game biologists.

2. Wildlife crossings for elk, deer and moose should be incorporated into any county or rural road underpasses of Highway 95 (see Figure 3). These crossings also need wildlife fencing (8-foot high page wire), should have soft (dirt or small gravel) side walls and paths (rather than cement or other hard surfaces) and the bridges should be high and wide enough to facilitate wildlife use. Provisions for wildlife crossings should only be made where wildlife use is expected and where wildlife are welcome on private lands (deer, elk and moose).

3. Mitigation for water development(s) for the eastern route. Access to water may be an attraction for wildlife to cross the highway. If access to water for wildlife is cut off by the highway, then alternate water sources should be developed.

There is also a proposal to provide two stand-alone wildlife crossings for deer and elk. The author found that the rationale for where these should be located, or even if they are needed, is not strong. There is neither significant road kill nor adequate habitat to the east to warrant stand-alone wildlife crossings. Tony Clevenger provided excellent recommendations on the type of wildlife crossings which would likely be effective. The locations, which he did not assess, appeared to funnel animals only into marginal habitat on the west side of the highway. A more reasonable location would be in a location that allowed animals to move toward the Bald Butte area, probably on the divide between Paradise Ridge and Bald Butte. Wildlife using the east side of Paradise Ridge could likely use the county road underpasses, and these would be logical places to develop crossings for large ungulates, if desired.

CONTACTS: The following people were contacted by the author for this report:

1. Dave Cadwallader, Regional Supervisor, Idaho Department of Fish and Game. Lewiston, ID.
2. Ray Henneky, Environmental Staff Biologist, Idaho Department of Fish and Game. Lewiston, ID.
3. Jerome Hansen, Wildlife Biologist, Idaho Department of Fish and Game. Lewiston, ID.
4. Gregg Servheen, Wildlife Biologist, Idaho Department of Fish and Game. Boise, ID.
5. Clay Fletcher, Wildlife Biologist, US Fish and Wildlife Service, Boise, ID.
6. Elaine Somers, Environmental Protection Agency, Seattle, WA.
7. Ken Helm, Transportation Planner, Idaho Transportation Planner, Lewiston, ID.
8. Kim Just, Idaho Transportation Department, Boise, ID.
9. Zacary Funkhouser, Senior Environmental Planner, Lewiston, ID
10. Wayne Melquist, Wildlife Biologist, CREX Consulting, St. Maries, ID.
11. Brent Ingrham, Environmental Program Manager, Federal Highway Administration, Boise, ID.
12. Dr. Jim Peek, Professor of Wildlife Management Emeritus, University of Idaho, Moscow, ID.

Figure 3. Country road crossing (twin spans) of US 6 near Price, Utah. This structure serves as an effective vehicle and wildlife crossing. Note the natural soil/vegetation on the sides of the bridge and the adequate length of the structure.

APPENDIX A: WILDLIFE AND FISH SPECIES MENTIONED IN TEXT - US 95 – THORNCREEK TO MOSCOW.

1. Raccoon	*Procyon lotor*
2. Skunk	*Mephitis mephitis*
3. White-tailed deer	*Odocoileus virginianus*
4. Mule deer	*Odocoileus hemionus*
5. Rocky Mountain elk	*Cervus elaphus*
6. Moose	*Alces alces*

LITERATURE CITED AND REFERENCES

Ager, A. A., B.K, Johnson, J. W. Kern and J. G. Kie. 2003. Dailey and seasonal movements and habitat use by female rocky mountain elk and mule deer. Journal of Mammalogy 84:1076-1088.

Bank, Fred G., C. Leroy Irwin, Gary L. Evink, Mary E. Gray, Susan Haygood, John R. Kinar, Alex Levey, Dale Paulson, Bill Ruediger and Raymond M. Sauvajot. 2002. Wildlife habitat connectivity across european highways. Federal Highway Administration Report Number: FHWA-PL-02-011. 60 pages

Boecklen, W.J., and N.J. Gotelli. 1984. Island biogeographic theory and conservation practice: species-area or specious-srea relationship? Biological Conservation. V. 29: pp. 63-80.

Bonoff, Micheal. 2005. Oregon department of transportation’s OTIA III bridge program: 400 bridges, one biological opinion. Mason, Bruce & Girard, Inc. Proceedings of the 2005 International Conference on Ecology and Transportation. Center for Transportation and the Environment. Raleigh, N.C. In press.

Booth, Jerry, Celina Booth and Melina Booth vs. State of Arizona. 2003. Court of Appeals, State of Arizona. Appeal from the Superior Court of Pima County. Case No. C336464.

Boulanger, J. 1999. Analysis of highway traffic volume and wildlife mortality for Storm Mountain Lodge environmental screening. In, Environmental Assessment for the Storm Mountain Lodge redevelopment, Axys Environmental Consulting Ltd., Calgary, Alberta.

Brown, Janice. 2006. Eco-Logical: an ecosystem approach to developing infrastructure projects. FHWA Report: FHWA-HEP-06-011. 83 pages.

Clevenger, A.P. (undated). Design recommendations: wildlife underpasses, u.s. 95 – genesee to Moscow, Idaho. Memo to Idaho Transportation Department. 5 pages.

Evink, G.L., P. Garrett and D. Zeigler, eds. 1999. Proceedings of the third international conference on wildlife ecology and transportation. FL-ER-73-99. Florida Department of Transportation, Tallahassee, Florida. 330pp.

Farrig, L., J.H. Pedlar, S. E. Pope, P. D. Taylor, and J.F. Wegner. 1995. Effect of road traffic on amphibian density. Biological Conservation 73:177-182.

Forman, R. T. T., and D. Sperling, J. A. Bissonette et al. 2003. Road ecology: science and solutions. Washington D.C., Island Press. 481 pages.

Forman, R.T.T., and A.M. Hersperger. 1996. Road ecology and road density in different landscapes, with international planning and mitigation solutions. In: Evink, G.L.; Garrett, P.; Ziegler, D.; and J. Berry (Eds.) Trends In Addressing Transportation Related Wildlife Mortality. Proceedings of the Transportation Related Wildlife Mortality Seminar.

Flathers, C.H. and TW Hoekstra. 1989. An analysis of the wildlife and fish situation in the United States: 1989-2040. U.S. Department of Agriculture Forest Service Gen. Tech. Rep. RM-178. 147 pp.

Gelbard, J.L., and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology 28:42-432.

Gunson, K.E., A.P. Clevenger. 2003. Large animal-vehicle collisions in the central Canadian rocky mountains: patterns and characteristics. In 2003 Proceedings of the International Conference on Ecology and Transportation, editied by C. Leroy Irwin, Paul Garret, and K.P. McDermott. Raleigh, NC: Center for the Environment, North Carolina State Univ., 2003. Pgs 355-365.

Harris, L. 1984. The fragmented forest: island biogeography theory and the preservation of biotic diversity. The University of Chicago Press, Chicago.

Huijser, Marcel. 2005. The reliability of the animal detection system on highway 191 in yellowstone national park. Proceedings of the 2005 International Conference on Ecology and Transportation. Center for Transportation and the Environment. Raleigh, N.C. In press.

Hitchcock, M., and A. Ager. 1992. Microcomputer software for calculation an elk index on blue mountain winter range. U.S. Department of Agriculture, Forest Service, General Techincal Report PNW-GTR-301, Portland, Oregon.

Idaho Department of Fish and Game. 2006. General wildlife assessment thorncreek road to Moscow. Prepared for Idaho Transportation Department. Project No. DHP-NH-4110 (156). 26 pages.

Idaho Department of Fish and Game. Undated. Draft terrestrial wildlife impact assessment proposed u.s. 95 realignment and widening top of reisenauer hill to moscow. Prepared for Idaho Transportation Department. 7 pages.

Irwin, L.L., and J.M. Peek. 1983. Elk habitat use relative to forest succession in Idaho.Journal of Wildlife Management 47(3):664-672.

Johnson, B.K., J.W. Kern, M.J. Wisdom, S.L. Finholt, and J.G. Kie. 2000. Resource selection and spatial separation of mule deer and elk during spring. Journal of Wildlife Management 64:685-697.

Leeson, B.F. 1996. Highway conflicts and resolutions in banff national park, alberta, canada. In: Evink, G.L.; Garrett, P.; Ziegler, D.; and J. Berry (Eds.) Trends In Addressing Transportation Related Wildlife Mortality. Proceedings of the Transportation Related Wildlife Mortality Seminar.

Lyon, L.J. 1979. Habitat effectiveness for elk as influenced by roads and cover. Journal of Forestry 79:658-660.

Maehr, D.S. 1984. Animal habitat isolation by roads and agricultural fields. Biological Conservation. V. 29: pp. 81-96.

Melquist, W.E. 2005. Biological evaluation on the potential impacts of corridor alternatives from thorncreek to Moscow on large ungulates. CREX Consulting, St Maries, Id. 40 pages.

Noss, R.F., H.B. Quigley, M.G. Hornocker, T. Merrill, and P.C. Paquet. 1996. Conservation biology and carnivore conservation in the Rocky Mountains. Conservation Biology 10(4):949-963.

Noss, R.F., and L.D. Harris. 1986. Nodes, networks, and MUMs: preserving diversity at all scales. Environmental Management 10:299-309.

Noss, R.F. 1987. Protecting natural areas in fragmented landscapes. Natural Areas Journal 7:2-13.

Noss, R.F. 1983. A regional landscape approach to maintain diversity. BioScience 33:700-706.

Paquet, P., and A. Hackman. 1995. Large carnivore conservation in the Rocky Mountains: A long-term strategy for maintaining free-ranging and self-sustaining populations of carnivores. World Wildlife Fund Canada, Toronto, Canada.

Peek, J.M. Undated. North American Elk. U.S. Geological Service. http://biology.usgs.gov/s+t/noframe/c273.htm#11894

Perry, C., and R. Overly. 1977. Impact of roads on big game distribution in portions of the Blue Mountains of Washington. Washington Game Department, Bulletin No. 11.

Philox, C.K., A.L. Grogan, and D.W. Macdonald. 1999. Patterns of otter *lutra lutra* road mortality in Britan. Journal of Applied Ecology 38:799-807.

Pfister, H.P., V. Keller, H. Reck, and B. Georgii. 1997. Bio-ecological effectiveness of wildlife overpasses or “green bridges” over roads and railways lines. Bonn-Bad Godesberg, Germany: Herausgegeben vom Bundesministerium fur Verkehr Abeteilung Strassenbau.

Quigley, T.M., R.W. Haynes, and R.T. Graham (Eds.) 1996. Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin. USDA Forest Service General Technical Report PNW-GTR-382. Pacific Northwest Research Station, Portland, Oregon. pp 165-167.

Roloff, G. J. 1998. Habitat potential model for elk. In Prceedings 1997 Deer/Elk Workshop, Rio Rico, Arizona, ed J.C. deVos, Jr. 158-175. Phoenix: Arizona Game and Fish Department.

Romin, L.A., and J.A. Bissonette. 1996a. Deer-vehicle collisions: status of state of monitoring activities and mitigation efforts. Wildlife Society Bulletin 24:276-283.

Romin, L.A., and J.A. Bissonette. 1996b. Temporal and spatial distribution of highway mortality of mule deer on newly constructed roads at Jordanelle Reservoir, Utah. Great Basin Naturalist 56:1-11.

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2004. Effects of roads on elk: implications for management in forested ecosystems. Transactions of the North American Wildlife and Naturals Resource Conference 69: in press.

Rowland, M. M., L. J. Wisdom, B. K. Johnson, and J. G. Kie. 2000. Elk Distribution Modeling in Relation to Roads. Journal of Wildlife Management 64:672-684.
Ruediger, Bill. 1998. Rare carnivores and highways – moving into the 21st Century. In: Evink, G.L.; Garrett, P.; Ziegler, D.; and J. Berry (Eds.) Trends In Addressing Transportation Related Wildlife Mortality. Proceedings the International Conference on Ecology and Transportation. Pgs 10-16.

Ruediger, Bill and Monique DiGeorgio. 2007. Safe passage: a user's guide to developing effective highway crossings for carnivores and other wildlife. USDA Forest Service and Wilburforce. 19 pages.

Ruediger, William (Bill) C and Ken Wall. The effects of highways on elk (*Cervus elaphus*) habitat in the western united states and proposed mitigation approaches. 2005. In: 2005 Proceedings of the International Conference on Ecology and Transportation, edited by C. Leroy Irwin, Paul Garret, and K.P. McDermott. Raleigh, N.C. Center for Transportation and the Environment, North Carolina State University. Pgs 309-318.

Ruediger, Bill. 2004. Carnivore conservation and highways: Understanding the relationships, problems and solutions. In: People and Predators. Chapter 7. Island Press. Pgs 132-150.

Ruediger, Bill. 1996. The relationship between rare carnivores and highways. In: Evink, G.L.; Garrett, P.; Ziegler, D.; and J. Berry (Eds.) Trends In Addressing Transportation Related Wildlife Mortality. Proceedings of the Transportation Related Wildlife Mortality Seminar.

Thomas, J.W., and D.E. Toweill, eds. 1982. Elk of North America. Stackpole Books, Harrisburg, PA. 698 pp.

Wisdom, M.J. 1998. Assessing life-stage importance and resource selection for conservation of selected vertebrates. Ph.D. dissertation, Department of Fish and Wildlife, University of Idaho, Moscow.

BIOLOGICAL EVALUATION ON THE POTENTIAL IMPACTS OF CORRIDOR ALTERNATIVES FROM THORNCREEK ROAD TO MOSCOW ON LARGE UNGULATES

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INTRODUCTION

Approximately 4 million miles of public roads crisscross the United States (Finch 2000). This network of highways and byways, not to mention the existing rail system, is critical to the daily lives of most Americans and to our economy. However, the problem of highway accidents involving animals is of worldwide concern. Car-animal accidents are increasing in many locations around the world (Conover et al. 1995, Groot Bruinderink and Hazebroek 1996, Hughes et al. 1996). Property damage to vehicles, human injuries and fatalities, and potential reductions in local wildlife populations result from vehicle collisions with animals, especially large ones such as moose, elk, and deer. For example, Michigan, which ranks in the top 3 in the United States for number of car-deer collisions, had 65,451 reported deer-vehicle crashes in 1997 (Hindelang et al. 1999). And, more than 200 motorists are killed and thousands more injured in animal-vehicle collisions each year (Finch 2000, Messmer and West 2000). While vehicles and roads are an important and integral part of our daily lives, they are not so kind to wildlife. Not only do they directly impact individual animals killed in collisions, as long, linear features on the landscape, roads, railways, and highways result in habitat loss and fragmentation. Interest in issues involving wildlife and transportation corridors has grown dramatically in recent years (Evink et al. 1996, 1999; Messmer and West 2000; Forman et al. 2003).

The objective of this Biological Evaluation (BE) is to provide information to the Idaho Transportation Department (ITD) to facilitate evaluation of potential impacts of different transportation corridors on 1) the habitat and survival of white-tailed deer (*Odocoileus virginianus*), elk (*Cervus elaphus*), and moose (*Alces alces*) in the Project Area, and 2) the level of animal/vehicle collisions.

PROJECT DESCRIPTION, PROPOSED ACTIONS, AND ALTERNATIVES

ITD personnel are evaluating alternatives for the widening of US 95 into a divided 4-lane highway. The Project Area includes approximately 6.5 miles of realignment of US 95 from Thorncreek Road south of Reisenauer Hill, north to Moscow, Idaho, and from the west slope of Paradise Ridge, west to the Idaho-Washington border (Figure 1). Three potential corridors are being evaluated. The Existing Improved Corridor would follow the current route of US 95. The Eastern Corridor would realign the highway from Reisenauer Hill to Moscow, in the area between existing US 95 and the west slope of Paradise Ridge. The Western Corridor would realign the highway in an area north of Thorncreek Road to the South Fork Palouse River at the edge of Moscow, and between the Washington-Idaho border and existing US 95.

Public and agency meetings are also being held to help determine proposed alternatives within each corridor. ITD does not anticipate selection of a new route until 2006.

METHODS

I used a combination of field inspections, personal contacts, topographic map data, literature review, and personal knowledge to complete my evaluation of the potential impacts of corridor alternatives on ungulates in and adjacent to the Project Area. During 2004, different parts of the Project Area were visited on 6 occasions. Visits conducted on 23 April, 4 and 11 May, and 20 November consisted primarily of driving all roads within and adjacent to the Project Area. Photos were taken and different landscape features were noted to assist in the evaluation. On 19 May, I hiked the entire western part of Paradise Ridge, including the western slope down to the Eastern Corridor. During this hike, ponds, habitat and landscape features, and other pertinent information were documented and photographed. On 17 December, I hiked 3 patches of habitat located just inside the Washington border with Idaho and near the southwest boundary of the Project Area. While outside the Project Area, this area was inspected, photographed, and evaluated because of its proximity to the Project Area, and to better understand how deer, elk, and moose might be dispersed and move throughout the general area.

Additional information was gained through personal contacts. Even though some landowners in and adjacent to the Project Area may have had information useful in the evaluation process, I elected not to cite this information due to potential bias. However, I don't believe excluding this information affected my evaluation. Mortality data, provided by Clint Rand, the local Idaho Department of Fish and Game (IDFG) Conservation Officer, were limited and anecdotal. Nonetheless, it did provide me with a sense of the potential scope of the highway's impact on ungulates.

I attempted to evaluate the area equally, with respect to the potential impact of transportation corridors on the 3 species of ungulates. I reviewed the literature for habitat and nutritional values of forage, and attempted to relate these data to the manner in which deer, elk, and moose might use Paradise Ridge, the Project Area to the west, and other adjacent habitat. Profiles for each species, including habitat preferences, foraging behavior, and movements were summarized and used to better understand the relationship between human activities, the animals, and adjacent habitat. As part of the environmental baseline, I searched available literature for information about the history of these species in the Project Area, and examined past and present influences.

I considered the potential direct, indirect, and cumulative effects of transportation corridors within the Project Area on deer, elk, and moose. Direct effects are those impacts caused directly by the proposed action. Indirect effects are those caused by or that will result from the proposed action, but are likely to occur at a later time (not immediate). Finally, cumulative effects are the combined effects of this action along with unrelated activities that are **likely to occur** within the Project Area, and when evaluated collectively, could impact these species. I did not do an analysis of projected human population growth and development within and adjacent to the Project Area. I based my assumptions of rural development in areas where suitable habitat exists primarily from my own experience of having lived, worked, and recreated in the Moscow, Idaho, area off and on since 1972.

In my analysis of the potential direct, indirect, and cumulative effects of transportation corridors on deer, elk, and moose, I considered 7 parameters: 1) disruption of individuals, 2) habitat avoidance, 3) habitat disruption, 4) habitat enhancement, 5) direct mortality, 6) indirect mortality, and, 7) population effects.

GENERAL ASSESSMENT OF HABITAT

Eastern Corridor.

Paradise Ridge extends on a southwest to northeast axis, with a block of timber extending west from the northeast end of the Ridge (Figure 2). Visits to the Paradise Ridge complex were made on 23 April and 4 and 11 May. A detailed examination of that portion of Paradise Ridge within the Project Area was conducted on 19 May. The drier south facing slopes of Paradise Ridge are dominated by ponderosa pine (*Pinus ponderosa*), with a grass/forb understory (Figure 3). North facing slopes and an east facing slope near the southwest end of Paradise Ridge are moister and support Douglas fir (*Pseudotsuga menziesii*) and a more robust understory of low, medium, and tall shrubs. Northwest slopes are dominated by ponderosa pine with an understory of shrubs, forbs, and grasses. At least 3 small artificial ponds are located within the Eastern Corridor, and another 2 just outside the eastern boundary. The pond located on private land at the upper end of a forested draw and outside the Eastern Corridor (Figure 4) is attractive to deer, elk, and moose because it is near bedding areas and cover. While further away from cover, a pond at the lower end of the southwest side of Paradise Ridge and within the Eastern Corridor (Figure 5) is used by deer and probably by elk and moose.

The southwest end of Paradise Ridge contains some of the best remaining stands of Palouse grassland in Idaho (Lichthardt and Moseley 1997, Weddell and Lichthardt 1998, both cited in Weddell 2001). Located primarily in the SE _ of Section 32, T39N, R5W and NE _ of Section 5, T38N, R5W, this mosaic of plant communities includes bunchgrasses, exotic grasses, forbs, shrubs, and stands of ponderosa pines (Figure 6). These communities are valuable to wildlife because they provide structural diversity and cover for escape and security. On 19 May, I observed numerous game trails, deer beds, moderate-to-heavy browsing of shrubs, numerous pellet groups, and a cow moose in this area. I also observed 3 moose pellet groups in the ponderosa pine forest shown in the upper left part of Figure 6. Finally, I observed fresh deer tracks on a game trail cutting through a forested draw that contained flowing water. This forest draw provides escape cover and security for animals, including deer, elk, and moose, moving along and foraging out from the draw into agricultural fields (Figure 4). Part of this forest draw, the pond shown in Figure 5, and patches of suitable habitat occur within the barred area shown in Figure 1. And several small drainages entering into the barred area on the eastern side are probably used by deer, elk, and moose as travel routes to foraging areas.

Habitat west of Paradise Ridge to US 95 has been highly altered. The area consists of rural homes, agricultural fields, and previously-tilled lands currently in reserve through Federal and State programs, such as the Conservation Reserve Program (CRP) and Access Yes.

Western Corridor.

Most wildlife habitat in the Western Corridor portion of the Project Area has been greatly altered. I drove secondary roads in the Western Corridor (west of US 95) on 23 April, 4 and 11 May, and 20 November, and hiked through the 3 major patches of habitat in Washington closest to the Idaho border on 17 December to gain a better understanding of the suitability of the Western Corridor area for deer, elk, and moose. Homes are sparsely scattered among agricultural fields and tucked into small drainages and on knolls (see Figure 4). Timber stands suitable for sustained use by ungulates are nonexistent within the Western Corridor. Isolated tracts of land taken out of agricultural production contain grasses and forbs. Deer and elk likely use these altered lands, but use by moose is less certain. Brush fields persist in only a couple of small, steep draws near the Washington border and approximately _ mile west of the Jacksha Road saddle near the Idaho-Washington border. An old moose pellet group was found in this area on 17 December. These brush fields, crop land, and CRP plots are found within the barred area shown in Figure 1. Most of the area contained within this barred area is not suitable ungulate habitat. Instead, the area is used seasonally as a foraging area, resulting in depredation complaints (C. Hickey, Idaho Department of Fish and Game, personal communication).

The closest suitable ungulate habitat from fields within the Western Corridor is located outside the Project Area and in Washington, approximately 3-4 miles southwest of Paradise Ridge. These small patches of habitat, primarily brushy "eyebrows" and draws with a small amount of timber, provide suitable habitat for deer, and according to Idaho Fish and Game Conservation Officer Clint Rand, for a resident herd of elk (C. Rand, Idaho Department of Fish and Game, personal communication). Rand believes that as many as 20-30 elk live in this network of brushy draws. I found 2 old elk pellet groups in the 3 habitat patches explored on 17 December, but no fresh elk sign to indicate current use. Conversely, 6 white-tailed deer, many fresh pellet groups, and recent buck rubs were observed, with each of the draws containing a network of heavily-used deer trails. The closest of these patches of habitat to the Project Area, and also the largest (approximately 200 acres), contains a sparse stand of ponderosa pine, and is the only draw where I found flowing water (Figure 7). Few pines exist in the other 2 patches, with all 3 areas dominated by shrubs. The mix of tall, medium, and low shrubs provides forage and shelter for ungulates. Deer are likely permanent residents in this area, but the year-round status of elk and moose is unknown. The IDFG has received depredation complaints, primarily in late spring and summer, from Idaho farmers of elk in fields in the area adjacent to these pockets of habitat in Washington (C. Hickey and C. Rand, Idaho Department of Fish and Game, personal communication).

Movements within the Project Area.

In all likelihood, elk and moose that occur in the patches of Washington habitat and Paradise Ridge originated from the large tracts of contiguous habitat found on Moscow Mountain and the Palouse Range (see Figure 2). During December 2004, Clint Rand (C. Rand, Idaho Department of Fish and Game, personal communication) observed 2 herds of elk (24 and 67 animals, respectively) in fields just north of Highway 8, north of Tomer Butte, and east of Moscow, Idaho. However, these animals were never observed crossing the highway in the direction of Tomer Butte and Paradise Ridge. Based on the distribution of suitable cover, elk and moose from Paradise Ridge could move east and northeast towards Tomer Butte and beyond, or southwest to the patches of Washington habitat. Clint Rand (Rand, Idaho Department of Fish and Game, personal communication) documents 10-15 road-killed deer along Highway 8 each year in the vicinity of Tomer Butte. In this same area, he reports moose being hit on the highway during some years, with 2 hit in 2002.

Movement of elk or moose from the patches of Washington habitat would likely be towards Paradise Ridge, as there does not appear to be much suitable habitat in any other direction. Deer, on the other hand, likely move in all directions to and from Paradise Ridge and the patches of Washington habitat during all times of the year.

According to Rand (C. Rand, Idaho Department of Fish and Game, personal communication), deer and elk travel between Paradise Ridge and the patches of Washington habitat. He documents 10-15 road-killed deer on US 95 in the Project Area each year. However, Rand was unaware of either moose or elk being killed on US 95 in the Project Area. The closest cover in the Paradise Ridge area to the complex of habitat in Washington is located at the Kas Dumroese residence in the SW _ of Section 5. Sign indicating that moose frequent this stand of timber on the Dumroese property has been observed (C. Rand, Idaho Department of Fish and Game, personal communication). While there are no empirical data to indicate that moose travel from the Paradise Ridge area to the patches of Washington habitat, with moose populations expanding in recent years, it is likely that occasional movements or dispersal do occur. Recall that on 17 December I found an old moose pellet group in 1 of the small Idaho brush fields approximately _ mile from the closest patch of Washington habitat. And Rand (C. Rand, Idaho Department of Fish and Game, personal communication) has received reports of several moose in this area during the past several years.

HABITAT AND NUTRITIONAL VALUES OF FORAGE

Wildlife habitat includes 4 basic components—food, cover, water, and space. The spatial arrangement of these components in the project area relates closely to how elk, deer, and moose distribute themselves. However, the distribution of roads, highways, agricultural crops, and homes will also influence how animals use the available habitat.

An understanding of the nutritional value of the major groups of forage species provides insight as to how the Project Area and adjacent habitats may be used by elk, deer, and moose. Nutritive values vary among grasses, forbs, and shrubs, based on analyses of crude protein and digestible dry matter (Cook 2002). In general, forbs and grasses, compared with shrubs, tend to be higher in quality early in the growing season and lower in quality late in the growing season and during dormancy. Some species of grasses and forbs initiate growth in early spring, providing forage of high nutritive value. Shrubs generally initiate growth later, thus extending the existence of high value forage into late spring. Therefore, deer and elk would be expected to focus on south and west exposures and exposed ridges in late winter and early spring to forage on the early green-up of grasses and forbs.

During summer and autumn, shrubs and some species of forbs continue to grow, thus providing higher nutritive values than grasses, which, because they initiate growth early, also enter dormancy early. The digestibility of shrubs and forbs may average 15% higher than the digestibility of grasses by late summer (Cook 2002). Consequently, deer and elk may shift to shrubs during this period.

Some grasses reinitiate growth during autumn and remain green during winter, although growth in winter usually is suppressed. And some agricultural crops, including winter wheat, act similarly. The nutritive value of these plants typically is high, and remains high throughout winter. Ungulates foraging on these plants during winter enhance the nutritive value of their diets. In the Paradise Ridge area and patches of Washington habitat, depending on winter conditions, I would expect deer and elk to seek exposed grassy ridges and hillsides and adjacent fields of winter wheat at this time. As browsers, moose tend to remain in timber and patches of shrubs, irrespective of seasonal variations in nutritional value of the different forage groups.

SPECIES PROFILES

Rocky Mountain Elk

<u>Habitat Preferences</u>:
Habitat use by elk varies according to location. However, elk use open areas such as alpine meadows, river flats, aspen parkland, coniferous forests, brushy clearcuts, forest edges, and shrub steppe. Some populations in southern Idaho live year-round in shrub-steppe (sagebrush) habitats (Strohmeyer and Peek 1996). Elk commonly use open areas to feed on grasses, sedges, and forbs, then will retreat to the security of tall shrubs and timber to rest. In Alberta, conifer stands were highly selected for during autumn (hunting season) while grasslands were used much less than expected, and cultivated areas were completely unused (see review by Jalkotzy et al. 1997).

In more mountainous areas, elk tend to use upper slopes during all seasons (Skovlin et al. 2002). They are attracted to southerly aspects during winter and spring, as these are the first slopes to become bare of snow. The presence of thermal cover (primarily timber stands) influences elk use of the habitat. Hiding or escape cover is a feature of habitat that provides elk with security or a means of escape from predators or disturbances (e.g., logging, road construction, or other human activities).

Foraging Behavior:
Elk are intermediate or mixed feeders and less selective in their diet than browsers such as deer (Cook 2002). Elk feed predominantly on grasses, although they consume forbs and browse on shrubs when grasses are unavailable. Considerable geographic and seasonal variation exists in their diet, with forage preferences related to forage availability and phenology. Clearly, the winter diet is influenced by forage availability, primarily dictated by snow conditions. In central Idaho, snow depths in excess of 18-24 inches caused elk to move into habitat with less snow (Leege and Hickey 1977). Elk exist on whatever forage is accessible on the winter range. For example, if grasses predominate on the winter range, elk primarily eat grass. On winter shrub ranges in northern Idaho, the majority of their diet is woody plants. Because of their diverse feeding behavior, the expansion of elk populations, especially into agricultural areas, has created problems as animals become attracted to agricultural crops.

In spring, a transition period from winter to summer foods, elk typically graze on those species that begin growth early, normally grasses, and shift consumption to forbs or shrubs during summer. By autumn, dried grass, grass regrowth (depending on moisture), and shrubs may dominate the elk's diet. Cook (2002) provides an exhaustive list of the relative seasonal values of trees, shrubs, forbs, ferns, lichens, grasses, and grass-like plants to elk.

Movements:
Elk are active at night, but tend to be more active at dusk and dawn. Diurnal (daytime) feeding is more common in summer than in winter. Feeding periods are more prolonged in winter, but still tend to be concentrated during morning and evening hours. In mountainous areas, and depending on snow depth, herds move to lower elevations in winter to feed. Some elk undertake long seasonal migrations between summer and winter ranges, while others are non-migratory (Peek 2003). Elk home ranges are highly variable and influenced by numerous factors. Based on radio-collared elk, Irwin and Peek (1983) documented home ranges of 5 mi_ in northern Idaho forests. Numerous studies have shown that elk tend to avoid roads (see review by Jalkotzy et al. 1997).

White-tailed Deer

Habitat Preferences:
Whitetails are found in a variety of habitats from forests to fields with adjacent cover. The best habitat conditions are found in earlier successional or edge-type habitats where forage is abundant. Conifer stands are important for winter shelter. In temperate regions, white-tailed deer are only limited by snow conditions (depth, duration, and quality). In Idaho, whitetails prefer low to intermediate elevations and dense, deciduous woodlands and brush, and riparian areas (streams, lakes, and marshes) (Pauley 1990). For many years, agricultural plantings (crops) have been used to enhance deer habitat in areas

where management objectives are to improve herd quality or raise carrying capacity. So it should be no surprise that the white-tailed deer is the leading wildlife species associated with agricultural damage (Conover 1998). Urban deer populations have become a management challenge for many state wildlife agencies.

Foraging Behavior:
While white-tailed deer tend to be more browsers than elk, foods eaten are as varied as the range of habitats occupied by this adaptable species. Browse, mast (fruits, berries, and acorns), and forbs in varying amounts make up the majority of the diet throughout its range (Miller et al. 2003). For example, during spring, their diet is likely to be dominated by freshly growing grasses. Forbs tend to be more dominant in their diet in early summer, while leafy green browse dominate in late summer. Deer will concentrate on fruits, if available during autumn, or acorns where oak trees occur. Evergreen woody browse often dominates in winter when the ground is covered with snow.

Movements:
Whitetails are active day or night, but similar to elk, they are mainly crepuscular. Because whitetails tend to occupy the lower elevations, unlike elk, they aren't often forced to migrate in winter. Instead, they will concentrate in timber where snow is less deep. These areas are typically referred to as deer "wintering yards."

Moose

Habitat Preferences:
Moose prefer a mosaic of second-growth forest, openings, lakes, streams, and wetlands. In Idaho, moose prefer shrubby, mixed coniferous and deciduous forests with nearby lakes, marshes, and bogs. Aquatic areas are important for foraging, while forested areas are important for winter cover. Moose tend to avoid hot summer conditions by using shade provided by dense timber or bodies of water. Pierce and Peek (1984) found that, in their north-central Idaho study area, old-growth grand fir/Pacific yew stands were critical winter habitat for moose, with even-aged pole timber and open areas preferred in summer. Shrubs associated with riparian areas are important components of their diet. While far from ideal, timber stands, shrub fields, and small artificial ponds associated with Paradise Ridge provide sufficient habitat for moose. The suitability of the patches of Washington habitat to sustain moose is unknown, and would require further investigations in order to make a determination.

Foraging Behavior:
Moose are browsers, consuming primarily the stems and twigs of woody plants in winter and the leaves and succulent shoots of shrubs and trees at other times of the year (Bowyer et al. 2003). During summer they will browse on the new growth of trees and shrubs, and on aquatic vegetation associated with lakes and ponds, where they appear to be attracted to the high sodium content in aquatic plants.

Movements:
Like deer and elk, moose are mainly crepuscular. Depending on habitat, home ranges may reach several thousand acres. Moose are the largest member of the deer family, and with their long legs, are able to negotiate much greater snow depths than deer or elk. Movements are generally not influenced by snow depth and moose may or may not migrate between summer and winter ranges. However, random movements and dispersal by moose likely occur, and the timing and direction of such movements are unpredictable.

ENVIRONMENTAL BASELINE

History of deer, elk, and moose in the Project Area

Populations of deer, elk, and moose have increased in size and expanded in distribution in Idaho since Davis (1939) described these species in his book on the mammals of Idaho. However, current population estimates for each of the species are unavailable. Larrison (1967) and Larrison and Johnson (1981) provided general information on the mammals of Idaho, including elk, moose, and both species of deer. The authors indicate that each of these species occurs throughout the Idaho Panhandle in suitable habitat, however, they do not provide information about the occurrence of any of these species in the vicinity of the Project Area.

The atlas of Idaho's wildlife (Groves et al. 1997) provides distributional maps for each of the state's 364 breeding vertebrates. Distribution, as represented on the maps, is based on predictions from known county-of-occurrence data combined with information on which habitats or vegetation types within counties are occupied by each species. Paradise Ridge and the Project Area is inclusive in the distribution map for white-tailed deer, uncertain for elk, and excluded in the map for moose. While this may be attributed to map scale, it does reflect on the limited amount of suitable habitat for elk and moose in the Paradise Ridge area and the patchiness of forested habitat from more contiguous stands to the east and north.

The mosaic pattern of vegetation (timber stands, brush and grass fields, and agricultural crops) in the Paradise Ridge area (Figures 3, 4, 5, and 6) creates ecotones—areas where different types of vegetation are juxtaposed—which are important components of elk and deer habitat, and in part, moose habitat. Undoubtedly, white-tailed deer have long been present in the Paradise Ridge area. Expansion of elk and moose throughout many parts of Idaho during the past 25 years likely resulted in the establishment of a small number of elk and moose in the Paradise Ridge area. Indeed, Johnson (D. Johnson, University of Idaho, personal communication) and Wright (G. Wright, University of Idaho, personal communication) both feel that the reoccurrence of elk and moose in the area coincided with the expansion of these species throughout many regions of Idaho. As a Conservation Officer in the area for more than 20 years, Clint Rand's (C. Rand, Idaho Department of Fish and Game, personal communication) observations support the contentions of Johnson and Wright. Elk movements in and around the Project Area are often dictated, in large part, by the location and distribution of agricultural crops, where they forage, but they are not plentiful south of Moscow (J. Crenshaw, Idaho Department of Fish and Game, personal communication). Crenshaw also believes that moose can occasionally be found in the area south of Moscow. However, because moose tend to be solitary and can be great wanderers, their persistence in the area may be hard to predict.

Past and present human influence

Humans have long impacted the Project Area. Timber harvest, agricultural conversion, livestock grazing, development, and home construction have chipped away at native plant communities. According to the IDFG, 89% of ponderosa pine communities have disappeared in Latah County. Stands of timber in this portion of the Palouse are greatly diminished, fragmented, and largely isolated. Today, Paradise Ridge is virtually surrounded by agricultural fields, and an ever-increasing number of homes are penetrating the remaining stands of timber.

These changes have probably had the least effect on white-tailed deer, which thrive on a mixture of timber, shrub fields, grasslands, and agricultural crops (see SPECIES PROFILES, above). Further, whitetails have probably benefited from the changes that have occurred, as they are highly adept at coexisting with humans.

Stands and stringers of timber mixed with shrubs and grasslands provide escape and resting cover adjacent to foraging areas that are attractive to elk. However, the proliferation of homes in and adjacent to timber likely has a negative effect on elk. Unlike white-tailed deer, elk do not coexist well in close proximity to humans.

Moose are browsers (see above), foraging primarily in timber and brush fields. In winter, moose often invade urban areas in search of food, which generally comes in the form of ornamental plants in someone's backyard. In spite of increased development and home construction during the past 20 years, especially on the timbered north and east portions of Paradise Ridge, moose numbers are likely greater now than in the past. This has certainly been the trend throughout Idaho. In Idaho Falls, IDFG personnel are often busy each winter removing moose from residential areas. Consequently, moose, like whitetails, have probably not been negatively impacted by humans. And because they are attracted to ornamental shrubs, like deer, they could become a nuisance.

The Project Area is part of IDFG Game Management Unit 8 (see the IDFG Big Game Seasons brochure); Paradise Ridge is subunit 8-34. IDFG allows hunting for all 3 species in this Unit. There are general hunting seasons for deer and elk and controlled hunts for both elk (150 tags) and moose (6 tags) in areas of Unit 8 that include the Project Area. However, according to Jay Crenshaw (J. Crenshaw, Idaho Department of Fish and Game, personal communication), there are no population data or harvest data for Paradise Ridge and the Project Area. Crenshaw indicated that IDFG conducted an aerial mid-winter survey of Subunit 8-34 in 1997, but they did not observe either elk or moose. Unit 8 was flown again in 2004, but subunit 34 was not selected because the previous survey in 1997 failed to detect elk or moose.

PARAMETERS USED TO ASSESS IMPACTS

As described in the METHODS section, 7 parameters were considered in evaluating potential transportation corridor impacts on deer, elk, and moose. In a detailed review of the scientific literature, Jalkotzy et al. (1997) used these and other parameters to evaluate the effects of linear developments on ungulates. Some observations from this review for each parameter follow:

1) Disruption of individuals.

Linear developments can result in disruptions in deer, elk, and moose populations. Animals tend to move away from the disturbance. Measured displacements for elk in 5 studies in Montana ranged up to 5 miles with the greatest movements detected when heavy equipment on a ridge line was visible over a large area. Displacement of elk during road construction and logging was temporary. In hunted deer populations, reactions to people on foot tended to be greater than to motorized vehicles. The response of moose to traffic may be subtle (e.g., grazing off into cover without making visual contact with a vehicle).

2) Habitat avoidance.

Habitat avoidance adjacent to roads is the most serious effect linear developments have on elk, and the degree of avoidance is directly related to the types (e.g., primary or primitive road) and amounts (e.g., traffic volume) of human disturbance to which elk are subjected. Road avoidance distances of 220 yards to >1,700 yards have been documented in several western states. In a north Idaho study, elk preferred to rest in areas >440 yards from traveled roads in all seasons (Irwin and Peek 1983). In one area of Alberta, elk avoided habitat within 330 yards of primary (paved) roads in all seasons. While in another area of Alberta, fewer elk than expected (number of animals that would likely occur in the area if no primary roads existed) occurred within 330 yards of primary roads in all seasons except spring. The actual amount of habitat lost because of reduced use by elk can be calculated from avoidance data. Habitat avoidance can occur if some or all individuals in an elk population are unwilling to cross disturbance corridors (i.e., the corridors act as barriers or filters to movement).

Deer disturbed by human activity exhibit habitat avoidance in ways similar to elk, however, deer don't appear to be as sensitive. Avoidance of roads is likely a characteristic of hunted populations because deer can readily habituate to disturbance corridors, most notably in protected areas. A model predicted that 50%, 75%, and 95% of deer use would occur within 48 yards, 108 yards, and 271 yards of cover, respectively.

The degree of avoidance or use of a disturbance corridor may also be associated with habitat availability. Moose avoid habitat in the vicinity of roads because of the human activity associated with them, especially hunting. In an Alberta study, moose use of browse along transects within 220 yards of roads was 55% less than on transects 220-440 yards from roads. In Montana, a researcher found that moose abandoned an area when a highway was being constructed.

3) Habitat disruption.
Disturbance corridors can cause habitat disruption for all 3 species through the direct removal of habitat. The United States has approximately 3.9 million miles of public roads (Bureau of Transportation Statistics 2001, Federal Highway Administration 1995). And according to the National Research Council (1997), these roads and the associated rights-of-way total roughly 20 million acres, or 1% of the total United States land area (Forman et al. 2003). Indeed, roads dissect and eliminate a vast amount of wildlife habitat. However, this loss of habitat is minor when compared to the loss of habitat on either side of the road resulting from habitat avoidance (see above).

Roads also can disrupt habitat indirectly through the introduction of exotic plants, and pollutants like salt and automobile emissions. In a Colorado study conducted in 1978 and 1979, concentrations of lead in vegetation were inversely correlated with distance from the roadway (Harrison and Dyer 1984). Equations developed to estimate deer absorption of lead from contaminated roadside vegetation indicated that deer in some age classes needed only to consume 1.4% of their daily intake of forage from roadsides before consuming excessive amounts of lead. Because leaded gasoline is no longer used, consumption of lead by ungulates and other wildlife should not be an issue.

4) Habitat enhancement.
Habitat can be enhanced by roads through the creation of more forest edge and the forage associated with highway rights-of-way. For example, roads established through a closed forest will open up the canopy, creating edges that encourage the growth of forage species (shrubs, forbs, and grasses).

5) Direct mortality.
Direct mortality is generally associated with primary roads where vehicle speeds are greater. Individuals of all 3 species are killed on highways wherever their range is bisected by roads. Deer are likely the most frequently-killed large mammal on North American roads. Collisions with vehicles and trains are the greatest source of human-related mortality for deer and moose after hunting. In a Michigan study, where a 2-lane highway and later an interstate intersected a wintering area, white-tailed deer mortality levels were twice that of the pre-interstate annual mortality figures. Several studies have shown that the relationship between deer activity and deer-automobile collisions are functions of highway location relative to deer requisites such as feeding and resting sites and to the relative availability of feeding areas other than rights-of-way. For example, deer in South Dakota were killed more often than expected adjacent to shelterbelts (good deer habitat) and less often than expected adjacent to grassland habitats (poor deer habitat) along Interstate 29.

Similar relationships apply to elk and moose, where mortality is greater when roads occur adjacent to desirable habitat, and less in areas of poor habitat. Elk and moose are killed on highways wherever their range is bisected by roads. In Kootenay National Park, British Columbia, greatest collision frequencies corresponded to the locations and periods of heaviest elk and moose use of the road corridor and not necessarily to periods of greatest traffic volume. Locally, Rand (C. Rand, Idaho Department of Fish and Game, personal communications) reported that, during a 22-month period in the late 1990s, 13 moose were killed on US 95 in the vicinity of "Steakhouse Hill" 5 miles north of Moscow. In this particular area, the highway bisects moose habitat.

6) Indirect mortality.
Indirect mortality occurs as a result of linear developments because these disturbance corridors tend to allow human access into areas for hunting. Roads, more than any other factor, affect the distribution of hunters and consequently, the distribution of the hunter kill for all species. Over-harvest of many ungulate populations has been documented in areas with greater access. Because access will be strictly controlled along the new transportation corridor, indirect mortality due to access will not be a factor.

7) Population effects.
Population effects may occur as a result of highway and hunting mortality associated with linear developments. These effects can be independent or cumulative. In parts of Illinois, deer numbers increased on protected land and in more lightly-hunted larger forests, but could be temporarily extirpated in smaller woodlots. In Kootenay National Park, Canada, researchers felt that moose mortality along the highway may be contributing to the continued decline of the population in this protected area.

POTENTIAL IMPACTS BASED ON 7 PARAMETERS

1) Disruption of individuals.
Temporary displacement of individuals, primarily elk, will likely occur during construction and only if highway construction occurs in the barred areas identified in Figure 1. However, because displacement will only be temporary, long-term disruption of individuals should be minimal.

2) Habitat avoidance.
Elk may avoid existing adjacent habitat if highway construction occurs within the barred areas identified in Figure 1. Corridor construction elsewhere within the Project Area should not cause avoidance by elk, deer, or moose. However, habitat avoidance because animals are reluctant to cross any transportation corridor within the Project Area could exist for all 3 species, with deer likely to be the least impacted. Reluctance of animals to make east-west movements can be reduced by providing wildlife highway crossing structures (see Appendix A and Forman et al. 2003). However, there are no guarantees that crossing structures will be 100% effective.

3) Habitat disruption.
Habitat loss should not be a factor for transportation corridors within the Project Area as long as the barred areas identified in Figure 1 are avoided. The effects that road pollutants (e.g., salt, lead) may have on deer, elk, or moose are unknown. However, lead should no longer be an issue as all gasoline sold today is unleaded.

4) Habitat enhancement.
No net gain in habitat is expected from construction of a transportation corridor within the Project Area.

5) Direct mortality.
Without provisions for minimizing road kills, expansion from a 2-lane to a divided 4-lane highway may result in increased deer, elk, and moose mortalities. When a section of the TransCanada Highway was twinned in advance of fencing, elk road kills increased significantly (see Jalkotzy et al. 1997). In Michigan, where an interstate was constructed parallel to a 2-lane highway through deer winter range, car-deer kills increased 500% over the average of the previous 4 years (Reilly and Green 1974). Depending on the site selected, the Project Area could end up with a new twinned highway in addition to the existing US 95. Even though the existing US 95 would be relegated to use primarily by local residents, ungulates could continue to occasionally be killed along this stretch, especially if speeds are not reduced. Increased vehicle speeds and traffic volume can result in increased ungulate mortality where transportation corridors bisect suitable habitat. Further, risks to drivers will increase with increased vehicle speeds. However, wildlife crossings can mitigate for these increased risks.

6) Indirect mortality.
Because access will be strictly controlled along the new transportation corridor, indirect mortality due to access will not be a factor.

7) Population effects.
Provided that provisions are made to minimize collisions with vehicles, deer populations in the area should not be impacted by construction of a 4-lane highway. Deer are prolific and adapt well to rural residential development. Independent of other factors (e.g., loss of habitat resulting from residential development), a transportation corridor should not jeopardize existing populations of elk and moose. Elk and moose are less adaptable to residential development and people are not particularly tolerant of these animals when they damage or destroy property. Consequently, the cumulative effects of these factors, primarily rural development and habitat fragmentation and loss, could limit or prevent use of Paradise Ridge and the Project Area by elk and moose.

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Direct, indirect, and cumulative effects were evaluated for each of the target species and discussed below. The assessment was then synthesized and tabulated (Table 1) for ease in comparing the corridor alternatives. Direct effects are those impacts caused directly by the proposed action. Indirect effects are those caused by or that will result from the proposed action, but are likely to occur at a later time (not immediate). Finally, cumulative effects are the combined effects of this action along with unrelated activities that are likely to occur within the Project Area, and when evaluated collectively, could impact these species.

White-tailed Deer

Direct Effects

Noise and increased human presence will temporarily displace deer during the construction phase if the transportation corridor is located within the barred areas identified in Figure 1.

Irrespective of the corridor selected, a 4-lane highway constructed in the Project Area will likely result in increased highway speeds and an increase in the number of road-killed deer. The installation of wildlife crossings (primarily underpasses) and proper signing would reduce the number of road kills.

Numerous deer tracks were observed along a pond located at the lower west slope of Paradise Ridge (Figure 5). An Eastern Corridor will have a negative impact if it is constructed between this pond and Paradise Ridge, as deer would continue to try and use the pond. If this were to happen, deer and motorists would be at risk without a suitable wildlife crossing.

Corridor construction within the barred area in the Eastern Corridor (Figure 1) would cross existing wildlife habitat, including untilled lands and vegetated draws. These habitats, and currently-tilled agricultural lands, are all used by deer. Therefore, the direct effects to deer are the removal of these habitats and increased road kills without mitigation (see Table 1). However, there will be little or no loss of existing habitat in the barred area of the Western Corridor, as it consists primarily of agricultural fields where depredation problems occur.

Indirect Effects

Roads can disrupt habitat indirectly through the introduction of exotic plants and pollutants like salt and automobile emissions (see Chapter 10, Forman et al. 2003). Concentrations of lead in vegetation tend to be higher near roadways. Deer can consume and absorb excessive amounts of lead by feeding on just small amounts of contaminated roadside vegetation. Lead should no longer be an issue as all gasoline sold today is unleaded. However, there are no data to determine whether or not other pollutants associated with the road construction would have a negative impact on animals in the Project Area.

Cumulative Effects

While I have no empirical data to support this, rural residential development will likely continue in the Paradise Ridge area. Since I lived in Moscow in 1972-74, the number of homes in the wooded and adjacent areas of Paradise Ridge has increased markedly. Wildlife habitat loss from increased development on Paradise Ridge and fragmentation of habitat will likely continue, irrespective of construction of the Eastern Corridor, as highway access will be strictly controlled. However, because whitetails commonly feed on lawns, ornamental plants, and fruit trees, the cumulative effects on deer would be minimal. Cumulative effects should not be a factor if construction occurs in the Western Corridor or the Existing Improved Corridor.

Rocky Mountain Elk

Direct Effects

I did not detect the presence of elk during the 19 May 2004 field inspection, or while scanning likely habitat with binoculars on other trips to the area. However, according to Clint Rand (C. Rand, Idaho Department of Fish and Game, personal communication), a herd of elk resides in an area that includes the Paradise Ridge complex, Tomer Butte, Little Potlatch and Middle Potlatch Creeks to the east, and suitable habitat that extends south from the Palouse Range and north of Highway 8 (Figure 2). Whether or not this same herd uses the patches of habitat in Washington is unknown. Aside from the patches of Washington habitat adjacent to the Project Area and agricultural fields, there is little habitat to attract elk west of an Eastern Corridor that is not available to elk in the vicinity of Paradise Ridge. Ponds on the east slope of the southwest extension of Paradise Ridge and near the upper end of a forest draw (Figure 4) provide sufficient water, thus reducing the need for elk to move into the vicinity of an Eastern Corridor in search of water. Based on habitat preferences, foraging behavior, and movements summarized earlier, and the analysis of effects reviewed above, direct effects may include the possibility of increased road kills without mitigation (Table 1).

Noise and increased human presence during the construction phase may displace elk that happen to be in the immediate area during the time of construction, but only for construction within the barred areas (Figure 1). However, this displacement should only be temporary.

Indirect Effects

No long-term indirect effects to elk are expected to occur as a result of corridor construction within the Project Area. Elk travel between Paradise Ridge and the patches of habitat along the border in Washington (C. Rand, Idaho Department of Fish and Game, personal communication). While construction of a 4-lane highway will not prevent these periodic forays by elk, the installation of strategically-placed wildlife underpasses would facilitate this movement and reduce the potential for elk-vehicle collisions.

Cumulative Effects

Unlike deer, elk are more sensitive to both temporary and permanent human intrusion into the habitat in which they occur. Of the factors considered during this cumulative effects analysis, habitat fragmentation and loss as a result of increased rural residential development on Paradise Ridge would have the greatest impact. The cumulative effects of primarily residential development and fragmentation and loss of habitat could be sufficient to eventually discourage elk use of the Paradise Ridge area. More important to the presence of elk in the Paradise Ridge area is maintaining connectivity to tracts of suitable habitat to the north and east (see Figure 2), and ensuring the suitability of this corridor of habitat patches. Road construction within the Project Area should not jeopardize this elk population.

Moose

Direct Effects

Moose forage and bed in the bunchgrass/low shrub community and timber stands on the west slope of Paradise Ridge. On 19 May 2004, a cow moose was observed in the bunchgrass/low shrub community; the animal had been bedded down among shrubs on the hillside. Clint Rand (C. Rand, Idaho Department of Fish and Game, personal communication) has observed moose sign in a woodlot owned by the Dumroese's (Figure 1, site B). Further, moose would likely be attracted to a pond at the base of Paradise Ridge (Figure 5). Construction of an Eastern Corridor within the barred area (Figure 1) would displace moose from habitat currently used (Table 1).

Indirect Effects

Movements of moose west of U.S. 95 are probably uncommon, as habitat is limited and separated by 3 to 4 miles of agricultural fields. Nonetheless, exploratory movements by moose likely occur through the Project Area, which could be mitigated by 1 or more wildlife underpasses. However, of the 3 species evaluated here, moose may be the most reluctant to use underpasses. Clevenger et al. (2002) found that moose preferred overpasses rather than underpasses when crossing the Trans-Canada Highway in Banff National Park. Therefore, the greatest indirect effect of corridor construction in the Project Area might be the restriction of western movement by moose.

Cumulative Effects

Continued development, including road building and home construction, and habitat loss in the Paradise Ridge area, and corridor construction in the barred area (Figure 1, site B) would likely have a negative cumulative effect on moose. Complaints by homeowners that moose are eating ornamental shrubs in their yards or tearing down fences often lead to the removal of animals. In the Paradise Ridge area, if removal exceeds replenishment from immigration, moose would become temporary and intermittent residents. Cumulative effects should not be a factor if construction occurs in the Western Corridor or the Existing Improved Corridor.

SUMMARY OF FINDINGS

ITD personnel are evaluating options for the widening of US 95 into a divided 4-lane highway from Thorncreek Road to Moscow. The objective of this BE is to provide information to ITD to facilitate evaluation of potential impacts of different transportation corridors within the Project Area on white-tailed deer, elk, and moose.

I arrived at the findings through the following process:

1. The Project Area was visited 6 times between 23 April and 17 December 2004 to evaluate the landscape and collect empirical data for the analysis.
2. I reviewed pertinent literature for habitat and nutritional values of forage, and attempted to relate these data to the manner in which deer, elk, and moose use Paradise Ridge and the Project Area.
3. I contacted pertinent individuals and agency personnel for anecdotal and unpublished information about ungulates in and adjacent to the Project Area.
4. As part of the environmental baseline, I reviewed literature for a historical perspective on deer, elk, and moose in the Project Area, then compared that with the accounts of people knowledgeable with the current status of each species in the area.
5. Species profiles, including habitat preferences, foraging behavior, and movements were summarized and used to better understand the spatial relationship between habitats, human activities, and the 3 species of ungulates in the Project Area.
6. In analyzing the potential direct, indirect, and cumulative effects of the transportation corridors on deer, elk, and moose, I considered 7 parameters: 1) disruption of individuals, 2) habitat avoidance, 3) habitat disruption, 4) habitat enhancement, 5) direct mortality, 6) indirect mortality, and, 7) population effects.

The western slope of Paradise Ridge consists of a mosaic of plant communities that include bunchgrasses, exotic grasses, forbs, shrubs, and stands of ponderosa pines (see Figure 6). Patches of wildlife habitat just to the west of the Project Area in Washington are dominated by shrubs mixed with forbs and grasses and a small stand of ponderosa pines (Figure 7). These communities are valuable to wildlife because they provide structural diversity and cover for escape and security.

Some grasses reinitiate growth during autumn and remain green during winter. And some agricultural crops, including winter wheat, act similarly. Based on a review of the nutritional values of various forage groups, the nutritive value of these plants typically is high, and remains high throughout winter. In the Paradise Ridge area and the patches of Washington habitat, deer and elk (if present) would likely seek exposed grassy ridges and hillsides and adjacent fields of winter wheat during autumn and winter, and south and west exposures and exposed ridges in late winter and early spring to forage on the early green-up of grasses and forbs. During summer and autumn, shrubs and some species of forbs continue to grow, thus providing higher nutritive values than grasses. However, the role of various agricultural crops as forage to these ungulates should not be dismissed. Consequently, deer and elk may shift to shrubs during this period. As browsers, moose would tend to remain in timber and patches of shrubs, irrespective of seasonal variations in nutritional value of the different forage groups. Corridor construction outside the barred areas (Figure 1) is sufficiently far from these areas that disturbance or displacement of deer, elk, and moose from foraging and resting areas should not be a factor.

Based on elk foraging behavior and movement in relation to snow depths during winter, if elk are present, they should not be forced to move from the security of timber stands on Paradise Ridge. Agricultural fields extend east between stands of timber in the NE _ of Section 32, and resident elk probably forage in the upper (eastern) part of these fields as they are situated in close proximity to resting and escape cover. These fields are approximately _ mile from the area considered for an Eastern Corridor. The status of elk in the patches of Washington habitat is currently unknown.

White-tailed deer have long adapted to the diversity of habitats found within and adjacent to the Project Area. While they tend to be more browsers than elk, foods eaten are as varied as the range of habitats occupied by this adaptable species. Snow depths in the Paradise Ridge area are probably not great enough to force deer to migrate. Therefore, transportation corridors in the area should not be a factor in deer migration. However, deer can be expected to move between Paradise Ridge and patches of habitat to the west in Washington during any season.

Moose prefer a mosaic of second-growth forest, openings, lakes, streams, and wetlands. In Idaho, moose prefer shrubby, mixed coniferous and deciduous forests with nearby lakes, marshes, and bogs. Aquatic areas are important for foraging, while forested areas are important for winter cover. Shrubs associated with riparian areas are important components of their diet. The Project Area and adjacent habitats provide only marginal habitat for moose.

Moose are browsers, consuming primarily the stems, twigs, and leaves of woody plants. During summer they browse on the new growth of trees and shrubs, and on aquatic vegetation associated with lakes and ponds, where they appear to be attracted to the high sodium content in aquatic plants. The Project Area and adjacent Paradise Ridge lacks sufficient aquatic habitat to be very attractive to moose. However, the few artificial ponds that exist in the area likely attract moose. The scarcity of water in the patches of Washington habitat makes this area less suitable for moose than the Paradise Ridge area.

Depending on habitat, moose home ranges may reach several thousand acres. Moose are the largest member of the deer family, and with their long legs, are able to negotiate much greater snow depths than deer or elk. Movements are generally not influenced by snow depth and moose are not likely to exhibit seasonal migrations. Therefore, transportation corridors should not be a factor in moose migration, although random movements and dispersal do occur.

The mosaic patterns of vegetation (timber stands, brush and grass fields, and agricultural crops) in the Paradise Ridge area, and to a lesser extent the patches of Washington habitat, are important components of elk, deer, and moose habitat. Undoubtedly, white-tailed deer have long been present in both areas. Elk and moose have expanded throughout many parts of Idaho during the past 25 years. The reoccurrence of elk and moose in habitats adjacent to the Project Area probably coincided with the expansion of these species throughout many regions of Idaho. However, because moose tend to be solitary and can be great wanderers, their occurrence and persistence in the area may be hard to predict.

There are many factors that affect road mortality of wildlife, including traffic, road, and landscape influences, and species behavior and ecology. While deer, elk, and moose populations will not be jeopardized by construction of a 4-lane transportation corridor anywhere within the Project Area, based on an analysis of 7 different parameters, the collective impacts would be progressively less moving west from Paradise Ridge. Of the 7 parameters evaluated, direct mortality resulting from collisions with motor vehicles will have the greatest impact on all 3 species. However, this impact could be greatly reduced through construction of properly-designed wildlife crossings.

The Western Corridor consists primarily of agricultural fields and rural residences. The south end of this evaluation area is between Paradise Ridge and several patches of small, but suitable habitat just inside Washington, a distance of 3 to 4 miles. Deer travel between these 2 areas, and in all likelihood, so do elk and moose. Elk that bed in the patches of habitat in Washington feed in agricultural fields within the barred area shown in Figure 1. The IDFG has received depredation complaints from farmers of elk foraging in fields to the east of these pockets of habitat (C. Hickey and C. Rand, Idaho Department of Fish and Game, personal communication). Construction of the transportation corridor in the barred area would disrupt this movement. The effects of a Western Corridor constructed outside the barred area will be insignificant. Nonetheless, the impacts on animals moving across a 4-lane highway within the Western Corridor should be addressed.

Any transportation corridor would have to deal with year-round east-west movements of deer and possibly seasonal movements of elk and moose. The east-west movements of moose between Paradise Ridge and the pockets of habitat in Washington are not well understood. Evidence of moose occurring west of US 95 exist. Because moose can wander great distances, the potential for collisions with vehicles remains, irrespective of which site is selected within the Project Area. Moose are attracted to ponds, so ponds located adjacent to, but west of an Eastern Corridor should be discouraged.

Installation of wildlife underpasses, being considered by ITD (Federal Highway Administration and Idaho Transportation Department, no date) in the Eastern Corridor and recommended by Clevenger (no date) and IDFG (no date), would mitigate impacts within the barred area (Figure 1, A and B). Wildlife crossings at any corridor site selected would prove beneficial to reduce the impacts of a 4-lane highway. Underpasses and associated fencing are necessary to allow animals to move freely from either side of the transportation corridor, and reduce risks to both animals and humans resulting from wildlife-vehicle collisions.

CONCLUSIONS

Pre-construction planning and the identification of mitigation activities are valuable actions that help reduce future wildlife mortalities and prevent long-term impacts on wildlife populations. Awareness continues to grow, as does our knowledge about the ways that transportation corridors (roads, highways, and railways) impact wildlife movements and populations. Nonetheless, we know surprisingly little about the extent to which these features affect populations of most wildlife species. Considering the amount of money spent by insurance companies each year to repair vehicles damaged from collisions with wildlife, it's surprising that more funds and effort are not expended to find solutions to the problem.

The most effective techniques to get large animals safely across highways (viaducts, overpasses, and underpasses) are also expensive. Consequently, it is neither practical nor realistic to make entire highways (or railways) permeable to wildlife movement. Jackson and Griffin (1998) suggest that a practical strategy for mitigating transportation impacts on wildlife may be to reserve expensive techniques for areas that are identified and designated as important travel corridors or connections between areas of significant habitats. The Project Area is not located within any designated or known important travel corridor for deer, elk, or moose, nor would the proposed transportation corridor bisect significant habitat for these species. Nevertheless, construction of a 4-lane highway will likely result in an increase in wildlife-vehicle collisions, and installation of wildlife crossing structures would mitigate for this potential increase in road kills.

The proposed project could potentially impact a small amount of wildlife habitat and disrupt use of adjacent habitats. Nonetheless, deer, elk, and moose will likely continue periodic movements within the Project Area after construction of the new transportation corridor is completed. And while individual animals will be impacted, existing populations should not be threatened by the Project.

Impacts of 10 Alignments within the Project Area

The ITD recently identified 10 preliminary alignments in the 3 potential corridors within the Project Area and requested these alignments be evaluated based on the evaluation for each of the 3 corridor areas. The following section includes my assessment as to whether any issues involving deer, elk, or moose are significant enough to warrant construction unacceptable in any of the particular alignments. This assessment includes the assumption that twinning of highways in areas where ungulates occur generally results in increased ungulate mortality.

<u>Existing Improved Corridor</u>

The preliminary central alignments in the Existing Improved Corridor include C-1, C-2, and C-3. Alignment C-1 follows existing US 95. Alignment C-2 follows existing US 95 from Thorncreek Road to just north of Jacksha Road, then continues into Moscow west of the existing highway. Alignment C-3 follows existing US 95 to just north of Eid

Road. At that point, C-3 continues north, paralleling, but to the east of, US 95 until it reconnects with the highway near Cameron Road just south of Moscow. Beyond the likely increased highway mortality resulting from twinning the highway, none of these alignments would have a detrimental impact on resident deer, elk, or moose populations.

Eastern Corridor

The preliminary east alignments in the Eastern Corridor include E-1, E-2, and E-3. All 3 alignments follow US 95 from Thorncreek Road to the top of Reisenauer Hill. Alignment E-1 extends straight north from Reisenauer Hill, following an existing powerline before rejoining US 95 at the south end of Moscow. While this alignment appears to be near Samson Springs, it is sufficiently far from existing ungulate habitat on the west slope of Paradise Ridge to have no appreciable impact on resident ungulates. Alignments E-2 and E-3 leave US 95 at Reisenauer Hill, extending far enough east to apparently pass through a stand of ponderosa pine (see Figure 1, area B). Both alignments pass through the lower end of a forest draw (see Figure 4), with E-2 crossing further up the draw. Selection of either alignment E-2 or E-3 would result in loss of existing habitat for all 3 species of ungulates. While ungulate populations would not likely be compromised, selection of any eastern alignment would result in increased highway mortality without suitable mitigation (see RECOMMENDATIONS section of the report). Within the Eastern Corridor, alignment E-1 would have the least impact on ungulates, while E-2 would have the greatest because of habitat loss and proximity to other suitable habitat. However, none of these alignments would have a detrimental impact on resident deer, elk, or moose populations.

Western Corridor

The preliminary west alignments in the Western Corridor include W-1, W-2, W-3, and W-4. Except for W-4, all alignments extend west of US 95 from Thorncreek Road, rejoining US95 just south of Moscow. W-4 follows US 95 to just north of Jacksha Road, then extends to the east before returning to US 95 at the outskirts of Moscow. W-1 and W-3 extend the farthest west of all the alignments and passes through the barred area shown in Figure 1. The area depicted by the barring includes primarily agricultural fields used by elk that occasionally reside in canyon draws on the Washington side of the state boundary (Figure 7). Two potential scenarios could occur in this area if either W-1 or W-3 were selected. First, crop depredation could be reduced if elk avoid the area as a result of the new highway. Or, increased ungulate mortality would occur without mitigation (see RECOMMENDATIONS section for the Western Corridor) if animals continue to be attracted to agricultural fields in spite of the presence of the highway. Impacts of highway construction in either the W-2 or W-4 alignments would be no greater than what might be expected from twinning of the highway. As stated previously, twinning of highways in areas where ungulates occur generally results in increased ungulate mortality. No loss of natural habitat would occur if any of the western alignments were selected. None of these alignments would have a detrimental impact on resident deer, elk, or moose populations.

MITIGATION REQUIREMENTS

Because mitigation requirements were based on whether or not highway construction within the Project Area would jeopardize deer, elk, or moose populations, no mitigation is required. However, this does not mean that such factors as increased road kills in the Project Area, possible habitat avoidance, and increased risks to motorists were not considered in this BE; those impacts have previously been acknowledged. Options for mitigating these factors are addressed in the recommendations section.

RECOMMENDATIONS

Recommendations as they relate to deer, elk, and moose are provided for each of the construction corridors evaluated. Recommended actions would benefit deer, elk, moose, and other wildlife if the transportation corridor is constructed, but failure to implement a recommended action would not jeopardize populations of any of the species.

Eastern Corridor

Recommendation 1A: At least 1 and preferably 2 wildlife underpasses (see Appendix A) should be constructed as part of an Eastern Corridor located east of the north-south powerline and within the barred area (Figure 1) to mitigate for the foraging activities and periodic east-west movement of deer, elk, moose, and other wildlife.
Rationale 1A: Depending on the exact location of the transportation corridor, the best location for a wildlife crossing (underpass) is near the forest draw shown in Figure 4. A pond near the upper end of the draw (Figure 4) adds to the attractiveness of this draw to large mammals and other wildlife. A second underpass to the south would accommodate animals using habitat at the southwest end of Paradise Ridge. Suitable locations for underpasses, based on topography, become less evident to the west of the barred area and the north-south powerline. Wildlife-vehicle collisions result in the deaths of ungulates wherever transportation corridors exist (see Direct mortality parameter). Wildlife crossing structures are designed to get animals safely across a roadway, thereby providing for natural movements and reducing road kills. When this is achieved, both animals and humans will benefit. Where road mortalities occur, wildlife crossings have been shown to reduce collisions with vehicles. See Chapter 5 (Wildlife Populations) and Chapter 6 (Mitigation for Wildlife) in Road Ecology: Science and Solutions (Forman et al. 2003), the Wildlife Crossings Toolkit (www.wildlifecrossings.info), and proceedings from the past 4 International Conferences on Wildlife Ecology and Transportation (ICOWET) for additional information. Habitat improvements (e.g., watering ponds) that discourage wildlife movements across highways also help to reduce highway mortalities.

Recommendation 2A: Protected (security) habitat (e.g., conservation easements and/or land acquisitions) should be sufficient in size to connect big game travel corridors with wildlife highway underpasses. As a tentative guideline, security habitat should extend a minimum of 330 yards perpendicular from the edge of the highway underpass on both

sides, and be 100 yards wide centered on the middle of the underpass. However, the exact shape and size of this security habitat may vary, depending on underpass site location.
Rationale 2A: Adequate security cover currently exists on the east side of the proposed underpass sites identified in 1A, within the barred area. Additional habitat improvement may be necessary to the west of the underpass sites to help funnel animals to the site while moving from west to east. The value of a wildlife crossing is compromised if the intended species are reluctant or unable to reach them because adjacent security habitat is lacking, inadequate, not protected, or destroyed (see Habitat avoidance parameter). Therefore, it is imperative that adequate habitat in association with underpasses be secured. See Chapter 6 (Mitigation for Wildlife) in Road Ecology: Science and Solutions (Forman et al. 2003), the Wildlife Crossings Toolkit (www.wildlifecrossings.info), and ICOWET proceedings for additional information.

Recommendation 3A: Fencing (minimum of 8' high), in association with wildlife underpasses, is necessary to help funnel wildlife to crossings (Clevenger et al. 2001). The planting of shrubs and other forage plants leading to the underpasses would provide security and forage for animals and help to funnel them to the crossings (see 2A).
Rationale 3A: Fencing, in association with wildlife crossings, has been shown to effectively reduce wildlife road mortality. See Clevenger et al. (2001), Chapter 6 (Mitigation for Wildlife) in Road Ecology: Science and Solutions (Forman et al. 2003), the Wildlife Crossings Toolkit (www.wildlifecrossings.info), and ICOWET proceedings for additional information.

Recommendation 4A: One-way wildlife exit ramps (Appendix A) need to be installed in conjunction with underpasses and fencing to allow animals trapped on the roadway by diversion fences to exit the highway. The number and distribution of ramps should be determined once the location of the underpass is determined.
Rationale 4A: Some animals will inadvertently gain access to the roadway, generally at the fence ends, when fencing is used in conjunction with wildlife crossings. Animals unable to escape may panic and endanger both themselves and motorists. See the Wildlife Crossings Toolkit (www.wildlifecrossings.info) for additional information.

Recommendation 5A: Loss of existing suitable habitat for deer, elk, and moose is confined primarily to the barred area (Figure 1) in the Eastern Corridor. If highway construction occurs within the barred area, mitigation for this loss could include purchasing conservation easements and/or land in the Paradise Ridge area commensurate with the amount of habitat lost, purchasing areas delineated by IDFG (no date), or land identified as important for connectivity to underpasses.
Rationale 5A: Security cover leading to and from wildlife underpasses is critical to the successful use of underpasses by ungulates (see Rationale 2A, above).

Recommendation 6A: Installation of wildlife-sensitive culverts (see Appendix A and Forman et al. 2003, Chapter 6) where adjacent habitat exists would benefit smaller animals by facilitating their passage from 1 side of the roadway to the other.

Rationale 6A: Large underpasses, as discussed in 1A, would be used by numerous species of wildlife in addition to the ungulates for which they are intended. In addition to the sites where these structures could be constructed, there are additional places where the drainage patterns and existing vegetation are conducive to wildlife culverts. Planning and mitigation at the time of construction can help prevent long-term degradation of wildlife populations (Jackson 2000). Small animal (amphibians, reptiles, and mammals) populations may be more vulnerable to population fragmentation and isolation (Jackson 2000, Forman et al. 2003) as a result of highway construction.

Recommendation 7A: Signs alerting motorists to potential wildlife on the highway should be erected if wildlife underpasses are not constructed. Additional signage may be necessary at a later date, even in conjunction with underpasses, depending on patterns of animal movement.
Rationale 7A: Warning signs are installed by many states to alert motorists to potential wildlife (typically ungulates) on roadways. Unfortunately, attempts to modify human behavior as a mitigation technique are not perceived as being very successful (Forman et al. 2003). Flashing lights warning motorists of possible wildlife crossing may help to draw attention to the potential for collisions with animals. Because evaluations of success have been based mainly on opinion rather than research, it is advisable and prudent to install warning signs for the benefit of those motorists who heed such signs.

Existing Improved Corridor

Recommendation 1B: Topography and the location and distribution of suitable habitat are important factors in site selection for wildlife crossing structures. Depending on the corridor construction location, at least 1 wildlife highway crossing (and associated fencing and habitat improvements) is recommended.
Rationale 1B: Studies have shown that ungulate road kills increase when 2-lane highways are twinned (see Direct Mortality parameter and Rationale 1A). The topography along existing US 95 is probably sufficient for construction of an underpass. However, the structure would need to be located in an area that would provide for the natural movement of animals to and from Paradise Ridge. If it isn't, then the likelihood of ungulates using it becomes questionable.

Recommendation 2B: Signs alerting motorists to potential wildlife on the highway should be erected if wildlife underpasses are not constructed. Additional signage may be necessary at a later date, even in conjunction with underpasses, depending on patterns of animal movement.
Rationale 2B: Warning signs are installed by many states to alert motorists to potential wildlife (typically ungulates) on roadways. Unfortunately, attempts to modify human behavior as a mitigation technique are not perceived as being very successful (Forman et al. 2003). Flashing lights warning motorists of possible wildlife crossing may help to draw attention to the potential for collisions with animals. Because evaluations of success have been based mainly on opinion rather than research, it is advisable and prudent to install warning signs for the benefit of those motorists who heed such signs.

Recommendation 3B: Installation of wildlife-sensitive culverts (see Appendix A) where adjacent habitat exists would accommodate crossing and benefit smaller animals by facilitating their passage from 1 side of the roadway to the other.
Rationale 3B: The route of the existing highway (US 95) has numerous places where culverts would provide connectivity for habitat on either side of the road. See references and explanation under Rationale 6A.

Recommendation 4B: Topographic features (e.g., ridges, drainage bottoms, areas with little relief) and the locations of crossings are important factors when considering habitat improvements. Pond construction, wetland enhancements, or other wildlife habitat improvements should only occur to the east of the transportation corridor, in the direction of Paradise Ridge. However, should any habitat improvements occur to the west of the highway corridor, they should be integrated into a wildlife crossing structure.
Rationale 4B: Any habitat improvements that discourage animals from crossing highways to feed reduce the potential for wildlife-vehicle collisions (see Direct Effects for white-tailed deer).

Western Corridor

Recommendation 1C: Depending on the corridor construction location, at least 1 wildlife highway crossing (and associated fencing and habitat improvements) is recommended if this corridor is selected.
Rationale 1C: The barred area identified in the Western Corridor (Figure 1) consists primarily of agricultural fields and CRP lands, and except for a small, brushy drainage, there is no ungulate habitat. This area is used primarily for seasonal foraging by elk and deer attracted to agricultural crops. Because the drainages in the barred area are generally in a north-south axis, the approach of animals from resting cover to the west is difficult to predict, and the topography not conducive to construction of an underpass. Therefore, for these reasons, and because land use within the barred area is unpredictable, I can only recommend, rather than require, that an underpass be constructed, and only if the highway construction location provides a reasonable site for an underpass. Site selection would need to take into account topography and the location and distribution of the patches of habitat in Washington and adjacent features in Idaho that might attract deer and elk or cause them to move across a particular area. For example, if highway construction were to occur along the east edge of the barred area or further east, the probability of deer and elk repeatedly crossing the transportation corridor to feed is greatly diminished. The issue then becomes one of periodic movements of animals towards Paradise Ridge. Studies have shown that ungulate road kills increase when 2-lane highways are twinned (see Direct Mortality parameter and Rationale 1A). Therefore, highway construction in the Western Corridor would need to address the potential for increased road kills, irrespective of whether or not an underpass is constructed.

Recommendation 2C: Signs alerting motorists to potential wildlife on the highway should be erected if a wildlife underpass is not constructed. Additional signage may be necessary at a later date, depending on patterns of animal movement.

Rationale 2C: See Rationale 2B above.

Recommendation 3C: Installation of wildlife-sensitive culverts (see Appendix A) where adjacent habitat exists would accommodate crossing and benefit smaller animals by facilitating their passage from 1 side of the roadway to the other.
Rationale 3C: Logical places for culverts include where the highway intercepts drainage ditches, intermittent streams, and wet sites that are not cultivated. Because these types of places provide cover, animals tend to use them during movements and migration. Planning and mitigation at the time of construction can help prevent long-term degradation of wildlife populations (Jackson 2000). Small animal (amphibians, reptiles, and mammals) populations may be more vulnerable to population fragmentation and isolation (Jackson 2000, Forman et al. 2003) as a result of highway construction.

Recommendation 4C: Pond construction, wetland enhancements, or other wildlife habitat improvements would be the most effective if they were located in the barred area (Figure 1) to the west of the transportation corridor, and if their locations took into account topographic features and the locations of crossings (if any).
Rationale 4C: Ungulates feeding in agricultural fields in the barred area probably retreat to the patches of Washington habitat for cover and to bed. Any habitat improvements that discourage animals from crossing highways to feed reduce the potential for wildlife-vehicle collisions.

REFERENCES AND PERSONAL COMMUNICATIONS

Bowyer, R.T., V. Van Ballenberghe, and J.G. Kie. 2003. Moose. Pages 931-964 *in* G.A. Feldhamer, B.C. Thompson, and J.A. Chapman, eds. Wild Mammals of North America, 2nd Ed. The Johns Hopkins University Press, Baltimore, MD.

Bureau of Transportation Statistics. 2001. National Transportation Statistics 2000. Publication BTS01-01. U.S. Department of Transportation, Washington, D.C.

Clevenger, A.P, B. Chruszcz, and K. Gunson. 2001. Highway mitigation fencing reduces wildlife-vehicle collisions. Wildlife Society Bulletin 29(2):646-653.

Clevenger, A.P., B. Chruszcz, K. Gunson, and J. Wierzchowski. 2002. Roads and wildlife in the Canadian Rocky Mountain Parks – Movements, mortality and mitigation. Final Report prepared for Parks Canada, Banff, Alberta.

Clevenger, A.P. No date. Design Recommendations, Wildlife Underpasses, Game crossing #1 at Sta 166 + 70, Game crossing #2 at Sta 174 + 00, U.S. 94 – Genesee to Moscow, Idaho. Report prepared for the Idaho Department of Transportation, Boise.

Conover, M.R. 1998. Perceptions of American agricultural producers about wildlife on their farms and ranches. Wildlife Society Bulletin 26:597-604.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. DuBow, and W.A. Sanborn. 1995. Review of human injuries, illness and economic losses caused by wildlife in the U.S. Wildlife Society Bulletin 23:407-414.

Cook, J.G. 2002. Nutrition and food. Pages 259-349 *in* D.E. Toweill and J.W. Thomas, eds. North American Elk: Ecology and Management. Wildlife Management Institute. Smithsonian Institution Press, Washington, D.C.

Crenshaw, J. Personal communication. Electronic mail correspondence on 11 January 2005. Jay Crenshaw is the Regional Wildlife Manager, Idaho Department of Fish and Game, Clearwater Region.

Davis, W.B. 1939. The recent mammals of Idaho. Contribution from the Museum of Vertebrate Zoology, University of California, Berkley. The Caxton Printers, Ltd., Caldwell, ID.

Evink, G., D. Ziegler, P. Garrett, and J. Berry (eds.). 1996. Highways and movement of wildlife: Improving habitat connections and wildlife passageways across highway corridors. Proceedings of the Florida Department of Transportation/Federal Highways Administration Transportation-related Wildlife Mortality Seminar. Orlando, FL. 336pp.

Evink, G.L., P. Garrett, and D. Zeigler, (eds.). 1999. Proceedings of the Third International Conference on wildlife ecology and transportation. FL-ER-73-99. Florida Department of Transportation, Tallahassee, FL. 330pp.

Federal Highway Administration. 1995. Our Nation's highways: Selected facts and figures. Publication FHWA-PL-95-028. U.S. Department of Transportation, Washington, D.C.

Federal Highway Administration and Idaho Transportation Department. No date. Top of Lewiston Hill to Genesee and Genesee to Moscow. Environmental Assessment. ITD Project NH-4110 (133) Key No. 7769, ITD Project DHP-1566 (001) Key No. 7505. U.S. Department of Transportation, Federal Highway Administration, and Idaho Transportation Department, Boise.

Finch, G. 2000.Critter Crossings: Linking habitas and reducing roadkill. U.S Department of Transportation, Federal Highways Administration Publication No. FHWA-EP-00-004. Washington, D.C.

Forman, R.T.T., D. Sperling, J.A. Bissonette, A.P. Clevenger, C.D. Cutshall, V.H. Dale, L. Fahrig, R. France, C.R. Goldman, K. Heanue, J.A. Jones, F.J. Swanson, T. Turrentine, and T.C. Winter. 2003. Road ecology: Science and solutions. Chapter 2. Roads. Island Press, Washington, D.C.

Groot Bruinderink, G.W.T.A., and E. Hazebroek. 1996. Ungulate traffic collisions in Europe. Conservation Biology 10:1059-1067.

Groves, C.R., B. Butterfield, A. Lippincott, B. Csuti, and J.M. Scott. 1997. Atlas of Idaho's Wildlife: Integrating Gap Analysis and Natural Heritage Information. Idaho Department of Fish and Game, Boise.

Harrison, P.D., and M.I. Dyer. 1984. Lead in mule deer forage in Rocky Mountain National Park, Colorado. Journal of Wildlife Management 48(2):510-517.

Hickey, C. Personal Communication. Meeting at the Clearwater Regional Office, Idaho Department of Fish and Game, on 15 November 2004. Clay Hickey is the Landowner-Sportsman Coordinator for the Region.

Hindelang, M., D. Premo, E. Rogers, and K. Premo. 1999. Addressing deer-vehicle accidents with an ecological landscape GIS approach. Pages 185-192 *in* G.L. Evink, P. Garrett and D. Zeigler, eds. Proceedings of the Third Internation Conference on Wildlife Ecology and Transportation. FL-ER-73-99. Florida Department of Transportation, Tallahassee, FL.

Hughes, W.E., A.R. Saremi, and J.F. Paniati. 1996. Vehicle-animal crashes: An increasing safety problem. Institute of Transportation Engineers Journal 66(8):24-28.

Idaho Department of Fish and Game. No date. Draft terrestrial wildlife impact assessment, proposed U.S. 95 realignment and widening, top of Reisenauer Hill to Moscow. Idaho Department of Fish and Game Report, Lewiston.

Irwin, L.L., and J.M. Peek. 1983. Elk habitat use relative to forest succession in Idaho. Journal of Wildlife Management 47(3):664-672.

Jackson, S.D. 2000. Overview of transportation impacts on wildlife movement and populations. Pages 7-20 *in* T.A. Messmer and B. West, eds. Wildlife and Highways: Seeking solutions to an ecological and socio-economic dilemma. The Wildlife Society, Bethesda, MD.

Jackson, S.D., and C.R. Griffin. 1998. Toward a practical strategy for mitigating highway impacts on wildlife. Pages 17-22 *in* G.L. Evink, P. Garrett, D. Zeigler, and J. Berry, eds. Proceedings of the international conference on wildlife ecology and transportation. FL-ER-69-98. Florida Department of Transportation, Tallahassee.

Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Arc Wildlife Services Ltd., Alberta, Canada.

Johnson, D.R. Personal communication. Telephone conversation on 18 May 2004. Dr. Johnson is Professor Emeritus, Department of Biological Sciences, University of Idaho, Moscow.

Larrison, E.J. 1967. Guide to Idaho Mammals. Journal of the Idaho Academy of Science, Volume VII.

Larrison, E.J., and D.R. Johnson. 1981. Mammals of Idaho. The University Press of Idaho, Moscow. 166pp.

Lichthardt, J., and R.K. Moseley. 1997. Status and conservation of the Palouse grassland in Idaho. Idaho Department of Fish and Game. 28pp + appendices.

Leege, T. A., and W. O. Hickey. 1977. Elk-snow-habitat relationships in the Pete King drainage, Idaho. Wildlife Bulletin No. 6. Idaho Department of Fish and Game, Boise.

Messmer, T.A., and B. West (eds.). 2000. Wildlife and Highways: Seeking solutions to an ecological and socio-economic dilemma. The Wildlife Society, Bethesda, MD.

Miller, K.V., L.I. Muller, and S. Demarais. 2003. White-tailed Deer. Pages 906-930 *in* G.A. Feldhamer, B.C. Thompson, and J.A. Chapman, eds. Wild Mammals of North America, 2nd Ed. The Johns Hopkins University Press, Baltimore, MD.

National Research Council. 1997. Toward a sustainable future: Addressing the long-term effects of motor vehicle transportation on climate and ecology. National Academy Press, Washington, D.C.

Pauley, G.R. 1990. Habitat use, food habits, home range, and seasonal migration of white-tailed deer in the Priest River drainage, north Idaho. M.S. Thesis, University of Idaho, Moscow.

Peek, J.M. 2003. Wapiti. Pages 877-888 *in* G.A. Feldhamer, B.C. Thompson, and J.A. Chapman, eds. Wild Mammals of North America, 2nd Ed. The Johns Hopkins University Press, Baltimore, MD.

Pierce, J., and J. M. Peek. 1984. Moose habitat use and selection patterns in north central Idaho. Journal of Wildlife Management 48:1335-43.

Rand, C. Personal communication. Telephone conversation on 14 October 2004 and electronic mail correspondence on 13 January 2005. Clint Rand has been a Idaho Department of Fish and Game Conservation Officer in the Moscow, Idaho area for the past 25 years.

Reilly, R.E., and H.E. Green. 1974. Deer mortality on a Michigan interstate highway. Journal of Wildlife Management 38(1):16-19.

Skovlin, J.M., P. Zager, and B.K. Johnson. 2002. Elk Habitat Selection and Evaluation. Pages 531-555 *in* D.E. Toweill and J.W. Thomas, eds. North American Elk: Ecology and Management. Wildlife Management Institute. Smithsonian Institution Press, Washington, D.C.

Strohmeyer, D.C., and J.M. Peek. 1996. Wapiti home range and movement patterns in a sagebrush desert. Northwest Science 70:79-87.

Weddell, B.J., and J. Lichthardt. 1998. Identification of conservation priorities for and threats to Palouse grassland and Canyon grassland remnants in Idaho, Washington, and Oregon. Idaho Bureau of Land Management, Technical Bulletin No. 98.

Weddell, B.J. 2001. Preliminary evaluation of potential mitigation sites at Paradise Ridge, Latah County, Idaho. Draba Consulting, Pullman, WA.

Wright, G. Personal communication. Meeting at the University of Idaho on 19 May 2004. Dr. Wright is a Professor in the Department of Fish and Wildlife Resources, University of Idaho, Moscow, and in the Cooperative Fish and Wildlife Research Unit, USGS.

LIST OF TABLES

Table 1. Possible direct, indirect, and cumulative effects of corridor alternatives on white-tailed deer, elk, and moose. Agricultural fields were excluded in assessing habitat loss.

Species and Effects	Eastern Corridor	Existing Improved Corridor	Western Corridor[1]
White-tailed Deer			
Direct Effects[1]	Some habitat loss, depending on corridor location; increased road kills likely without mitigation, impact low with mitigation; temporary displacement during construction.	Insignificant habitat loss; enlarged transportation corridor could increase road kills; impacts low with proper signage.	Insignificant habitat loss; enlarged transportation corridor could increase road kills; impacts low with proper signage.
Indirect Effects[2]	Introduction of exotic plants and pollutants; effects unknown.	Introduction of exotic plants and pollutants; effects unknown.	Introduction of exotic plants and pollutants; effects unknown.
Cumulative Effects[3]	CE due to expected increased rural residential development insignificant; deer are highly adaptable to human activities.	None anticipated.	None anticipated.
Elk			
Direct Effects	Some habitat loss, depending on corridor location; increased road kills possible without mitigation; impacts low with mitigation. Temporary displacement possible during construction if in barred area.	Enlarged traffic corridor could result in periodic road kills; impacts low with adequate signage.	Enlarged traffic corridor could result in periodic road kills; depending on corridor location, impact low with adequate signage. Temporary displacement during construction if in barred area.
Indirect Effects	Introduction of exotic plants and pollutants; effects unknown.	Introduction of exotic plants and pollutants; effects unknown.	Introduction of exotic plants and pollutants; effects unknown.
Cumulative Effects	Elk more sensitive to residential development and fragmentation; future use could be compromised, irrespective of construction.	None anticipated.	None anticipated.
Moose			
Direct Effects	Some habitat loss, depending on specific location; road kills possible without mitigation; impacts low with mitigation. Temporary displacement during construction.	Enlarged traffic corridor could result in periodic road kills; impacts lows with adequate signage.	Enlarged traffic corridor could result in periodic road kills; impacts low with adequate signage.
Indirect Effects	Introduction of exotic plants and pollutants; effects unknown.	Introduction of exotic plants and pollutants; effects unknown.	Introduction of exotic plants and pollutants; effects unknown.
Cumulative Effects	Moose more sensitive to residential development and habitat fragmentation; future use could be compromised, irrespective of construction.	None anticipated.	None anticipated.

[1] Direct Effects (DE) are the immediate impacts caused by the proposed action.
[2] Indirect Effects (IE) are the impacts caused by or that will result from the proposed action, but are likely to occur at a later time.
[3] Cumulative Effects (CE) are the combined impacts of this action along with unrelated activities that are likely to occur within the project area, and when evaluated collectively, could impact the species.

LIST OF FIGURES

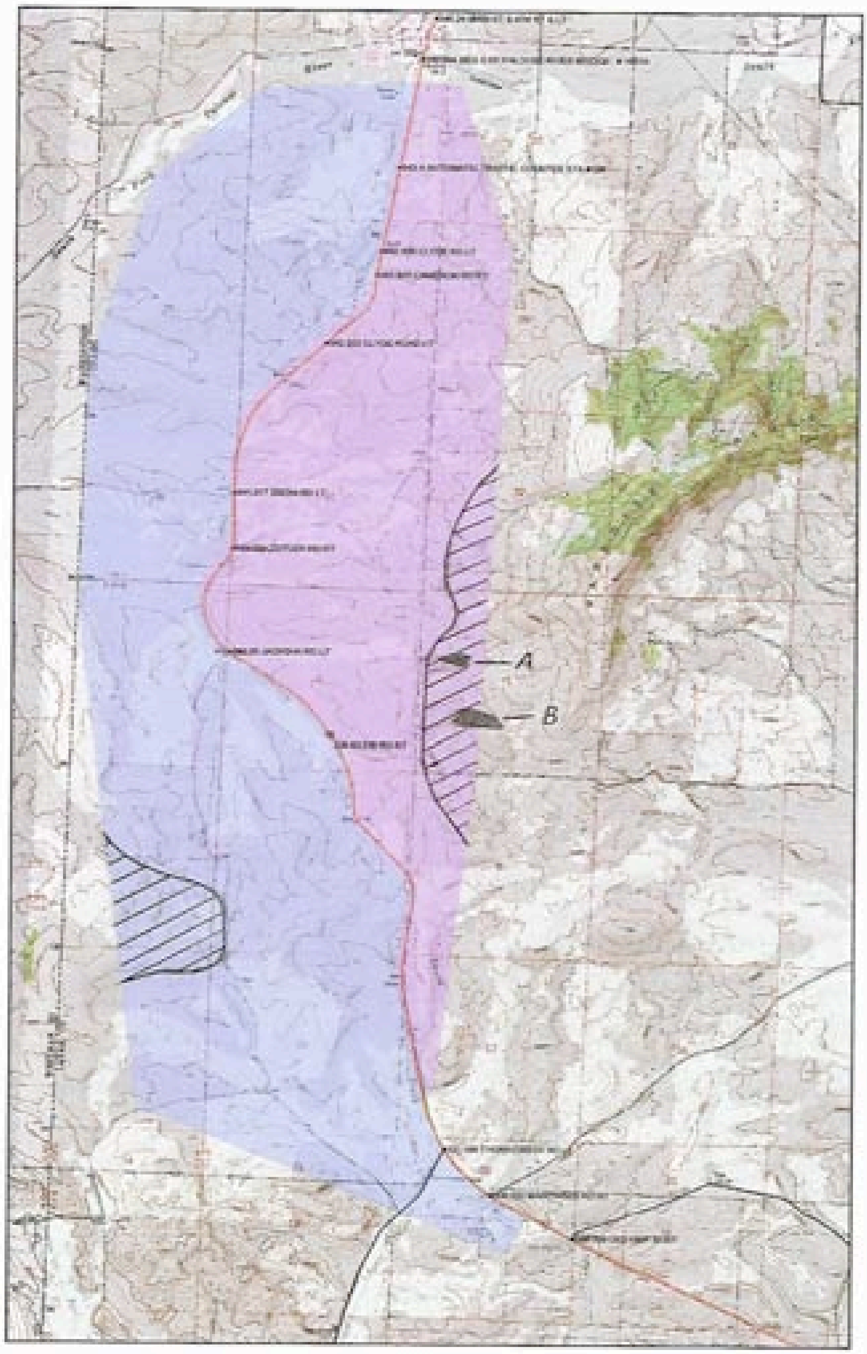

Figure 1. Map of the Project Area with the Eastern (purple) and Western (blue) Transportation Corridors divided by existing US 95. Areas where corridor construction would have the greatest impact on deer, elk, or moose in the Project Area are noted with barring. The 2 darkened areas (A and B) include patches of trees and shrubs, suitable habitat for these ungulates.

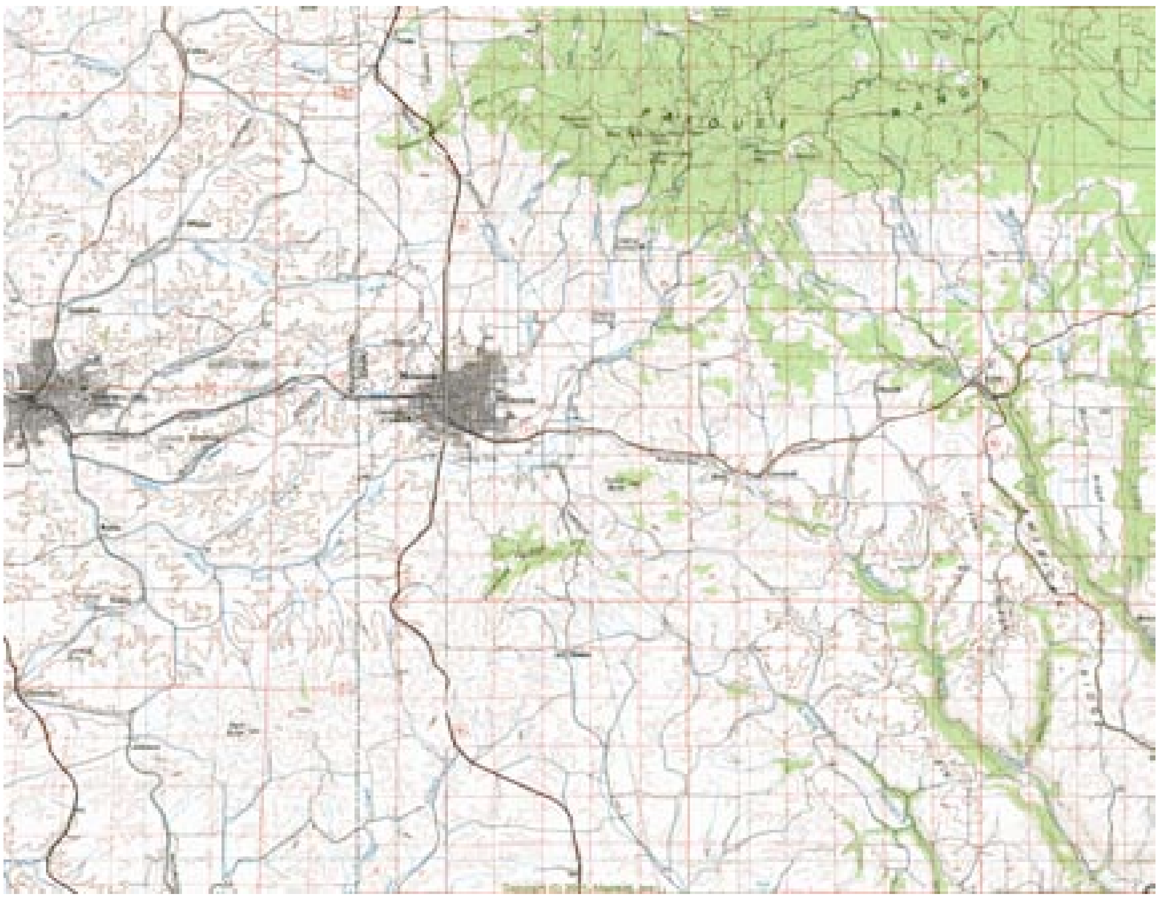

Figure 2. Map of Paradise Ridge showing larger stands of forested habitat, including Moscow Mountain and the Palouse Range to the northeast. Adjacent patches of habitat to the northeast and east, including Tomer Butte, provide connectivity to Paradise Ridge for movement of large mammals. While white-tailed deer have long been widely distributed throughout the Palouse, elk and moose on Paradise Ridge likely dispersed more recently from these larger stands of habitat.

Figure 3. The drier south side of Paradise Ridge, looking east, is dominated by ponderosa pine with a grass/forb understory. Because of its southern exposure and proximity to agricultural fields, this area probably attracts deer and elk during winter and early spring.

Figure 4. A forested draw extends down the west slope of Paradise Ridge through agricultural fields. This draw provides cover for animals moving into the Eastern Corridor area, while the pond near the upper end of the draw (right-center of photo) provides water. Existing US 95 and the landscape typical of the Western Corridor can be seen in the upper third of the photo.

Figure 5. Pond located within the Eastern Corridor and at the base of Paradise Ridge. Numerous fresh deer tracks were observed at the edge of this pond on 19 May 2004.

Figure 6. View of the west slope of Paradise Ridge showing a variety of habitats and plant communities.

Figure 7. Patches of wildlife habitat in Washington provide cover for ungulates that feed in agricultural fields in the Western Corridor.

Appendix A. Common types of wildlife crossing structures, barriers, and escape structures. Information from Wildlife Crossings Toolkit (www.wildlifecrossings.info).

BIOLOGICAL EVALUATION ON THE POTENTIAL IMPACTS OF CORRIDOR ALTERNATIVES FROM THORNCREEK ROAD TO MOSCOW ON LONG-EARED MYOTIS AND PYGMY NUTHATCHES

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INTRODUCTION

A network of Federal, State, and County highways comprise a transportation system that is crucial to the daily lives of most Idahoans and to the economy. Without this network of roads and the means to deliver and retrieve products, many of the conveniences most people take for granted would become measurably less convenient. While we gain from better roads and vehicles to transport us more quickly to our destinations, wildlife can be the unfortunate victim of these improvements. Large ungulates, including deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) are the most notable species associated with wildlife-vehicle collisions due to their large size, the potential for extensive damage to vehicles and the loss of human lives, and the fact that a dead deer or moose on or along the road is pretty hard not to notice. Conversely, small animals, including birds, mammals, reptiles, and amphibians, rarely cause vehicle damage, generally go unnoticed by motorists, and often get deflected off the road when hit. Because of their small size and difficulty to detect, we have little knowledge of the impact transportation corridors have on most of these species. For many species, the direct impact on them may be insignificant, but the indirect and cumulative effects resulting from the loss of important habitat could be much greater. The long-eared myotis (*Myotis evotis*) and pygmy nuthatch (*Sitta pygmaea*), both classified as Species of Special Concern (SSC) by the Idaho Department of Fish and Game (IDFG), were identified as species to consider in evaluating alternatives for the widening of US 95 into a divided 4-lane highway.

The Palouse Prairie

This segment is paraphrased from the draft Idaho Comprehensive Wildlife Conservation Strategy (ICWCS), recently completed by the IDFG (IDFG 2005) and located on their website at **http://fishandgame.idaho.gov/cms/tech/CDC/cwcs.cfm** . The Palouse Prairie is typified by loess-covered basalt plains, rolling hills, plateaus, and river break-lands. Elevation ranges from 1,200 to 6,000 ft (366 to 1,830 m). Precipitation ranges from 10 to 30 in (250 to 760 mm), mostly in the form of winter snow. Summers are warm, dry, and often windy. The Snake River is the major drainage in this Section.

Bluebunch wheatgrass (*Agropyron spicatum*) and Idaho fescue (*Festuca idahoensis*) dominate the arid portions of this section while meadow-steppe vegetation, including Idaho fescue and common snowberry (*Symphoricarpus albus*), are common in the areas of greater precipitation. Ponderosa pine (*Pinus ponderosa*) woodlands and forests prevail on hills and low mountains. Douglas-fir (*Pseudotsuga menziesii*) forests dominate in higher elevations with isolated fragments of Western red cedar (*Thuja plicata*) and Grand fir (*Abies grandis*) on sheltered north slopes. At least 11 of the 14 bats occurring in Idaho, including the long-eared myotis, are found in the Palouse Prairie (Gillies 2004). And the ponderosa pine woodlands and forests are habitat for the pygmy nuthatch.

PROJECT DESCRIPTION

ITD personnel are evaluating alternatives for the widening of US 95 into a divided 4-lane highway. The Project Area includes approximately 6.5 miles of realignment of US 95 from Thorncreek Road south of Reisenauer Hill, north to Moscow, Idaho, and from the west slope of Paradise Ridge, west to the Idaho-Washington border. Three potential transportation corridors are being evaluated. The Existing Improved Corridor would follow the current route of US 95. The Eastern Corridor would realign the highway from Reisenauer Hill to Moscow, in the area between existing US 95 and the west slope of Paradise Ridge. The Western Corridor would realign the highway in an area north of Thorncreek Road to the South Fork Palouse River at the edge of Moscow, and between the Idaho-Washington border and existing US 95. Public and agency meetings have been held and are continuing to be held to help determine proposed alternatives within each corridor. ITD does not anticipate selection of a new route until 2006.

OBJECTIVE

The primary objective of this project was to prepare a Biological Evaluation (BE) for the Idaho Transportation Department (ITD) that provides information on the potential impacts of the highway project on the long-eared myotis and pygmy nuthatch.

METHODS

Based on the ecological requirements of each species, the Project Area was surveyed to determine suitable habitat. Suitable habitat were mapped and the perimeter plotted with a hand-held GPS unit (Garmin GPSmap 76CS). I assumed that each species was present at some time during the year at those locations identified as suitable habitat. Attempts to observe each species were made during field visits, however, mist-netting for bats was not an objective at this time. Information from personal contacts with knowledgeable individuals, review of available data, and identification of suitable habitat for each species was used to evaluate the direct, indirect, and potential cumulative effects of each corridor within the Project Area and associated human activities during and after completion of the Project.

I relied heavily on several excellent documents and sources for drafting the species accounts for both the pygmy nuthatch and long-eared myotis. Most notable from this list included the Ecology, Conservation and Management of Western Bat Species (Western Bat Working Group 1998), the GAP (Geographic Approach to Planning for biological diversity) Analysis of Idaho (Scott et al. 2002), the draft Idaho Bat Conservation Plan (Gillies 2004), the Atlas of Idaho's Wildlife (Groves et al. 1997), and the draft ICWCS (IDFG 2005).

GENERAL ECOLOGY

Bats

Bats are a diverse group comprising more than 20% of all mammalian species in the world. There are 145 species of bats known to occur in North America, with 46 species found in the United States and 14 species in Idaho (Baker et al. 2003 as cited in Gillies 2004). The bats of Idaho all belong to the family Vespertilionidae (vesper or mouse-eared bat) and are strictly insectivorous. Most species of bats occurring in Idaho are difficult to distinguish because of their dark brown wing membranes and short brownish fur (Gillies 2004). However, the long-eared myotis has the longest ears (0.84 inches) of any North American myotis (Adams 2003).

Bats occupy virtually every habitat except the extreme arctic and polar regions, and are found throughout North America. However, the number of species increases in southern latitudes and decrease in northern latitudes. Their range is governed by food, temperature, and roost-site availability (Richardson 2002 as cited in Gillies 2004).

The seasonal distribution of a bat species may vary throughout the year. In Idaho, this aspect of bat ecology is understudied (Gillies 2004). Many species migrate to warmer or cooler climates when fall arrives. However, 12 of the 14 species in Idaho, including the long-eared myotis, hibernate in cool hibernacula sites, usually traveling short distances to these locations.

Bats are long-lived for their size, and have been known to exceed 30 years in the wild (Richardson 2002 as cited in Gillies 2004). Their low rate of reproduction is compensated for by their longevity. However, because of this low reproductive rate, bat populations are more susceptible to dramatic demographic fluctuations, including population size, growth, density, and distribution.

Bats in Idaho consume large numbers of insects each night, thus playing a critical role in maintaining the balance of night-flying insect populations. Scientists estimate that a single little brown bat (*M. lucifugus*) can consume up to 600 mosquito-sized insects in an hour (Gillies 2004).

Many bats forage, capture prey, and feed while in flight. Foraging at different levels of the forest canopy allow bats to minimize competition for available insects. Insectivorous bats are well adapted to the short and ephemeral life cycles of their prey. Riparian areas such as wetlands, springs, and ponds are important foraging areas because they tend to concentrate insects.

Bats use a variety of natural and man-made (e.g., , barns and other buildings, bat boxes, and artificial bark) roost sites that serve as day and night roosts (which are generally separate sites), maternity roosts (where reproductive females and their young congregate), and hibernacula (overwintering sites) (Gillies 2004). There are specific requirements associated with each kind of roost. Besides protecting the bats from predators and being relatively free from disturbance, there may be explicit environmental requirements for roost selection, depending on species. Roosts suitable for maternity colonies must be warm (for fetal and juvenile development) and close to adequate foraging areas (Tuttle 1997 as cited in Gillies 2004). Hibernacula must be cold, yet humid to prevent dehydration. Although different species select for different conditions, hibernaculum temperatures are usually below 50° F, with temperatures remaining stable throughout the season (Richardson 2002 as cited in Gillies 2004).

Bat distribution and population sizes are significantly correlated to the availability of suitable roosting sites. Bats display a high degree of fidelity for maternity and hibernaculum sites, but they are less loyal to night and day roosts. Because bats are concentrated in maternity and hibernaculum sites, these locations deserve special conservation efforts.

Long-eared Myotis

The long-eared myotis is a small forest bat with 2 subspecies, *M. e. evotis* and *M. e. pacificus,* found in Idaho (Larrison and Johnson 1981). An adult weighs between 0.2 and 0.3 ounces and has a wingspan of 10-12 inches (Adams 2003). This species is named for its prominently long blackish ears that extend beyond the tip of the nose when laid forward (Larrison and Johnson 1981). Its pelage is dull or pale brown to straw-colored (Adams 2003). Distinguishing between the long-eared myotis and the fringed myotis (*M. thysanodes*) is simplified by the differences in ear length.

The long-eared myotis is well distributed across the western landscape, ranging from southern British Columbia, Alberta, and Saskatchewan to the Baja peninsula and east into the Great Plains of North Dakota, South Dakota, and Nebraska (Groves et al. 1997, Adams 2003). This species ranges throughout Idaho, missing only from parts of the Snake River Plain and the Bruneau River Canyon (Gillies 2004).

The long-eared myotis is a species associated with a variety of habitat types in the Pacific Northwest, including forested areas, forest edge habitats, riparian areas, and water sources, especially those with rocky outcrops (Csuti et al. 1997; Groves et al. 1997). The species is common in lodgepole pine (*Pinus contorta*) forests (Groves et al. 1997). Except for developed areas, most habitats are generally considered acceptable (Johnson and Cassidy 1997). Idaho cover types associated with this species includes grasslands, xeric shrublands, broadleaf forests, needleleaf forests, mixed broadleaf/needleleaf forests, burnt timber, forested riparian and wetland areas, and barren land cover types with exposed rock (Gillies 2004).

The long-eared myotis is adapted for foraging in dense vegetation, sometimes gleaning insects from leaves, bark, rocks, and the ground. Prey includes beetles, flies, lace-winged insects, moths, true bugs, and wasps (Adams 2003). Sexual prey selection has been observed, with males taking more moths and females more beetles (Gillies 2004). Long-eared myotis may be especially adept at high elevation foraging in cold ambient temperatures (Gillies 2004).

Individuals roost under exfoliating tree bark, dead and live trees, caves, mines, cliff face crevices, sink holes, rocky outcrops on the ground, buildings, and bridges (Manning and Jones 1989; Vonhof and Barclay 1996, 1997). Large diameter trees and snags are preferred roost sites in Arizona (Rabe et al. 1998; Waldien et al. 2000). Emergence and foraging times likely vary with prey availability, temperature, precipitation, and reproductive status.

Like many other temperate members of the Genus *Myotis*, this species mates during fall and fertilization occurs after ovulation in spring. A single pup is produced in May-July, depending on local temperatures, with lactation occurring into late July. Pups grow rapidly, learn to fly, and become fully-grown at 3-6 weeks of age. As might be expected, the highest rate of mortality occurs in the first year when juveniles are learning to fly and hunt independently. Nonetheless, individuals may live for 22 years or more (Manning and Jones (1989). Small maternity colonies form in late spring while non-reproductive females and males roost singly or in small clusters nearby (Manning and Jones 1989).

Winter habits are poorly understood. This species may be a short distance migrant to suitable hibernacula, likely mines and caves.

<u>Nuthatches</u>

There are 4 species of nuthatches in the family Sittidae (Sibley 2000). Nuthatches have short bills and tails and a unique tree-climbing method; they often climb head down, feeding on insects gleaned from the crevices of bark. They accomplish this by using only their legs and feet, with 1 foot placed lower as a brace and the other foot placed higher to grip the bark of the tree.

Pygmy Nuthatch

The pygmy nuthatch is a tiny bird (4.5 inches long and weighing 0.37 ounces) with a brown cap, grayish-blue back, and creamy-buff underparts. Females incubate 4-9 eggs for 15-16 days, with the young leaving the nest at approximately 22 days. At least 6 subspecies of pygmy nuthatches have been described; *S. p. melanotis* is the subspecies present in Idaho.

The pygmy nuthatch is a year-round resident in ponderosa and similar pines from south-central British Columbia and mountains of the western U.S. to central Mexico. Throughout its range, the patchy distribution of the nuthatch is dictated by the patchy distribution of pines (Kingery and Ghalambor 2001 as cited in IDFG 2005). In northern Idaho, it is locally common, less common in the west-central mountains, and rare in the southern and eastern parts of the state (Groves et al. 1997).

In Idaho, the pygmy nuthatch is generally limited in its distribution to the southern slope of mountains at elevations up to approximately 3,500 feet, where it occupies suitable habitat year-round. While primarily associated with ponderosa pine forests and woodlands, it may also inhabit other dry forest habitat types, including Douglas-fir (*Pseudotsuga menziesii*), and less frequently pinyon/juniper (Groves et al 1997).

Nuthatches nest in natural or excavated cavities in dead pines, live trees with dead sections, standing snags, and they may even use posts (Groves et al. 1997). The birds may use the same cavity trees for nesting and year-round roosting (K. Dumroese, personal communication). Nuthatches prefer old-growth, mature, undisturbed forests for nesting, with unlogged forests hosting significantly more pygmy nuthatches than logged forests (Sydeman et al. 1988 as cited in IDFG 2005). Pygmy nuthatch numbers correlate significantly with the volume of ponderosa pine, and studies suggesting this species needs heterogeneous stands with a mixture of well-spaced old pines and vigorous trees of intermediate age (see pygmy nuthatch species account in IDFG 2005).

The birds forage on outer branches and twigs, and along tree trunks. The diet consists of insects, such as ants, beetles, grasshoppers, moths, and wasps, but may also include spiders and pine seeds (Groves et al. 1997).

Pygmy nuthatches are social throughout the year and small family groups will travel together after the nesting season. Larger family groups of 5-15 individuals may form loose flocks in fall and winter where they forage as a flock and roost communally within the group territory. Pygmy nuthatches occasionally join mixed-species flocks during winter.

ENVIRONMENTAL BASELINE

Long-eared Myotis

Status in the Project Area

There are few data on bat population abundance, population trends, and habitat requirements in Idaho (Gillies 2004). The distribution of the long-eared myotis in Idaho is poorly understood, and the status of this bat in the Project Area is largely unknown. A master's thesis from the University of Idaho examined bats on the Palouse (Bonnell 1967) and found that the long-eared myotis always roosted near water. The single element occurrence record for this species in the IDFG Conservation Data Center database came from Bonnell's study. A female specimen was collected from an abandoned gold mine NE of Moscow on 24 April 1966, outside the Project Area.

The U.S. Forest Service (FS) and IDFG conducted bat surveys on portions of the Palouse Ranger District as part of the FS Region One Bat Grid Project (Jageman 2005). Sampling occurred during a 10-survey-night period from 17-29 July 2005. Eleven of the 38 bats captured with mist nets were long-eared myotis. While no surveying was done within or adjacent to the Project Area, the results would suggest that the long-eared myotis likely occurs in the Project Area.

Rita Dixon (R. Dixon, IDFG, personal communication) mist-netted long-eared myotis at a mine north of Deary, Idaho, and has captured them elsewhere in the Palouse. She indicated that she would expect to find them in the Paradise Ridge area, and recommended netting at ponds in the Project Area to see if long-eared myotis are present.

Threats

Recent concern over the decline of bat populations on local, national, and global levels has prompted management agencies to focus their attention on bat conservation. Reasons for decline vary according to individual species and populations and include natural and human-related causes. However, common themes include habitat alteration, loss, and degradation; roost disturbance and destruction; pesticide application; and lack of public awareness.

Human disturbance, either directly (at roost sites) or indirectly (habitat alteration), is especially important in contributing to bat population declines. Maternity colonies and hibernacula are particularly sensitive to disturbance. All bat species listed as federally endangered in the United States spend at least part of their lives in caves (Gillies 2004). The increasing popularity of cave exploration is possibly one of the most important causes of population declines in bats (Tuttle 1997 as cited in Gillies 2004).

Roost sites are considered to be a limiting factor in bat population biology (Fenton 1997) and, therefore, deserve special conservation attention and protection from disturbance. Roost destruction is a direct threat to maternity colonies and hibernacula, specifically mine closure without proper biological surveys, recreational caving, and building exclosures.

Forest management techniques that remove snags could affect roost sites. Habitat alteration through timber harvest directly reduces the availability of roost sites and indirectly reduces prey populations. Fire, either natural or prescribed, reduces roost-site availability in some instances, but also creates additional sites.

For the long-eared myotis, information on virtually all aspects of their seasonal life requirements is needed. Knowledge of population trends and limiting factors are lacking, and the importance of snags as summer roosts in the Project Area is of particular interest.

Conservation Status

The following Federal and State status and rank classification for the long-eared myotis were taken from Gillies (2004) and the IDFG website (Idaho Conservation Data Center 2005). The long-eared myotis has a global ranking of G5 (demonstrably widespread, abundant, and secure) from the network of Natural Heritage and Conservation Data Centers for species based on range-wide status. Its state (Idaho) rank based on the same source is “S3?” (rare or uncommon but not imperiled, based on occurrence data; the question mark indicates uncertainty exists about the stated rank). In Idaho, all bats are classified as “Protected” by the IDFG and the long-eared myotis is also a Species of

Special Concern (SSC) Type 5. SSC include any native species that could become listed as threatened or endangered throughout all or a significant portion of its Idaho range due to 1 or more of 3 factors. It is classified as a "Type 5" or "Watch List" species by both the IDFG and Bureau of Land Management (BLM). Watch List species are not considered BLM sensitive species, but they could be added to the sensitive species list depending on new information concerning threats, species biology, or statewide trends. The Watch List includes species with insufficient data on population or habitat trends or the threats are poorly understood. However, there are indications that these species may warrant special status designation and appropriate inventory or research efforts should be a management priority. Neither the FS nor the U.S. Fish and Wildlife Service (FWS) provide special classification for the long-eared myotis.

The Western Bat Working Group identifies the long-eared myotis as a "Medium priority" species (Western Bat Working Group 1998). Medium priority indicates a level of concern that should warrant closer evaluation, more research, and conservation actions of both the species and possible threats. Adams (2003) considers the threat to long-eared myotis populations to be low in Montana, northern Idaho, and adjacent areas.

Pygmy Nuthatch

Status in the Project Area

The pygmy nuthatch is an uncommon bird in Idaho, although locally common in northern Idaho (Groves et al. 1997). Nuthatches normally occurs in pine forests and woodlands, especially ponderosa pine stands typical of Paradise Ridge. I have observed pygmy nuthatches at various ponderosa pine stands in the Palouse in the past. Rita Dixon (R. Dixon, IDFG, personal communication) told me that the area around Robinson Lake Park in Moscow regularly has pygmy nuthatches, as does Idler's Rest and pretty much any of the areas on the Palouse that still have ponderosa pines.

Kas Dumroese, who resides just outside the Eastern Corridor of the Project Area, but also has land inside the corridor, commonly observes pygmy nuthatches in his ponderosa pine stand (a portion of which is inside the Eastern Corridor) adjacent to his home (K. Dumroese, personal communication). Dr. Dumroese has maintained meticulous records of pygmy nuthatch occurrences on his property since 1996. Between 18 August 1996 and 9 July 2005, he has documented 206 records of pygmy nuthatches on his property, with flocks of up to 26 individuals constituting a single record (Dumroese 2005).

Threats

Timber harvest, fire suppression, and grazing have been identified as key factors causing the degradation of ponderosa pine forests in Idaho and the intermountain west. These human impacts have caused extensive changes in the distribution, structure, and species composition of ponderosa pine forests during the last 100-150 years. Loss of historically open, park-like stands of pine during the 1900's may be responsible for the pygmy nuthatch population declines apparent in recent times. Restoring ponderosa pine forests and woodlands in Idaho, along with studies to determine why nuthatches are declining need to be undertaken in an effort to reverse this trend.

Conservation Status

Range-wide, the pygmy nuthatch is secure (G5), although statewide, it is classified as critically imperiled (S1). However, in a list of Idaho's Special Status Birds (IDFG website **www.fishandgame.idaho.gov/cms/tech/CDC/animals/birds.cfm**), the pygmy nuthatch is given a statewide S2S3 ranking, meaning there is uncertainty of which ranking they should be, S2 (imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction) or S3 (Rare or uncommon but not imperiled). The FS classifies the pygmy nuthatch as a "sensitive species", which includes taxa for which viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. The BLM includes the pygmy nuthatch on its Watch List (Type 5), and it is classified by IDFG as Protected Nongame and a Species of Special Concern (a native species which is either low in numbers, limited in distribution, or has suffered significant habitat loss). Declining pygmy nuthatch observations on the annual statewide Breeding Bird Survey have been responsible, in part, for concern over the status of this species in Idaho.

RESULTS OF FIELD INVESTIGATIONS

Field trips were made to the Project Area on 27 August and 9 September 2005. Because I am somewhat familiar with the Project Area as a result of a similar project on large ungulates, the first trip was primarily a broad reconnaissance to get an idea of potential suitable sites for pygmy nuthatches and long-eared myotis. The second field trip was for the purpose of visiting potential suitable habitat within and adjacent to the Project Area, documenting these sites with photographs, and obtaining GPS coordinates.

Long-eared Myotis

The lack of data on most aspects of long-eared myotis life requirements in Idaho hampers a rigorous analysis of the animal in the Project Area. For example, only 1 graduate project has been completed on this species in Idaho. Based on what we know about habitat preferences and roosting requirements, long-eared myotis likely occur throughout the Project Area, however, densities are unknown. Assuming the bats will roost in timber and are attracted to water to forage, the Eastern Corridor probably provides the greatest amount of suitable foraging habitat and is adjacent to timbered roosting habitat. Ponds located within this corridor likely attract insects that, in turn, attract bats. Dr. Dumroese frequently sees bats foraging in the vicinity of his home, which is adjacent to the Eastern Corridor, however, he does not know which species they are (K. Dumroese, personal communication). Unfortunately, without mist-netting selected sites, the identification of bats to species would not be possible.

Bats could forage throughout the entire Project Area, and if they use man-made structures (e.g., buildings) for roosts, they likely frequent each of the 3 corridors. Given the range of habitats the long-eared myotis occupies, this species appears quite adaptable and able to use features found in all corridors.

Based on what little data are available, it seems apparent that caves and abandoned mines are key components of the bat's habitat needs. However, what we don't know is whether or not caves and mines are necessary for an area to be occupied by the bats, or what influence they have on the level of use and density of bats in a given area. As far as I know, caves and mines are absent from the Project Area.

Cliffs are another habitat feature that attracts bats, especially if there are suitable holes and crevices for them to roost in. No actual cliffs occur in and adjacent to the Project Area, although there is a rocky outcrop on the southwest slope of Paradise Ridge at N46°39.797', W116°59.057' (Figure 1). On 9 September 2005, I inspected this outcrop; fissures in the rocks were few and I did not see any evidence of bat use.

I did not visit any of the ponds in and adjacent to the Project Area for this investigation. However, ponds and their associated insects clearly attract bats. As previously stated, large diameter trees and snags are preferred roost sites in Arizona. And if forested areas, forest edge habitats, riparian areas, and water sources are, indeed, the kinds of areas these bats prefer, the Eastern Corridor should provide the best habitat in the Project Area.

Pygmy Nuthatch

Ponderosa pine stands largely define suitable habitat for the pygmy nuthatch. Suitable habitat is extremely limited in the Project Area and found only at 2 sites along the eastern edge of the Eastern Corridor. I inspected these sites on 9 September 2005.

At the lower end of a forested draw, there is a sparse triangular-shaped stand of ponderosa pine (Figure 2), defined by the following GPS coordinates:
N46°40.578', W116°59.469' (Location A)
N46°40.559', W116°59.469' (Location B)
N46°40.670', W116°59.436' (Location C)
The entire stand, defined by these coordinates, has no more than 60 mature ponderosa pine trees. Locations A and C are adjacent to the intermittent stream associated with the forested draw. I believe that only 5 pine trees (Figure 2, Location A) fall within the eastern boundary of the Eastern Corridor. I did not observe any nuthatches at this site, nor were there any snags or evidence of possible nesting (no cavities were observed). However, participants of the Audubon Societies' Christmas Bird Count have observed pygmy nuthatches in this area (K. Dumroese, personal communication).

The remaining site visited is a stand of ponderosa pine owned by the Dumroese family (Figure 3). This stand is defined by the following GPS coordinates:
N46°39.673', W116°59.742' (Location D)

N46°39.675’, W116°59.759’ (Location E)
N46°39.677’, W116°59.924’ (Location F)
N46°39.724’, W116°59.853’ (Location G)
N46°39.753’, W116°59.780’ (Location H)
N46°39.740’, W116°59.746’ (Location I)
N46°39.766’, W116°59.658’ (Location J)
N46°39.743’, W116°59.612’ (Location K)
N46°39.683’, W116°59.477’ (Location L)
N46°39.679’, W116°59.565’ (Location M)
N46°39.718’, W116°59.644’ (Location N)
The densest part of this stand occurs within the boundaries of Locations D-F. Pines are more sparsely distributed in the area defined by Locations J-N. The down-slope side of the stand borders an intermittent stream and is defined by Locations F-L. The proposed right-of-way alignment for old Alternative 10A (now called E-2) is at Location E. The area located within the Eastern Corridor is loosely defined by Locations E-H (Figure 4).

Pygmy nuthatch vocalizations were heard numerous times while hiking through the stand. On several occasions, nuthatches were observed feeding at outer branches of mature pines. These birds were part of mixed-species flocks that included black-capped chickadees (*Parus atricapillus*), ruby-crowned kinglets (*Regulus calendula*), and likely other small insect-eating passerines. Dr. Dumroese has observed pygmy nuthatches year-round in this stand of pines (K. Dumroese, personal communication). He has also observed juveniles soliciting adults for food at his bird feeders, suggesting that nesting occurs in the vicinity.

Snags (Figure 5) and live trees with dead tops (Figure 6) were observed throughout the pine stand. The left photos in Figure 5 (N46°39.685’, W116°59.805’) and Figure 6 (N46°39.705’, W116°59.851’) are within the Eastern Corridor boundary. Approximately 10 snags and a minimum of 4 live ponderosa pine trees with dead tops were observed throughout the woodlot. Cavities were present in all of these snags and trees, attesting to the value of these structures to cavity-nesting birds.

Another small stand of ponderosa pine is located just south and east of the Dumroese stand and east of the Eastern Corridor boundary (Figure 7). This stand was not visited, but it appears to contain suitable habitat for pygmy nuthatches.

ANALYSIS OF EFFECTS

Direct, indirect, and potential cumulative effects were evaluated for each of the target species and discussed below. The assessment was then synthesized and tabulated (Table 1) for ease in comparing the corridor alternatives. Direct effects are those impacts caused directly by the proposed action. Indirect effects are those caused by or that will result from the proposed action, but are likely to occur at a later time (not immediate). Finally, potential cumulative effects are the combined effects of this action along with unrelated activities that are likely to occur within the Project Area, and when evaluated collectively, could impact these species.

Long-eared Myotis

Direct

I do not foresee any direct effects on this species resulting from highway construction at any of the 3 proposed transportation corridors. Bats do not appear to forage over highways and are thus not prone to collisions with vehicles.

Indirect

Eastern Corridor: No indirect effects were identified, unless water sources (ponds) and stands of ponderosa pine located on the Dumroese property and the bottom of the forested draw are removed and there is no mitigation (e.g., installation of bat boxes) for this removal. However, because so little is known about the presence or density of long-eared myotis in the Project Area, it is difficult to gauge the effect level.
Existing Improved Corridor: No indirect effects were identified, provided existing water features are maintained or mitigated for.
Western Corridor: No indirect effects were identified, provided existing water features are maintained or mitigated for.

Potential Cumulative

Potential cumulative effects may result if there is any pond reduction (all corridors) or if roosting habitat is removed (timbered portions of the Eastern Corridor).

Pygmy Nuthatch

Direct

I do not foresee any direct effects on this species resulting from highway construction at any of the 3 proposed transportation corridors. Pygmy nuthatches do not forage over highways and will not be prone to collisions with vehicles.

Indirect

Eastern Corridor: The removal of suitable habitat (ponderosa pines) at the lower end of the forested draw and the timber stand on the Dumroese property would result in the likely loss of nesting, foraging, and roosting habitat for pygmy nuthatches.
Existing Improved Corridor: No indirect effects were identified if highway construction were to occur in this corridor.
Western Corridor: No indirect effects were identified if highway construction were to occur in this corridor.

Potential Cumulative

Any loss of ponderosa pines, especially mature trees, could have a cumulative effect on the pygmy nuthatch, considering its imperiled status.

SUMMARY OF FINDINGS

Long-eared Myotis

The surface area required for twinning of highways and the associated right-of-ways will result in some loss of potential/existing foraging habitat in the Project Area, irrespective of which transportation corridor is selected. If the Existing Improved Corridor is selected, this loss could be less if parts of existing US 95 are retained. However, there is no way of either measuring this difference or knowing the overall significance road construction may have on bat populations.

Pygmy Nuthatch

Cavity-nesting birds, like pygmy nuthatches, have suffered because of the loss of natural cavities (Ritter 1997). Pygmy nuthatches do occur in the Eastern Corridor and almost certainly nest in ponderosa pines and snags located on the Dumroese property. Suitable nuthatch habitat occurs throughout the Paradise Ridge area, especially the south-facing slopes that are dominated by ponderosa pines.

No suitable pygmy nuthatch habitat occurs in either the Existing Improved Corridor or Western Corridor. There is a small stand of young ponderosa pines in 1 of the habitat patches located in Washington, west of the Western Corridor. This particular area is surveyed each year during the Audubon Societies' Christmas Bird Count, but no pygmy nuthatches have ever been detected (K. Dumroese, personal communication).

CONCLUSIONS

Long-eared Myotis

I believe that impacts, if any, to the long-eared myotis or its habitat resulting from the construction of a new twinned highway in the 3 potential corridors should be negligible and should not jeopardize bat populations. In comparing the 3 potential corridors, impacts would be greater in the Eastern Corridor, primarily because of the diversity of foraging and roosting habitat that exists in and adjacent to this area.

Pygmy Nuthatch

Similarly, impacts to pygmy nuthatches would be greatest if construction occurred in the Eastern Corridor, as that is where suitable habitat exists and is adjacent to additional suitable habitat on Paradise Ridge. While it isn't possible to know if nuthatch populations would be adversely impacted, the potential for loss of nesting, foraging, and roosting habitat exists in the Eastern Corridor, depending on the specific location of the highway. There should be no impact on pygmy nuthatch populations if construction occurred in either the Existing Improved Corridor or the Western Corridor.

Impacts of 10 Alignments within the Project Area

The ITD recently identified 10 preliminary alignments in the 3 potential corridors within the Project Area and requested these alignments be evaluated based on the evaluation for each of the 3 corridor areas. The following section includes my assessment as to whether any issues involving long-eared myotis or pygmy nuthatch are significant enough to warrant construction unacceptable in any of the particular alignments.

Eastern Corridor

The preliminary alignments in the Eastern Corridor include E-1, E-2, and E-3. All 3 alignments follow US 95 from Thorncreek Road to the top of Reisenauer Hill. Alignment E-1 extends straight north from Reisenauer Hill, following an existing powerline before rejoining US 95 at the south end of Moscow. Alignments E-2 and E-3 leave US 95 at Reisenauer Hill, extending far enough east to apparently pass through a stand of ponderosa pines on the Dumroese property (see Figure 3). Alignment E-2 passes through the lower end of a forest draw (see Figure 2), while E-3 crosses this draw below (to the west) of the timber and adjacent to a small pond. Selection of alignment E-1 would not have any impact on either species. Selection of alignment E-2 would result in loss of existing habitat for the pygmy nuthatch on the Dumroese property and the lower end of the forest draw. Selection of alignment E-3 would result in habitat loss for nuthatches only in the ponderosa pine stand on the Dumroese property. If we assume long-eared myotis are roosting in trees and tree cavities, then the selection of either alignment E-2 or E-3 would result in the removal of likely roosting habitat for the bats. However, because so little is known about this bat species in the Palouse Area, I'm unable to predict the impact that either of these alignments would have on resident long-eared myotis populations. Further, without an accurate understanding of the actual status and distribution of pygmy nuthatches in the Palouse area, it is difficult to predict the impact of losing part of the ponderosa pine stand on the Dumroese property to the resident nuthatch population if alignment E-2 or E-3 were selected. See the RECOMMENDATIONS section of the report for both species.

Existing Improved Corridor

The preliminary alignments in the Existing Improved Corridor include C-1, C-2, and C-3. Alignment C-1 follows existing US 95. Alignment C-2 follows existing US 95 from Thorncreek Road to just north of Jacksha Road, then continues into Moscow west of the existing highway. Alignment C-3 follows existing US 95 to just north of Eid Road. At that point, C-3 extends north, generally paralleling, and to the east of, US 95, until it reconnects with the highway near Cameron Road just south of Moscow. None of these alignments would have a detrimental impact on either long-eared myotis or pygmy nuthatch populations.

Western Corridor

The preliminary alignments in the Western Corridor include W-1, W-2, W-3, and W-4. Except for W-4, all alignments extend west of US 95 from Thorncreek Road, rejoining US 95 just south of Moscow. W-4 follows US 95 to just north of Jacksha Road, then extends to the east before returning to US 95 at the outskirts of Moscow. W-1 and W-3 extend the farthest west of all the alignments, but none of the 4 alignments pass through existing bat or nuthatch habitat. None of these alignments would have a detrimental impact on resident long-eared myotis or pygmy nuthatch populations.

RECOMMENDATIONS

Long-eared Myotis

1. Ensure the presence of at least the same number of ponds currently located in the Project Area for the benefit of numerous wildlife species, including bats. Increasing the number of ponds might provide even more benefits to bats and other wildlife.
2. Construct and install bat boxes at selected sites to provide bat roosts. See the Bat Conservation International website at **www.batcon.org** or Nongame Wildlife Leaflet No. 11 on bats (Wackenhut and McGraw 1996) for details on building a bat house.
3. Avoid construction along the eastern edge of the Eastern Corridor where the removal of timbered areas would be necessary.

Pygmy Nuthatch

1. Avoid construction along the eastern edge of the Eastern Corridor where the removal of timbered areas would be necessary.
2. Ponderosa pine snags do not last many years before they rot and the trees topple. Nuthatches would benefit from the installation of nest boxes at selected sites to augment the limited number of natural nesting sites currently available.

REFERENCES AND PERSONAL COMMUNICATIONS

Adams, R. A. 2003. Bats of the Rocky Mountain West: Natural history, ecology, and conservation. University Press of Colorado, Boulder, CO.

Baker, R. J., L. C. Bradley, R. D. Bradley, J. W. Dragoo, M. D. Engstrom, R. S. Hoffman, C. A. Jones, F. Ried, D. W. Rice, and C. Jones. 2003. Revised checklist of North American mammals north of Mexico, 2003. Occasional Papers, Museum of Texas Tech University No. 229, 24 pp.

Bonnell, M. L. 1967. Emergence and foraging behavior in small populations of Idaho bats. M. S. Thesis, University of Idaho, Moscow.

Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. P. Gaines, and M. M. P. Huso. 1997. Atlas of Oregon Wildlife. Oregon State University Press, Covallis, OR.

Dixon, R. Personal communication. Multiple e-mail correspondences on 7 September 2005.

Dumroese, K. 2005. Pygmy nuthatch sighting record listing. Unpublished 7-page report.

Dumroese, K. Personal communication. Telephone conversation on 16 August 2005; E-mail message and sighting file on 8 September 2005; visit to his residence on 9 September 2005.

Fenton, M. B. 1997. Science and the conservation of bats. Journal of Mammalogy 78:1-14.

Gillies, K. E. 2004. Idaho Bat Conservation Plan. *DRAFT*. R. Dixon and C. Harris, eds. Nongame and Endangered Wildlife Program Technical Report. Idaho Department of Fish and Game, Boise, ID.

ECOMAP. 1993. National hierarchical framework of ecological units. Unpublished administrative paper. Washington, D. C.: U.S. Department of Agriculture, Forest Service. 20 pp. Ecoregions of the United States [map, revised ed.]. Robert Bailey, cartographer. 1994. Washington, D. C.: U. S. Department of Agriculture, Forest Service. Scale 1:7,500,000; colored.

Groves, C. R., B. Butterfield, A. Lippincott, B. Csuti, and J. M. Scott. 1997. Atlas of Idaho's Wildlife. Idaho Department of Fish and Game, Boise, Idaho.

Idaho Conservation Data Center. 2005. Global Rank (GRANK) and State Rank (SRANK). Idaho Department of Fish and Game, Boise. Available at **http://www.fishandgame.idaho.gov/cms/tech/CDC/heritage_rnaks.cfm**

Idaho Department of Fish and Game. 2005. Idaho Comprehensive Wildlife Conservation Strategy. Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise, ID. **http://fishandgame.idaho.gov/cms/tech/CDC.cwcs.cfm**

Jageman, H. 2005. Bat Grid Survey, Summer 2005, Palouse Ranger District. Unpublished 1-page report. U.S. Forest Service, Potlatch, ID.

Johnson, R. E. and K. M. Cassidy. 1997. Terrestrial mammals of Washington state: Location data and predicted distributions. Cassidy, K. M., Grue, C. E., Smith, M. R., and K. M. Dvornich. Washington State GAP Analysis – Final Report. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, WA, 304 pp.

Kingery, and Ghalambor. 2001. Pygmy Nuthatch (*Sitta pygmaea*). *In* A. Poole and F. Gill, eds. The Birds of North America, No. 567. The Birds of North America, Inc. Philadephia, PA.

Larrison, E. J., and D. R. Johnson. 1981. Mammals of Idaho. University of Idaho Press. 166 pp.

Manning, R. W., and J. K. Jones, Jr. 1989. *Myotis evotis*. American Society of Mammalogists, Mammalian Species, 329:1-5.

Pierson, E. D. 1998. Tall trees, deep holes, and scarred landscapes: conservation of North American bats. Pp. 309-325 *in* Kunz, T. H. and P. A. Racey, eds. Bat Biology and Conservation. Smithsonian Institution Press, Washington, DC.

Rabe, M. J., T. E. Morrell, H. Green, J. C. DeVos Jr., and C. R. Miller. 1998. Characteristics of ponderosa pine snag roosts used by reproductive bats in Northern Arizona. Journal of Wildlife Management. 62:612-621.

Richardson, P. 2002. Bats. Smithsonian Institution Press, The Natural History Museum, London, United Kingdom, 112 pp.

Ritter, S. 1997. Dead trees and living creatures: The snag ecology of Idaho. Nongame Wildlife Leaflet No. 13. Idaho Department of Fish and Game, Boise. First publication: Idaho Wildlife, Vol. 17, No. 4, Summer/Fall 1997.

Sibley, D. A. 2000. The Sibley guide to birds. Alfred A. Knopf, NY. 543 pp.

Scott, J. M., C. R. Peterson, J. W. Karl, E. Strand, L. K. Svancara, and N. M. Wright. 2002. A Gap Analysis of Idaho: Final Report. Idaho Cooperative Fish and Wildlife Research Unit. Moscow, ID.

Sydeman, W. J., M. Guntert, and R. P. Balda. 1988. Annual reproductive yield in the cooperative pygmy nuthatch (*Sitta pygmaea*). Auk 105:70-77.

Tuttle, M. D. 1997. America's Neighborhood Bats. The University of Texas Press, Austin, TX. 98 pp.

Vonhof, M. J. and R. M. R. Barclay. 1996. Roost-site selection and roosting ecology of forest-dwelling bats in southern British Columbia. Canadian Journal of Zoology 74:1797-1805.

Vonhof, M. J. and R. M. R. Barclay. 1997. Use of tree stumps as roosts by the western long-eared bat. Journal of Wildlife Management 61:674-684.

Wackenhut, M., and M. McGraw. 1996. Idaho's Bats: Description, habitats, and conservation. Nongame Wildlife Leaflet No. 11. Idaho Department of Fish and Game, Boise. First publication: Idaho Wildlife, Vol. 16, No. 4, Summer 1996.

Waldien, D. L., J. P. Hayes, and E. B. Arnett. 2000. Day roosts of female long-eared myotis in coniferous forests in western Oregon. Northwest Science 75:307-331.

Western Bat Working Group. 1998. Ecology, conservation and management of Western bat species. Bat species account. First annual Western Bat Working Group meeting, Reno, NV. 84 pp.

TABLES

Table 1. Possible direct, indirect, and cumulative effects of corridor alternatives on the long-eared myotis and pygmy nuthatch in the Project Area.

Table 1. Possible direct, indirect, and cumulative effects of corridor alternatives on the long-eared myotis and pygmy nuthatch in the Project Area.

Species and Effects	Eastern Corridor	Existing Improved Corridor	Western Corridor[1]
Long-eared Myotis			
Direct Effects[1]	None	None	None
Indirect Effects[2]	None, provided existing water sources and timbered habitat are maintained	None, provided existing water sources are maintained	None, provided existing water sources are maintained
Cumulative Effects[3]	Loss of existing suitable habitat	None	None
Pygmy Nuthatch			
Direct Effects	None	None	None
Indirect Effects	Potential loss of nesting, foraging, and roosting habitat	None	None
Cumulative Effects	Loss of existing suitable habitat	None	None

[1] Direct Effects (DE) are the immediate impacts caused by the proposed action.
[2] Indirect Effects (IE) are the impacts caused by or that will result from the proposed action, but are likely to occur at a later time.
[3] Cumulative Effects (CE) are the combined impacts of this action along with unrelated activities that are likely to occur within the project area, and when evaluated collectively, could impact the species.

FIGURES

Figure 1. Crevice shown in a fractured rock on the southwest end of Paradise Ridge. Bats are known to use rock crevices for roosting.

Figure 2. Ponderosa pines in the lower end of a forested draw, west slope of Paradise Ridge, are reportedly used by pygmy nuthatches. The right photo shows 5 mature ponderosa pines that are located within the boundary of the Eastern Corridor.

Figure 3. This stand of ponderosa pine, owned by the Dumroese family, is used by pygmy nuthatches for foraging and likely roosting and nesting. The top photo was taken from Paradise Ridge; the lower end of this stand, shown in the bottom photo, is located inside the eastern boundary of the Eastern Corridor.

Figure 4. These photographs show the lower end of the ponderosa pine stand owned by the Dumroese family that is located inside the Eastern Corridor boundary.

Figure 5. Snags such as these, as depicted by the holes, are important to cavity-nesting birds, including pygmy nuthatches. The snag in the left photo is inside the Eastern Corridor boundary.

Figure 6. Dead tops of ponderosa pines are used by cavity-nesting birds, including pygmy nuthatches, for nesting and roosting. The tree in the left photo is inside the Eastern Corridor boundary.

Figure 7. A stand of ponderosa pines southeast of Eid Road and just east of the Eastern Corridor is likely used by pygmy nuthatches.

Figure 1. Crevice shown in a fractured rock on the southwest end of Paradise Ridge. Bats are known to use rock crevices for roosting.

Figure 2. Ponderosa pines in the lower end of a forested draw, west slope of Paradise Ridge, are reportedly used by pygmy nuthatches. The right photo shows 5 mature ponderosa pines that are located within the boundary of the Eastern Corridor.

Figure 3. This stand of ponderosa pine, owned by the Dumroese family, is used by pygmy nuthatches for foraging and likely roosting and nesting. The top photo was taken from Paradise Ridge; the lower end of this stand, shown in the bottom photo, is located inside the eastern boundary of the Eastern Corridor.

Figure 4. These photographs show the lower end of the ponderosa pine stand owned by the Dumroese family that is located inside the Eastern Corridor boundary.

Figure 5. Snags such as these, as depicted by the holes, are important to cavity-nesting birds, including pygmy nuthatches. The snag in the left photo is inside the Eastern Corridor boundary.

Figure 6. Dead tops of ponderosa pines are used by cavity-nesting birds, including pygmy nuthatches, for nesting and roosting. The tree in the left photo is inside the Eastern Corridor boundary.

Figure 7. A stand of ponderosa pines south of Eid Road and east of the Eastern Corridor is likely used by pygmy nuthatches.

GENERAL WILDLIFE ASSESSMENT

THORNCREEK ROAD TO MOSCOW

Prepared By:

STATE OF IDAHO
IDAHO DEPARTMENT OF FISH & GAME

FOR

IDAHO TRANSPORTATION DEPARTMENT

Project Number: DHP-NH-4110 (156)
Key Number: 9294

Location
Hwy 95 South of Moscow
Latah County, Idaho

T39N R05W Sections 19, 20, 29, 30, 31, and 32
T39N R06W Sections, 24, 25, and 36
T38N R05W Sections 5, 6, 7, 8, 9, 17, 18, and 20
T38N R06W Sections 1, 12, and 13

USGS Quadrangles: Moscow West, Idaho and Moscow East, Idaho

December 2006

This wildlife assessment was prepared by Idaho Fish and Game, Clearwater Regional Office, at the request of the ITD District 2 Office, Lewiston, Idaho. The assessment satisfies the goals of a Cooperative Agreement between IDFG and ITD that enables ITD to utilize the biological expertise of IDFG in the preparation of biological evaluations of highway projects. The Agreement benefits ITD by expediting the biological evaluation and review process for various projects. The Agreement benefits IDFG by helping direct collection and evaluation of necessary biological information, as well as helping guide the interagency consultation process, both of which are important to the protection and maintenance of plant, fish and wildlife populations.

Introduction

The long-term ecological effects of road construction have been well documented (Evink, *et.al.* 1999). Road construction has both direct and indirect impacts to wildlife and habitat in perpetuity. As long, linear features on the landscape, roads and highways have impacts on wildlife and wildlife habitat that are disproportionate to the area of land that they occupy (Jackson, in Evink *et.al.* 1999; Forman and Deblinger 2000). Road construction can result in significant loss of biodiversity at both local and regional scales due to restricted movement between populations, increased mortality, habitat fragmentation and edge effects, invasion by exotic species, or increased human access to wildlife habitats (Findlay and Bourdages 2000). Effects of highways on wildlife can extend well away from the edge of the roadway (Forman and Deblinger 2000).

The purpose of this report is to assist ITD to evaluate potential direct, indirect and cumulative impacts to wildlife that would be expected to occur with the proposed restructuring of US95 from Thorncreek Road to Moscow and to recommend mitigations for impacts that we have identified to wildlife.

The project area is entirely within Latah County, Idaho. It includes all or portions of T39N R05W Sections 19, 20, 29, 30, 31, and 32; T39N R06W Sections, 24, 25, and 36; T38N R05W Sections 5, 6, 7, 8, 9, 17, 18, and 20; and T38N R06W Sections 1, 12, and 13.

Methods

Although native habitat and wildlife have been severely altered in the project area, the Palouse remains home to many indigenous and introduced wildlife species – too many, in fact, for an inclusive impact analysis. IDFG's goal was to conduct a time and cost-efficient analysis of the potential impacts of the proposed US95 development, by alternative, on a number of representative wildlife species that would provide an indication not only of impact for all species, but would also suggest suitable protections and mitigations for unavoidable impacts. We decided to assess impacts to a limited number of species that could serve as surrogates for all other wildlife species expected to be present in the project area.

An initial list of wildlife species considered for this analysis was generated from several sources. A review of the Idaho state sensitive species list maintained by IDFG Conservation Data Center (CDC) identified one species in the Project area, Pygmy Nuthatch, *Sitta pymaea*. Adding a 5 mile buffer around the project area resulted in addition of one additional species, Yellow-billed Cuckoo, *Coccyzus americanus*. Pygmy Nuthatch was dropped from the SGNC list before this analysis was completed; however, ITD commissioned an analysis for that species prior to this change (Melquist 2005), the results of which we have incorporated by reference here.

Our primary resource was the recently published Idaho Wildlife Comprehensive Wildlife Conservation Strategy (WCS) (IDFG 2005). The WCS is the most complete and most current, peer reviewed summary of Idaho wildlife species at risk available. The WCS was developed from scientific literature as well as information from such national and international programs as Partners in Flight and NatureServe. The WCS strategy summarizes current knowledge about

Species of Greatest Conservation Need (SGN) population status, species' habitat affiliations and ecology, causes for listing and threats to the species, and recommends strategies to protect those species.

The WCS divides the state into Ecological Sections based on habitat. The US95 Thorncreek to Moscow project area lies entirely within the Palouse Prairie Ecological Section. The WCS also describes various habitat types (*e.g.*, arableland, dry conifer forest) found in the Palouse Ecological Section and lists wildlife species expected to reside in or migrate through the Palouse Prairie Ecological Section for each habitat type.

IDFG also reviewed the Washington State Wildlife Comprehensive Wildlife Conservation Strategy for those Washington counties proximate to the project, in case there were some species listed for Washington that might have been missed in the Idaho listings. There were none.

In addition to wildlife species of greatest conservation need listed in the WCS, potential impacts were considered for white-tail deer, elk and moose because of their high social and economic importance to the state and the region. A separate report on the potential impact of the proposed action was prepared for ITD describing potential impacts to big game (Melquist 2005a). We have not incorporated that report herein. IDFG did, however, provide comments to ITD on the draft Melquist report (Cal Groen, IDFG, letter 6/20/2005) and we have included some of our own recommendations regarding big game impacts in the mitigations portion of this report.

For various reasons, not all of the Palouse Ecoregion species listed in the WCS would be impacted by the proposed project. The initial list of wildlife species was further refined by identifying species occurring year-round or breeding within the Palouse Prairie Ecological Section (IDFG 2006, Sibley, D.A. 2000; Burt and Grossenheider 1980) and based on local knowledge of the occurrence of and timing of occurrence of animals in the area (Sauder, IDFG, personal comm.). In addition, species habitat associations described in the WCS were compared with available habitat in the project area using maps (IDFG 2006; Lichtart 2005; Lichtart and Mosely 1997), aerial photos provided by ITD and local knowledge to determine whether suitable habitat was present in or near the project area. Species were removed from consideration if suitable habitat was not present, even though the potential exists for some species to occasionally range far from suitable habitat.

Applying the series of filters described resulted in a refined list of 32 species, including13 vertebrate and 19 invertebrate species, that could reasonably expected to be present in the project area and, therefore, potentially be impacted by the project. These species were examined more closely in the final stage of the wildlife impact analysis. Of these, various species were expected to be present in the project area for all, some or none of the proposed alternatives. Some species (*e.g.,* Spur throated Grasshoppers, California Myotis) were retained for consideration because there was not sufficient information to remove them from the list and/or we determined they could serve as an appropriate surrogate for other species.

Finally, the Palouse Giant Earthworm was considered in the analysis due to high local and academic interest in the species. A petition for listing the earthworm under the federal Endangered Species Act was recently submitted to the US Fish and Wildlife Service.

For each of the species remaining on the refined list, a determination of the likelihood of effect or no effect was made based on occurrence of the species in the project area and/or the presence of suitable habitat in the area. For each species for which a determination of potential effect was made, direct and indirect effects of the Project were described and mitigation recommendations were developed.

Results: Species for which the Project will have No Effect:

Woodhouse's Toad, *Bufo woodhousii*: Woodhouse's Toad are common within their range. However, there have been no reported occurrences of the species in the project area. The closest reported occurrence is a single historical record from Lewiston, which is well outside the project area.

Determination of Effect and Rationale: No Effect

- WCS maps indicate potential occurrences of Woodhouse's Toad near Lewiston, but not within project area.
- Woodhouse's Toad has never been recorded and is not known to occur in the project area.

Mountain Quail, *Oreortyx pictus*: The mountain quail is a year-round resident in the mountain ranges of far western North America. In Idaho, mountain quail are currently restricted in their range to areas of west-central Idaho, with remnant population strongholds in the Riggins area.

Determination of Effect and Rationale: No Effect

- Mountain quail are not present within the project area.
- There is very limited suitable mountain quail habitat within the project area.

Peregrine Falcon, *Falco peregrinus*: Less than 28 historic peregrine nest sites were known from Idaho and peregrines were extirpated as a breeding species by 1974. In Idaho, peregrines aeries are now found at elevations between 696 ft near Lewiston to nearly 8468 ft near Stanley. Most are thought to migrate south of Idaho during winter. Idaho currently has 33 known peregrine nesting territories of which 26 were occupied in 2004. In Idaho, peregrines are associated with mountains, major river corridors, reservoirs and lake basins. The nest sites closest to the project area are located 3 miles east of Clarkston, WA and 2 miles south of Asotin, WA.

Determination of Effect and Rationale: No Effect

- No peregrine falcon nesting territories occur within the project area.
- The project area is outside the normal foraging range of the closest nesting sites.

Yellow-billed Cuckoo, *Coccyzus americanus*: In Idaho, the yellow-billed cuckoo is a rare visitor and local breeder that occurs in scattered drainages primarily in the southern portion of the state. They are reported to occur most frequently and consistently in cottonwood forests with a thick understory. In western United States, the species is a riparian obligate species, needing large blocks of riparian habitat for breeding.

Determination of Effect and Rationale: No Effect

- Yellow-billed cuckoo have not been reported in the project area.
- There is no suitable habitat for this species present within the project area.

Townsend's Big-eared Bat, *Corynorhinus townsendii*: Populations of Townsend's big-eared bat in Idaho occur predominately on the Snake River Plain, but scattered populations have been reported throughout the state. Only 2 maternity colonies have been confirmed in Idaho, both in the Craters of the Moon National Monument. Distribution and abundance of Townsend's big-eared bats is highly correlated with suitable cavity forming rock formations and historic mining.

Determination of Effect and Rationale: No Effect

- No suitable habitat for this species occurs with the project area.
- There are no known populations of the species within the project area.

Nimapuna Tigersnail, A*nguispira nimapuna:* This species is a terrestrial snail endemic to Idaho. Colonies have been found in the South Fork Clearwater, lower Selway and Lochsa River drainages only. Nimapuna Tigersnails are found in streamside habitats in moist coniferous forests. Occupied sites are typically undisturbed and have deciduous trees and diverse forb understories. They are also found in shaded and mossy basalt talus.

Determination of Effect and Rationale: No effect.

- Nimapuna Tigersnails have not been reported in the project area.
- There is no suitable habitat in the project area.

Pale Jumping-slug, *Hemphilla camelus:* Prior reports of presence of Pale Jumping-slug nearest the project were from the Selway and SF Clearwater River drainages and portions of the lower Salmon River valley. Habitat comprises intact closed to nearly closed canopy Ponderosa Pine/Douglas Fir forests adjacent to major streams. The species occurs in relatively moist areas with a diverse plant understory and a duff layer. The prevalent substrate at occupied sites is usually basalt, but limestone- and schist-derived soils occur at some sites.

Determination of Effect and Rationale: No effect.

- There have been no reported occurrences of Pale Jumping-slugs in the project area
- There is no suitable habitat in the project area. (Of three corridors, only the eastern alternative has Ponderosa Pine forest, and that is relatively dry -- there are no major streams in the project area.)

Fir Pinwheel, *Radiodiscus abietum:* Populations of Fir Pinwheel were historically found at scattered sites throughout much of the northern forests. Populations have not been relocated at most sites during recent years, and only one population in the Salmon River valley has been confirmed to be extant. Fir Pinwheel inhabits rocky sites in Douglas Fir forests with a rich understory of forbs, shrubs and bryophytes. Rock formations typically consist of basalt, schist or limestone.

Determination of Effect and Rationale: No effect.

- No populations of Fir Pinwheel have been reported in the project area in recent years.
- There is no suitable habitat in the project area.

Salmon Coil, *Helicodiscus salmonaceus:* Salmon Coil are widespread in the Salmon River drainage. The species appears to occur in relatively dry conditions, often associated with talus or rock outcrops in dry, open sage scrub at low to moderate elevations.

Determination of Effect and Rationale: No effect.

- There is no suitable habitat in the project area.
- There have been no reported occurrences of Salmon Coil in the project area.

Lyre Mantleslug, *Udosarx lyrata*: Lyre Mantleslug occurs only in western Montana and northern Idaho. This species has been found at scattered sites in the Clearwater River drainage; however, current population status is unknown. Lyre Mantleslug occurs in mesic environments in valleys, ravines, gorges or talus fields. One occurrence site was described as subalpine, somewhat open, mixed pine and fir forest with forbs and downed wood. Populations have not been found at disturbed areas.

Determination of Effect and Rationale: No effect.

- Lyre Mantleslug has not been reported in the project area.
- Suitable habitat is unlikely in the project area. There is no suitable habitat in the central or western alignments; marginal habitat may be available in the eastern alignment.

Dry Land Forestsnail, *Allgona ptychophora solida*: Within Idaho, historical distribution of Dry Land Forestsnail includes Hells Canyon, lower Salmon River canyon and lower Clearwater River drainage. Nearest the project area, the lower Clearwater populations are thought to be extirpated. Dry Land Forestsnail inhabits large basalt taluses, most often at the base of north-facing slopes.

Determination of Effect and Rationale: No effect.

- The historic population closest to the project area is thought to be extirpated, and was outside the project area.
- There is no suitable habitat within the project area.

An Oregonian, *Cryptomastix mullani tuckeri:* This species is known to have formerly occurred along the mainstem of the Clearwater River from Orofino to Kooskia; however, its current status is "uncertain" and populations are known to persist in only a limited portion of historic range. Populations are believed to be extirpated from the Orofino area. Typical habitat is intact Ponderosa Pine forests along the Clearwater River, in moist shaded sites at the base of steep slopes with exposed bedrock.

Determination of Effect and Rationale: No effect

- The project area is outside the historic range.
- There is no suitable habitat in the project area.

An Oregonian (Hells Canyon), *Cryptomastix populi:* Idaho populations of this species occur in Snake River, lower Salmon River and lower Clearwater River canyons. They typically occur in basalt talus along lower slopes of the river canyons. Occupied sites are xeric and sparsely vegetated with hackberry, sagebrush and a variety of forbs and grasses.

Determination of Effect and Rationale: No effect

- The project area is outside the known range of the species.
- There is no suitable habitat in the project area.

Humped Coin, *Polygyrella polygyrella:* Current distribution of Humped Coin in Idaho includes several sites in White Bird Canyon, one near Mission Creek and one near Mt. Idaho. Humped Coin were historically present in the Clearwater River drainage. This species inhabits undisturbed open spruce and Douglas fir forests, commonly near basalt, schist or limestone outcroppings and permanent or persistent water. The largest populations are likely to occur in forested talus.

Determination of Effect and Rationale: No effect

- The project area is outside the historic range of Humped Coin.
- There is no suitable habitat available in the project area.

Palouse earthworm, *Drioleirus amercanus:* The Palouse earthworm is endemic to the Palouse bioregion. The species was first reported in 1897, and was described as being common in the area around Pullman, Washington; however, reported occurrences are very rare and there have been no recent confirmed occurrences reported in Idaho. Palouse earthworms inhabit relatively loose, rich soils in undisturbed bunchgrass prairie. Threats include loss of native Palouse habitat to agriculture, development and other disturbances, as well as introduction of European earthworm species.

Determination of Effect and Rationale: No Effect

- There have been no reported occurrences of Palouse earthworm in the project area.
- No remnant Palouse plant communities (suitable habitat) will be effected by the project.

Results: Species for which the Project will have a Potential Effect

The following species are likely to be effected by the project. To be conservative, we retained some species from the WCS listings for which we have limited knowledge of ecology or habitat associations, if we determined suitable habitat might be available in the project area, regardless of known occurrence. For each species, we attempted to identify potential direct, indirect and cumulative impacts and to recommend mitigations for those impacts. A more detailed discussion and a list of mitigations follows the species synopses.

All of the species listed below will be directly effected by loss of habitat. The amount of habitat lost varies between alternatives but, in all cases, is additive to the acreage already taken up by portions of the existing highway, portions of which will be retained as county road. All new construction is an additive impact to that portion of the existing highway that will remain as county road after build-out. We have assumed that all the habitat taken by construction of the new highway is suitable for those species affected.

There are numerous indirect impacts of highways on habitat and wildlife. Some indirect effects may influence wildlife to 1 kilometer or more from the highway (Forman and Deblinger 2000; Forman, 1999; Rudolph, *et.al.* 1999; Carr and Fahrig, 2001). Some known indirect effects, like the spread of exotic plants/invasive weeds along highways and increased vehicle-wildlife collisions are relatively straightforward. Other indirect impacts are not as well understood; for instance, the effects of highway noise on wildlife. Noise can have a number effects on wildlife, including causing avoidance of suitable habitat, interfering with breeding bird songs and communication, etc.; however, direct causal relationships between highway noise and declines in wildlife have been difficult to establish. For instance, highways adversely effect amphibian populations, but no clear links have been established to noise alone as a cause (Kaseloo and Tyson 2004). The effect of noise on birds has been more extensively studied and effects on both populations and breeding success have been established at varying distances from roads (Kaseloo and Tyson 2004; Forman and Deblinger 2000).

Specific indirect cause-effect relationships have not been well established; however, there is clearly a relationship between traffic volume and both the degree of impact and the distance of indirect impacts from highways on wildlife. The greater the traffic volume, the more pronounced the impact on wildlife (Kaseloo and Tyson 2004; Forman and Deblinger 2000; Forman, et.al. 2003; Alexander, *et.al.* 2005). Based on available literature (primarily Forman and Deblinger 2000) and based on projected traffic volumes for US95, we have adopted a "wildlife impact zone" or "zone of effect" of 300 meters from the edge of the highway for this analysis.

The most notable indirect effect of this project for many species will be fragmentation of habitat by the four-lane highway. The new road will be a 4-lane divided highway; the existing road is an undivided 2-lane. Speed limits on the new road will be increased by 5 miles per hour, from 60 mph to 65 mph. The number of vehicles using the new highway is projected to increase from 6130 vehicles per day to 9440 vehicles per day in about 20 years. Increased width of crossing, increased speeds and increasing numbers of vehicles will all impact the permeability of the highway for wildlife. Even if all the recommended mitigations are implemented, we anticipate there will be at least partial fragmentation of existing habitat as a result of this project, some from avoidance, resulting in isolation of individuals or populations. We also anticipate that the project will result in an increase in loss of individuals of most species due to the increased likelihood of wildlife-vehicular collisions; some of this loss may be significant.

We believe that selection of the eastern alternative would result in the most direct and indirect impacts to the greatest number of wildlife species in the project area. The proposed eastern alternative is closest to the largest tracts of the best remaining habitat in the project area; therefore, this habitat should support the greatest diversity of species and largest populations of species in the project area. Proximity of the highway to good habitat may increase avoidance of that valuable habitat by large ungulates (Melquist, 2005a), as well as other species. We also anticipate that there would be more vehicle/wildlife collisions on an eastern alignment because that alignment would be closest to preferred habitat; thus, more animals are likely to be present and attempting to enter/cross the road than would be encountered on central and western alignments. Effects of a new highway would be most pronounced for the eastern alignment.

Determination of cumulative impacts was somewhat problematic. Since habitat condition and land use will be the primary impacts on wildlife in the area, changes in land use as a result of the project would largely determine cumulative impact. Commercial and residential development in the project area is currently on the rise; however, the highway project itself is not anticipated to cause significant acceleration of growth along the new alignment (HDR Engineering 2005). Except for the area immediately south of Moscow, all of the Alternatives would have a moderate to low potential to induce development (HDR Engineering 2005). We anticipate that land use is likely to remain very similar to current conditions. Therefore, with appropriate mitigations, we have concluded that the cumulative impact for all species should be negligible.

The following species are likely to be effected by the project:

Northern Alligator Lizard, *Elgaria coerulea*: Idaho populations of Northern Alligator Lizard occur in the Panhandle region from Boundary County south to northern Clearwater County; however, the species is rarely encountered and poorly documented. The species occurs in coniferous forests, often in clearings or along forest edges. Sites typically have a prominent understory that includes grass or brush and surface debris, such as leaf litter, exfoliated bark, rotting logs and talus.

Determination of Effect and Rationale: Potential Effect -- Eastern Alternative only.

- Suitable habitat occurs only in the easterneastern alternative.

Direct Effects:

- Loss of habitat.

Indirect Effects:

- Potential loss to vehicle collisions.
- The road is likely to be a partial to complete barrier to movement.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Protection/restoration of suitable habitat at selected sites in or near the project area (purchase, easements, etc.). A detailed survey of the project area is needed to define actual acreage of potentially-suitable habitat for this species that is impacted.
- Installation of bridges, culverts in the project designed to allow movement of small terrestrial vertebrates, including potential retrofitting of existing structures.

Ring-necked Snake, *Diadophis punctatus*: The ring-necked snake is widespread throughout North America, but the distribution in the western part of the range is sparse and discontinuous. The species has been detected in two parts of Idaho. A cluster of populations occurring in west-central Idaho comprises records from the Clearwater and Potlatch River drainages and the lower Salmon River drainage near Whitebird. These populations extend into eastern Washington and are disjunct from populations occurring in central Washington by about 130 km. Ring-necked snake habitat requirements are poorly understood. In west-central Idaho, localities are typically adjacent to perennial rivers or streams in grassland or forested habitats.

Determination of Effect and Rationale: Potential Effect, all alternatives.

- Species distribution and/or occurrence within the project area is unknown

Direct Effects:

- Loss of potential habitat. Most of the suitable habitat is likely to be in the forested or shrubby areas in the eastern corridor and in riparian areas in all corridors.

Indirect Effects:

- Potential loss to vehicle collisions.
- The road is likely to be a partial to complete barrier to movement.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Bridges/culverts for streams and riparian areas wide enough to provide passage of terrestrial wildlife, including potential retrofitting of existing structures where appropriate.
- Wildlife passage culverts should be installed to retain connectivity between existing suitable habitats that would be fragmented by the highway. Culverts should be sized to accommodate use by multiple species.
- Avoidance, restoration of suitable forest habitat, streams and riparian areas to provide habitat.

Swainson's Hawk, *Buteo swainsoni*: In Idaho, this species breeds throughout the southern half of the state, as well as in the Palouse region of the Northwest. There are an estimated 16,800 breeding individuals in Idaho. The species is considered abundant and stable in Idaho and they fare well in agricultural areas. Swainson's breed in the Palouse and generally nest in trees and shrubs near riparian areas adjacent to agricultural lands.

Determination of Effect and Rational: Potential Effect

- Swainson's Hawk occurs across the project area and would be impacted by all three alternatives. Breeding and foraging habitats are present in all three alternatives.

Direct Effects:

- Loss of breeding and foraging habitat. Breeding habitat is limited in the project area, likely restricted to riparian areas with suitably large trees.
- Foraging occurs over the entire project area. The project will eliminate foraging habitat, the acreage of which varies by alternative; however, adequate foraging habitat will remain to support existing populations.

Indirect Effects:

- Increased numbers of collisions with vehicles.
- Potential impacts on prey species.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Avoidance, protection/restoration of riparian areas, especially larger trees or shrubs suitable for breeding.
- Protection/restoration of native vegetative communities and other suitable habitat.

Long-billed Curlew, *Numenius americanus*: The current population size of this species is unknown in Idaho. Long-billed curlews nest in open short-grass or mixed-prairie habitat with level to slightly rolling topography. They generally avoid areas with trees, high-density shrubs and tall, dense grasses. In Idaho, this species forages predominately in grassland, but may switch to plowed fields and wet pastures if grasslands become too tall or dense after high spring rainfall.

Determination of Effect and Rational: Potential Effect

- There are no known resident populations within the project area; however, long-billed curlews migrate through the area and occasionally stop to rest and feed within project boundaries.

Direct Effects:

- Loss of foraging habitat.

Indirect Effects:

- Vehicle collisions.
- Based on observations of curlew foraging activity in proximity to US95 near Grangeville, we do not anticipate avoidance of foraging habitat within 300 meters of the highway.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Protection/restoration of native vegetative communities and other habitat suitable habitat.

Short-eared Owl, *Asio flammeus*: The short-eared owl is one of the world’s most widely distributed owls, occurring throughout much of North America. Based on North American Breeding Bird Survey (BBS) data from 1994-2004, the species is most common in the intermountain west and upper Midwestern states, including Idaho, and the western and central provinces of Canada. The short-eared owl is a confirmed or suspected breeder across nearly all of Idaho and there are winter records in the northern and southern portions of the state. The estimate of the population size in Idaho is about 32,000 individuals. Short-eared owls are typically associated with open landscapes such as marshes, grasslands, tundra and agricultural lands (e.g., pastures, stubble fields, and hay fields).

Although they will utilize wooded environments during winter, they rarely breed in forests, except in areas that have been cleared of trees. Breeding habitats typically support sufficient vegetation (primarily grasses and forbs) to provide ground nesting and roosting cover and are in close proximity to productive and open hunting areas with abundant supplies of small mammals. In areas with sparse snowfall, short-eared owls will winter in the same areas as they breed, as long as these areas continue to provide shelter from the weather, support ample populations of small mammals and have low human disturbance. Where snows are deep enough that birds become conspicuous when on the ground, short-eared owls often will roost in forest and woodland environments.

Determination of Effect and Rational: Potential Effect

- Short-eared Owl occurs in all project corridors. They are present in the project area year-round. Foraging occurs in all corridors; nesting is known to occur within the project area.

Direct Effects:

- Foraging occurs over the entire project area. The project will eliminate foraging habitat, the acreage of which varies by alternative; however, adequate foraging habitat will remain to support existing populations.
- Short-eared owls overwinter in the Palouse. When snow remains on the ground, the owls may rely on forest/woodland habitat in the eastern portion of the project area for roosting. Removal of forest/woodland habitat on the eastern alternative may result in a reduction of winter roosting habitat.

Indirect Effects:

- Increased loss due to vehicle collisions. Short-eared owls forage close to the ground.
- Habitat fragmentation and avoidance.
- Disturbance from noise and activity may affect foraging, roosting, breeding.
- Potential impacts on prey species.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Avoidance, protection/restoration of suitable nesting and foraging habitat. This species benefits from any actions or projects that protect, enhance, or restore potentially suitable foraging and breeding habitats (IDFG 2006).
- Installation of fencing or reflective "posts" or installation of reflectors on other highway structures in key flight and/or foraging areas to be identified by wildlife biologists (Jacobson 2005). Short-eared owls are prone to vehicle collisions because they forage close to the ground. Fencing or reflective posts may cause short-eared owls to fly higher over highways, reducing collisions with vehicles.

- Avoid known nesting sites during construction. Monitor suitable nesting habitat prior to ground disturbing activities and schedule to avoid disturbance.
- Support a study of effect of highway disturbance on short-eared owl population distribution and breeding success, other impacts.

Grasshopper Sparrow, *Ammodramus savannarum***:** In Idaho, this species is locally abundant wherever suitable habitat occurs throughout the Snake River plain in the south and the Palouse in the north. This species is found in prairies, old fields, open grasslands, cultivated fields and savannas where it eats insects, other small invertebrates, grain and seeds. Grasshopper sparrow appears to prefer moderately open grasslands and prairies with patchy bare ground, occupying lusher areas with shrub cover in arid grasslands of the west (Vickery 1996). Tends to be extremely shy and secretive; even its song, which is weak and insect-like, makes this species difficult to detect during the breeding season.

Determination of Effect and Rationale: Potential Effect

- Species has potential to occur throughout the project area.

Direct Effects:

- Loss of foraging, perhaps breeding habitat.
- Increased fragmentation of suitable Palouse habitat. Habitat loss, fragmentation and degradation are reported to be the primary reasons for population declines of the grasshopper sparrow in North America.

Indirect Effects:

- Potential for increased number of collisions with vehicles.
- Potential highway disturbance impacts. Potential impact on breeding success. This species tends to be extremely shy and secretive; even its song, which is weak and insect-like, makes this species difficult to detect during the breeding season.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Can be partially mitigated by avoiding native Palouse remnant vegetation.
- Purchase, easements to protect/restore Palouse prairie habitat. Conversion of native grasslands to agricultural land (*e.g*., on the Palouse) has likely contributed to local and regional population declines.
- Survey Grasshopper Sparrow population in project area prior to, during and after construction to assess impacts of highway disturbance on the species.

Pygmy Nuthatch, *Sitta pygmaea* **:** (From Melquist 2005) At least 6 subspecies of pygmy nuthatches have been described; *S. p. melanotis* is the subspecies present in Idaho. The pygmy nuthatch is a year-round resident in ponderosa and similar pines from south-central British Columbia and mountains of the western U.S. to central Mexico. Throughout its range, the patchy distribution of the nuthatch is dictated by the patchy distribution of pines. In northern Idaho, it is locally common, less common in the west-central mountains, and rare in the southern and eastern parts of the state. In Idaho, the pygmy nuthatch is generally limited in its distribution to the southern slope of mountains at elevations up to approximately 3,500 feet, where it occupies suitable habitat year-round. Nuthatches nest in natural or excavated cavities in dead pines, live trees with dead sections, standing snags, and they may even use posts. The birds may use the same cavity trees for nesting and year-round roosting. Nuthatches prefer old-growth, mature, undisturbed forests for nesting.

Determination of Effect and Rationale: Potential Effect – eastern alternative only=

- Suitable habitat exists in or near the proposed eastern alternative.

Direct Effects:

- Plans for the eastern corridor include removal of suitable habitat (Ponderosa Pines) at the lower end of the forested draw and the timber stand on the Dumroese property, a loss of nesting, foraging, and roosting habitat.

Indirect Effects:

- Potential disturbance impacts.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- Avoid construction along the eastern edge of the eastern corridor where the removal of habitat trees would be necessary.
- Time removal of trees to avoid/minimize impacts to nesting birds. Consult with IDFG regarding timing.
- Ponderosa Pine snags do not last many years before they rot and the trees topple. Nuthatches would benefit from the installation of nest boxes at selected sites to augment the limited number of natural nesting sites currently available and to replace any nesting sites lost.
- Protection or restoration of suitable mature Ponderosa Pine forest at a minimum 1:1 ratio.

California Myotis, *Myotis californicus*: (From Melquist 2005) The Idaho distribution of this bat species is poorly understood. Most authorities consider this species to occur in the northern and extreme western parts of the state, but scattered records suggest that the species may occur statewide. Little information is available to describe habitat affiliations or ecology of this species in Idaho. Dry conifer forest, sagebrush steppe, riparian, and juniper habitats have been reported. Roost types in Idaho are also poorly known. Characteristics of roosts used for maternity sites and hibernacula in the state are not known. Elsewhere, buildings and bridges are major roost types, and individuals are also found under loose tree bark. Characteristics of roosts used for maternity sites and hibernacula in the state are not known; elsewhere a maternity colony of 52 individuals was reported in a large diameter snag.

Determination of Effect and Rationale: Potential Effect

- California Myotis have not been identified in the project area; however, differentiating between this and similar bat species requires close examination that has not been attempted in the project area. Bats are present in the project area; and suitable habitat exists for this species. Therefore, California Myotis are assumed to be present. Even if California Myotis are not present, protections/mitigations identified for this species will provide benefits for other species of bats common in the project area.

Direct Effects:

- Bats tend to forage primarily over water where insects are plentiful, often near and over water. The project will impact stream, riparian and wetland habitat in varying amounts, depending on alternative selected. There will be both short-term (during construction, prior to wetland restoration) and permanent loss of foraging habitat in all alternativess.
- Myotis species are known to use crevices in the bark of large Ponderosa Pine for roosting habitat. Removal of mature Ponderosa Pine may eliminate some roosting habitat if the eastern alternative is selected.

Indirect Effects:

- Bats are prone to collisions with vehicles. The four lane, higher speed highway is anticipated to increase the number of bats lost to collisions.
- Overpasses, bridges and culverts are often used by bats as roosting habitat. Such structures built in the new construction may attract bats to, thus increasing chances for bat losses to vehicles.
- New highway may fragment bat habitat – separate roosting/nesting sites from foraging areas, normally around ponds, streams and wetlands, thus forcing migration across highways, increasing chances for bat losses to vehicles.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis to maintain foraging habitat.
- Installation of suitable day and night roosting "facilities" in culverts and bridges, including retrofitting those on the "old" portion of US95 or at other roads in or near the project area (*i.e.*, away from heavy traffic). It may be appropriate to construct bridges on the new highway to discourage roosting (*e.g.*, do not seal joints).
- Construction of ponds, wetlands at suitable sites away from the highway to attract bats away from the highway to reduce collisions with vehicles.

A Stonefly, *Capnia zukeli*: This stonefly species is an Idaho endemic and is known from localities in Latah County. The habitat requirements of this species have not been described. In general, however, stonefly populations are affected by changes to aquatic habitat such as alteration of stream flow patterns, streambed substrate, thermal characteristics and water quality. Specific threats to Idaho populations of *Capnia zukeli* have not been identified; however, alteration and degradation of aquatic habitat is the primary concern for Idaho stonefly populations.

Determination of Effect and Rationale: Potential Effect

- The Thorncreek Road to Moscow project will impact several streams and drainages and wetlands that may provide habitat for *Capnia zukel.*

Direct Effects:

- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there may be some permanent loss of suitable habitat in all alternativess.

Indirect Effects:

- Loss to vehicles.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- For all alternativess, replace/restore all stream habitat effected on a 1:1 basis. There will be short term impacts, but no long-term adverse impacts on flow patterns, streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Stonefly, *Soyedina potteri*: This species occurs in Idaho and Montana. In Idaho, the species is known to occur in Clearwater and Idaho counties. The species occurs in creeks, small streams and small springs. Specific threats to Idaho populations of *Soyedina potteri* have not been identified. In general, however, stonefly populations are affected by changes to aquatic habitat such as alteration of stream flow patterns, streambed substrate, thermal characteristics and water quality. Alteration and degradation of aquatic habitat is the primary concern for Idaho stonefly populations.

Determination of Effect and Rationale: Potential Effect

- The Thorncreek Road to Moscow project will impact several streams and drainages and wetland that may provide habitat for *Soyedina potteri.*

Direct Effects:

- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there may be some permanent loss of suitable habitat in all alternatives.

Indirect Effects:

- Loss to vehicles.

Cumulative Effects:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis. There will be short term impacts, but no long-term adverse impacts on flow patterns, streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Stonefly, *Capnia lineate*: The distribution of this species includes localities in Idaho and California. In Idaho, the species is known to occur only in Latah County. No information has been documented that describes the habitat requirements of this species beyond the fact that nymphs occur in creeks. Specific threats to Idaho populations have not been identified. In general, stonefly populations are affected by changes to aquatic habitat such as alteration of flow patterns, streambed substrate, thermal characteristics and water quality. Alteration and degradation of aquatic habitat is the primary concern for Idaho populations.

Determination of Effect and Rationale: Potential Effect

- The Thorncreek Road to Moscow project will impact several streams and drainages and, depending on the Alternative selected, up to 7.06 acres of wetland that might provide habitat for *Capnia lineate.*

Direct Effects:

- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there may be some permanent loss of suitable habitat in all alternatives.

Indirect Effects:

- Loss to vehicles.

Cumulative Impacts:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis. There will be short term impacts, but no long-term adverse impacts on flow patterns, streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Stonefly, *Perlomyia collaris*: This species occurs in California, Idaho, Oregon, British Columbia and the Yukon Territory. In Idaho, the species is known only in Nez Perce County. Habitats includes creeks and rivers of the Pacific Northwest, particularly in spring-fed areas. Specific threats to Idaho populations have not been identified. In general, stonefly populations are affected by changes to aquatic habitat such as alteration of flow patterns, streambed substrate, thermal characteristics and water quality. Because this species is associated with sites having particularly high water quality, populations may be especially vulnerable at alteration and degradation of aquatic habitat.

Determination of Effect and Rational: Potential Effect

- The Thorncreek Road to Moscow project will impact several streams and drainages and, depending on the alternative selected, up to 7.06 acres of wetland that might provide habitat for *Perlomyia collaris.*

Direct Effects:

- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there may be some permanent loss of suitable habitat in all alternatives.

Indirect Effects:

- Loss to vehicles.

Cumulative Impacts:

- Negligible, with appropriate mitigations.

Potential Mitigations:

- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis. There will be short term impacts, but no long-term adverse impacts on flow patterns, streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Stonefly, *Taenionema umatilla*: This species occurs in west central Idaho and eastern Oregon. In Idaho, the species is known from locations in Latah County. Specific threats to Idaho populations have not been identified. In general, however, stonefly populations are affected by changes to aquatic habitat such as alteration of stream flow patterns, streambed substrate, thermal characteristics and water quality. Alteration and degradation of aquatic habitat is the primary concern for Idaho populations.

Determination of Effect and Rationale: Potential Effect

- The Thorncreek Road to Moscow project will impact several streams and drainages and, depending on the alternative selected, up to 7.06 acres of wetland that might provide habitat for *Taenionema umatilla.*

Direct Effects:

- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there may be some permanent loss of suitable habitat in all alternatives.

Indirect Effects:
- Loss to vehicles.

Cumulative Impacts:
- Negligible, with appropriate mitigations.

Potential Mitigations:
- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis. There will be short term impacts, but no long-term adverse impacts on flow patterns, streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Mayfly, *Paraleptophlebia traverae*: This species in known to occur only in Idaho and may be endemic to a single locality in Idaho County. Current status of the species in not known. The habitat occupied by this species has not been described. In general, mayfly populations are affected by changes to aquatic habitat, such as alteration of flow patterns, streambed substrate, thermal characteristics and water quality. Alteration and degradation of aquatic habitat is the primary concern for Idaho populations. Specific threats to Idaho populations have not been identified.

Determination of Effect and Rationale: Potential Effect
- The Thorncreek Road to Moscow project will impact several streams and drainages and, depending on the alternative selected, up to 7.06 acres of wetland that might provide habitat for *Paraleptophlebia traverae.*

Direct Effects:
- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there may be some permanent loss of suitable habitat in all alternatives.

Indirect Effects:
- Loss to vehicles.

Cumulative Impacts:
- Negligible, with appropriate mitigations.

Potential Mitigations:
- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis. There may be short term impacts, but no long-term adverse impacts on flow patterns,

streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Mayfly, *Parameletus columbiae*: Idaho distribution includes four occasions in Latah, Blaine and Teton counties. Specific threats to Idaho populations have not been identified. In general, mayfly populations are affected by changes to aquatic habitat, such as alteration of flow patterns, streambed substrate, thermal characteristics, and water quality. Alteration and degradation of aquatic habitat is the primary concern for Idaho populations. Specific threats to Idaho populations have not been identified.

Determination of Effect and Rationale: Potential Effect
- The Thorncreek Road to Moscow project will impact several streams and drainages and, depending on the alternative selected, up to 7.06 acres of wetland that might provide habitat for *Parameletus columbiae.*

Direct Effects:
- There will be short-term disruption of potential habitat during construction.
- Depending on design of stream and ditch passage through the highway ROW, there will be some permanent loss of suitable habitat in all alternatives.

Indirect Effects:
- Loss of individuals to vehicle collisions.

Cumulative Impacts:
- Negligible, with appropriate mitigations.

Potential Mitigations:
- For all alternatives, replace/restore all stream habitat effected on a 1:1 basis. There may be short term impacts, but no long-term adverse impacts on flow patterns, streambed substrate, thermal characteristics or water quality and stream connectivity will be maintained throughout the project area.
- Potential wetland habitat area will be maintained (alternative W and C) or increased slightly (alternative E).

A Spur-throat Grasshopper, *Melanoplus digitifer*: This grasshopper has been reported to occur at localities in Oregon and Idaho. In Idaho, this species has been found in Adams, Butte Caribou, Clearwater, Custer, Idaho and Valley counties. Specimens have been collected between 1160-1830 m. Habitat affiliations are not documented for this species. Threats to grasshoppers include pesticides and habitat modification. Although conversion of native habitat to agricultural uses has benefited some grasshopper species, there are not data to suggest that agriculture has benefited this species. Close similarities within the species and an abundance of races makes identification difficult.

Determination of Effect and Rationale: Potential Effect

- Although this species has not been reported in the project area, and although habitat affiliations have not been described for this species, this species has been reported in the Palouse and is included to represent similar species that may be affected by the project.

Direct Effects:
- Loss of suitable habitat. ROW as habitat loss.

Indirect Effects:
- Vehicle of individuals to collisions.

Cumulative effects:
- Negligible, with appropriate mitigations.

Potential Mitigations:
- Purchase, easement other protections/restoration for remnant native plant communities.
- Replace lost habitat.

A Spur-throat Grasshopper, *Melanoplus payettei*: This species occurs in Washington, Oregon and Idaho. In Idaho, specimens have been reported from Latah, Washington, Idaho and Valley counties. Threats to grasshoppers include pesticides and habitat modification. Although conversion of native habitat to agricultural uses has benefited some grasshopper species there are not data to suggest that agriculture has benefited this species. Specific threats to this taxon were unknown. Close similarities within the species and an abundance of races makes identification difficult.

Determination of Effect and Rationale:		**Potential Effect**
- Although this species has not been reported in the project area, and although habitat affiliations have not been described for this species, this species has been reported in the Palouse and is included to represent similar species that may be effected by the project.

Direct Effects:
- Loss of suitable habitat. ROW as habitat loss.

Indirect Effects:
- Loss of individuals to vehicle collisions.

Cumulative Effects:
- Negligible, with appropriate mitigations.

Potential Mitigations:
- Purchase, easement other protections/restoration for remnant native plant communities.
- Replace lost habitat.

Recommended Mitigations Discussion:

The most pervading limiting factor and threat for wildlife in the Palouse ecosystem, including the project area, is the loss of habitat to agriculture and other development. Palouse Grasslands have been converted nearly 100 percent to cultivated agriculture, making it an imperiled ecosystem (Lichtardt and Mosely 1997), perhaps the most endangered prairie ecosystem in North America (Noss, *et.al.* 1995). Nearly 90 percent of Ponderosa Pine plant communities have been lost in Latah County as well. Remnants of native Palouse plant communities may provide habitat for some species of wildlife dependent on those plant communities, including some of the species included in this assessment. Although the project will avoid direct impacts to remnant native plant communities, the effects of highways extend well beyond the edge of pavement (Forman and Deblinger 2000). We anticipate the new road will have indirect effects on some of those plant communities and their associated wildlife.

Also at risk in the project area are habitat types that provide relatively undisturbed cover and forage for many species; for instance, mixed grassland, shrub and forest that provide year-round habitat for deer, elk, moose and a variety of other game and non-game bird species. Agricultural fields provide habitat for species like pheasants, quail and gray partridge, but only if adequate grassland and woody cover is available nearby. The highway project will unavoidably reduce some of these valuable habitat components in the project area.

Habitat and wildlife would be most severely impacted by the proposed eastern corridor. The proposed eastern corridor lies along the toe of the Paradise Ridge slope. Paradise Ridge supports a rich diversity of native Palouse Prairie and important stands of Douglas hawthorne and Ponderosa Pine. It is home year-round to elk, white tail deer, moose and a variety of other wildlife. In addition to direct effects, the highway project is likely to have the greatest indirect impacts on wildlife if the eastern corridor is selected (Melquist 2005a; Melquist 2005b; Forman and Deblinger 2000). For instance, elk are likely to be displaced from suitable habitat along the base of the ridge as a result of increased activity (Melquist 2005a); other species may be displaced from suitable habitat as well.

As always, the first priority of mitigation should be avoidance. Because the eastern corridor would have the greatest impact on wildlife and habitat, due to both direct and indirect impacts to Paradise Ridge, we recommend the central and western alternatives over the eastern alternative to avoid those additional impacts.

Regardless of alternative selected, habitat will be lost in perpetuity. Because wildlife habitat is in such short supply and already imperiled in the project area, replacement of the habitat lost as a result of the project should be the primary focus of mitigation for the Thorncreek to Moscow project.

We recommend identification, protection and restoration of suitable wildlife habitat in or near the project area *at a minimum* ratio of 1:1 (acres replaced, protected and/or restored to acres impacted) for the western or central alternatives. If the eastern alternative is chosen, in consideration for the potentially greater direct and indirect impacts in the eastern corridor, we recommend replacement, protection or restoration of habitat at a ratio of 2 acres replaced for each acre impacted. Emphasis should be on replacement of habitat lost with like habitat (*e.g.*, mixed grassland for mixed grassland) or improvement of habitat to benefit affected species (*e.g*, replacement of cultivated land with shrub/grassland). Long-term or, preferably, permanent protection of replacement wildlife habitat should be insured. Acreage impacted should be calculated so that it includes a minimum 300 meter "zone of effect" from the edge of the pavement.

Maintaining connectivity across the landscape is also very important to wildlife in the project area. We have recommended the installation of wildlife passage structures (terrestrial culverts, culverts and bridges to accommodate terrestrial passage, etc.) as potential mitigation for many of the species in our assessment. Melquist (2005a) recommended wildlife passage structures for large ungulates; IDFG supports Melquist's recommendations, consistent with our past recommendations for structures to pass large wildlife.

Many structures can be designed to provide passage for numerous wildlife species, including both the species we assessed and other species they represent in the surrogate analysis. Design, location and spacing of various wildlife passage structures will be critical for effective mitigation for multi-species impacts. It is important to note that wildlife passage structures rely on careful selection, planting and maintenance of vegetation leading to and through wildlife structures, and that fencing may also be a critical functional component for some or all wildlife passage structures. We have not identified those components separately in our mitigation recommendations, but assume they will be incorporated as necessary to make any installed passage structures functional. As part of the mitigation, for all the crossing structures, we recommend consultation with IDFG when designing the crossing structures, planning their installation and monitoring their effectiveness.

The indirect effect of highways is poorly understood. Funding studies to evaluate the indirect effects of this highway project on a number of species, including the effectiveness of wildlife crossing structures, should be considered as possible mitigations. Surveys of Grasshopper Sparrow and Short-eared Owls and an assessment of the highway impacts on these species might be particularly appropriate for this project and will provide information useful for future projects. Similarly, post-construction monitoring of wildlife use of passage structures installed as part of the project should be integral to the project. Consult IDFG regarding the design and implementation of these studies.

Finally, we would like to note that the list of mitigations we have suggested is not exhaustive; many other mitigation options are available that alone or in combination may provide similar protections for wildlife.

References:

Alexander, S.M., N.M. Waters and P.C. Paquet. 2005. Traffic volume and highway permeability for a mammalian community in the Canadian Rocky Mountains. The Canadian Geographer. 49:4 (2005) 321-331.

Burt, W.H. and R.P. Grossenheider. 1980. Peterson Field Guide to Mammals, North America north of Mexico. Houghton Mifflin Pub. 3d Edition.

Carr, L.W and L. Fahrig. 2001. Effect of road traffic on two amphibian species of differing vagility. Conservation Biology 15 (4), 1071.

Evink, G.L., P. Garrett and D. Zeigler, eds. 1999. Proceedings of the Third International Conference on Wildlife Ecology and Transportation. FL-ER-73-99. Florida Department of Transportation, Tallahassee, Florida.

Findlay, C.S and J. Bourdages. 2000. Response time of wetland biodiversity to road construction on adjacent lands. Conservation Biology 14:86-94.

Forman, Richard T. T. & Deblinger, Robert D. 2000. The ecological road-effect zone of a Massachusetts (U.S.A.) suburban highway. *Conservation Biology* 14 (1), 36-46.

Forman, R.T.T, B. Reineking and A.M. Hersperger. 2002. Road traffic and nearby grassland bird patterns in a suburbanizing landscape. Environmental Management 29:6. (zone of influence)

Forman, R.T. *et.al.* *Road Ecology: Science and Solutions.* Island Press, Washington.

HDR Engineering. 2005. US95 Thorncreek Road to Moscow community profile and induced development. Report to Idaho Transportation Department, November, 2005.
Idaho Department of Fish and Game. 2006. Idaho Comprehensive Wildlife Conservation Strategy. Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise ID http://fishandgame.idaho.gov/cms/tech/CDC/cwcs.cfm)

Jacobson, S. L. 2005. Mitigation measures for highway-caused impacts to birds. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.2005.

Kaseloo, P.A. and K.O. Tyson. 2004. Synthesis of noise effects on wildlife. US Federal Highway Administration Report Report No.FHWA-HEP-06-016.

Lichtart, J. 2005. Draft biological evaluation of plant species and communities of conservation concern in the US 95 – Thorncreek to Moscow project area. Idaho Dept Fish and Game, Conservation Data Center.

Lichtart, J. and R.K. Mosely. 1997. Status and conservation of the Palouse grassland in Idaho. Idaho Department of Fish and Game. 28 pp and appendices.

Melquist, WE. 2005a. Draft biological evaluation on the potential impacts of corridor alternatives from Thorncreek Road to Moscow on large ungulates. Crex Consultants for Idaho Dept of Transportation.

Melquist, WE. 2005b. Biological evaluation on the potential impacts of corridor alternatives from Thorncreek Road to Moscow on long-eared myotis and pygmy nuthatches. Crex Consultants for Idaho Dept of Transportation.

Noss, R.F., E.T. LaRoe III, and J.M. Scott. 1995. Endangered ecosystems of the United States: A preliminary assessment of loss and degradation. USDI National Biological Service, Biological Report 28. Washington, DC. 58 pp.

Rudolph, D.C., S.J. Burgdorf, R.N. Conner and R.R. Schaefer. 1999. Preliminary investigation of the impact of roads and associated vehicular traffic on snake populations in eastern Texas. In: Evink, *et.al.* 1999. Proceedings of the Third International Conference on Wildlife Ecology and Transportation. FL-ER-73-99.

Sibley, D.A. 2000. Sibley Guide to Birds. National Audubon Society. Knopf.