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

Prepared by

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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

Habitat Preferences:
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.

Existing Improved Corridor

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.

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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

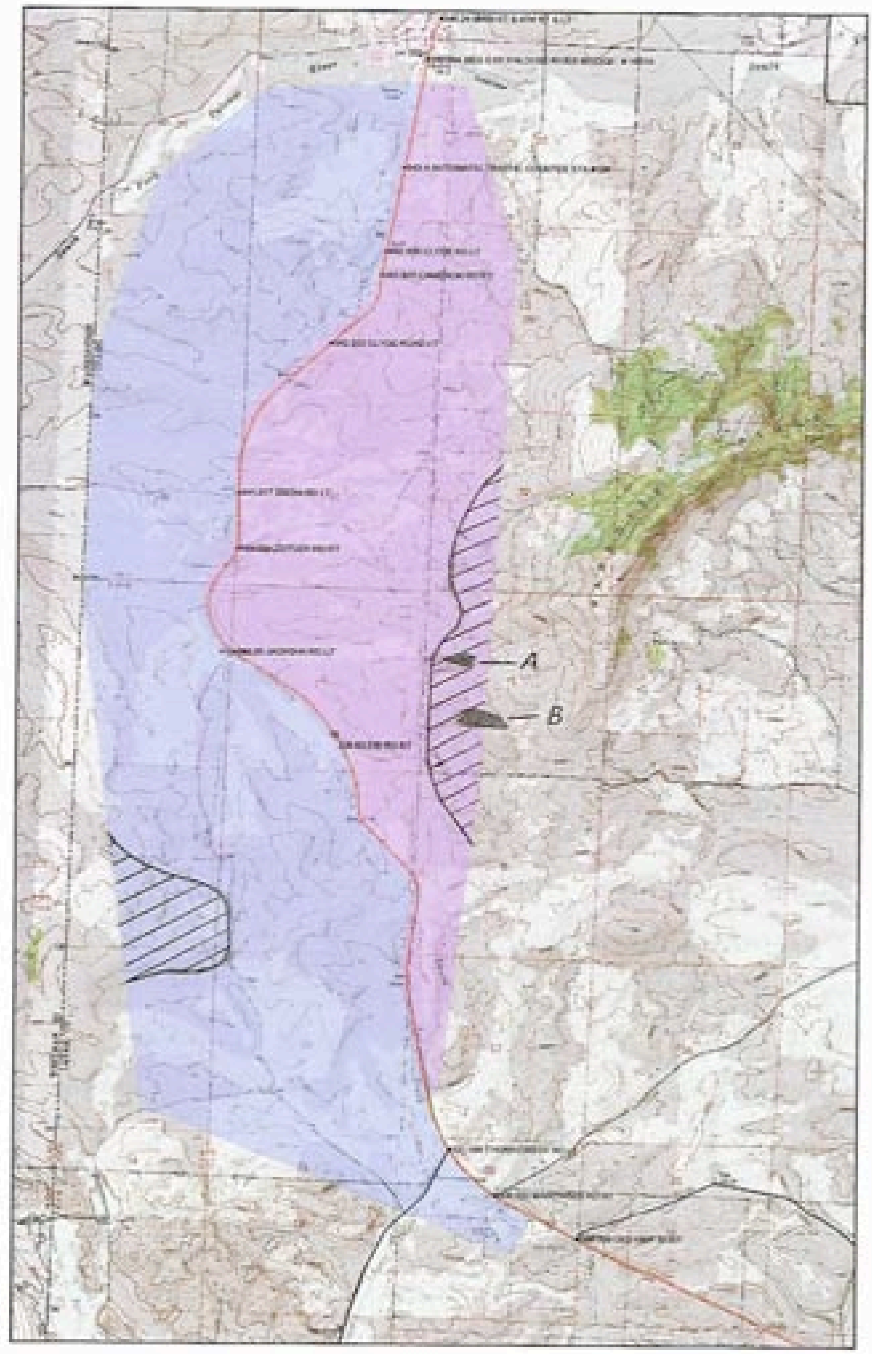

Figure 1. Map of the Project Area with the Eastern (purple) and Western (blue) Transportation Corridors divided by existing US 95. Areas where corridor construction would have the greatest impact on deer, elk, or moose in the Project Area are noted with barring. The 2 darkened areas (A and B) include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

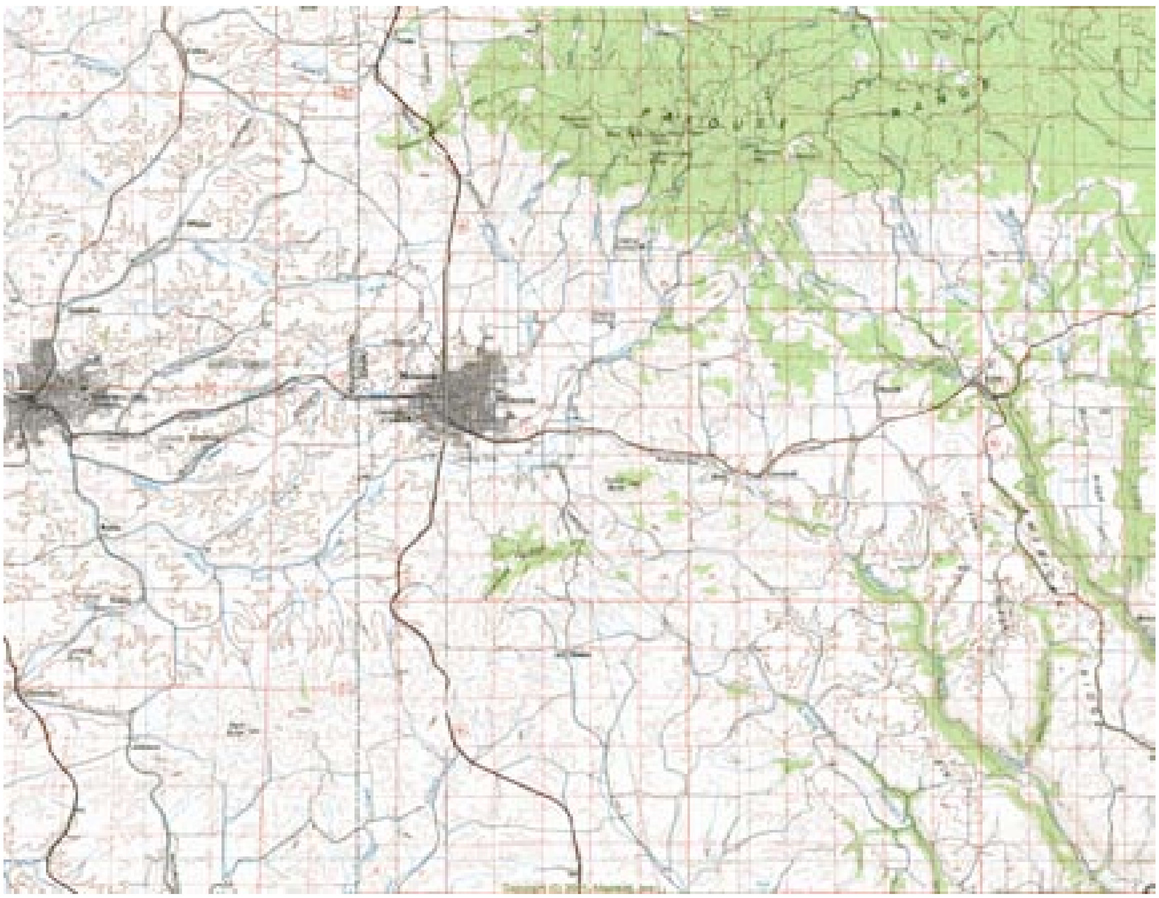

Figure 2. Map of Paradise Ridge showing larger stands of forested habitat, including Moscow Mountain and the Palouse Range to the northeast. Adjacent patches of habitat to the northeast and east, including Tomer Butte, provide connectivity to Paradise Ridge for movement of large mammals. While white-tailed 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).