2015 Amendment to the 2013 Biological Evaluation for the Revised Shoshone National Forest Land Management Plan

Shoshone National Forest/Rocky Mountain Region

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Table of Contents

1.0 Introduction

This amended biological evaluation (BE) updates the potential influences of the Shoshone National Forest Revised Land and Resource Management Plan on Rocky Mountain bighorn sheep (*Ovis canadensis canadensis)* and wolverines (*Gulo gulo luscus*). In this amended BE, a review of information regarding the distribution, habitats and observations of wolverines on the Shoshone National Forest, and of the potential cumulative effects to Rocky Mountain bighorn sheep, has been incorporated. Wolverine were added to this biological evaluation as a result of a proposed federal listing removal. Additional analysis for bighorn sheep is included as a result of Washington Office instructions outlined in the Shoshone National Forest Objection Responses (November 2014). This biological evaluation amends the previous 2013 BE and will be used, along with the original 2013 BE, to tier to for future BE's prepared for the Revised Forest Plan.

The Forest Service Manual (FSM) directs the Forest Service to develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions (FSM 2670.22). Sensitive species are those plant and animal species identified by a regional forester for which population viability is a concern as evidenced by (a) significant current or predicted downward trends in population numbers or density or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5).

The FSM directs the Forest Service to prepare biological evaluations for projects, as part of the National Environmental Policy Act of 1969, to determine the potential effects from those projects on sensitive species and to ensure that Forest Service actions do not contribute to loss of viability of threatened, endangered, proposed, or sensitive plant and animal species, or contribute to a trend toward federal listing of any species under the Endangered Species Act (FSM 2672.41 and 2670.32). A biological evaluation is defined as a documented review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any sensitive species (FSM 2670.5). A separate biological assessment was prepared to address effects on threatened, endangered and proposed species (FSM 2670.5).

Wolverines have been included in the amended BE because on August 13, 2014, the U.S. Fish and Wildlife Service withdrew a proposal to list the North American wolverine in the contiguous United States as a threatened species under the ESA. After carefully considering the best available science, the Service determined that the effects of climate change are not likely to place the wolverine in danger of extinction now or in the foreseeable future. As a result, the wolverine does not meet the statutory definition of either a "threatened species" or an "endangered species" and does not warrant protection under the ESA, and it is no longer included in the 2013 Biological Assessment prepared for Forest Plan Revision

However, the wolverine was restored to the Regional Forester's sensitive species list following the decision not to list under the ESA. This means it will continue to receive special management attention and consideration in programs and projects on the Shoshone National Forest. Because the analysis of possible effects to wolverines from implementation of the Revised Forest Plan has not changed from the original 2013 Biological Assessment, we have brought that analysis forward into this amended BE.

2.0 Updated Sensitive Species Evaluations and Analysis of Effects

North American wolverine

Status of the Wolverine in the Greater Yellowstone Ecosystem

Wolverines have a Holartic (habitats found in the northern continent) distribution. In North America, they occupy much of Alaska and northern Canada, and follow the Rocky Mountains south to northwestern Wyoming (Beauvais and Johnson 2004). Northwestern Wyoming, including the Shoshone, is thought to support the southernmost population of wolverines in North America.

Wolverines are one of the rarest carnivores in the United States, and they are persistent at extremely low population densities (Maj and Garton 1994). Based on current knowledge of occupied wolverine habitat and wolverine densities in this habitat, it is estimated that the wolverine population in the contiguous United States is approximately 250 to 300 individuals (USDI Fish and Wildlife Service 2010b).

Due to low population densities, no trend data is available for the Shoshone or the Greater Yellowstone Ecosystem. Over an 18-year period (1992 to 2009) only three observations of breeding wolverines were made in Wyoming (Inman et al. 2009). As of the winter of 2008-09, the Wildlife Conservation Society had five radio-collared wolverines that had home ranges within northwestern Wyoming (Inman et al. 2009); one of which dispersed to Colorado. Wolverines were also recently documented in the Thorofare region of the Washakie Wilderness (Shoshone National Forest) and Teton Wilderness (Bridger-Teton National Forest), but no wolverines were detected in the North Absaroka Wilderness (Shoshone National Forest), which contains prime habitat for wolverines (Murphy et al. 2011). Documented occurrences of wolverines in Wyoming from 1857 to 2004 are displayed in Figure BA- 3.

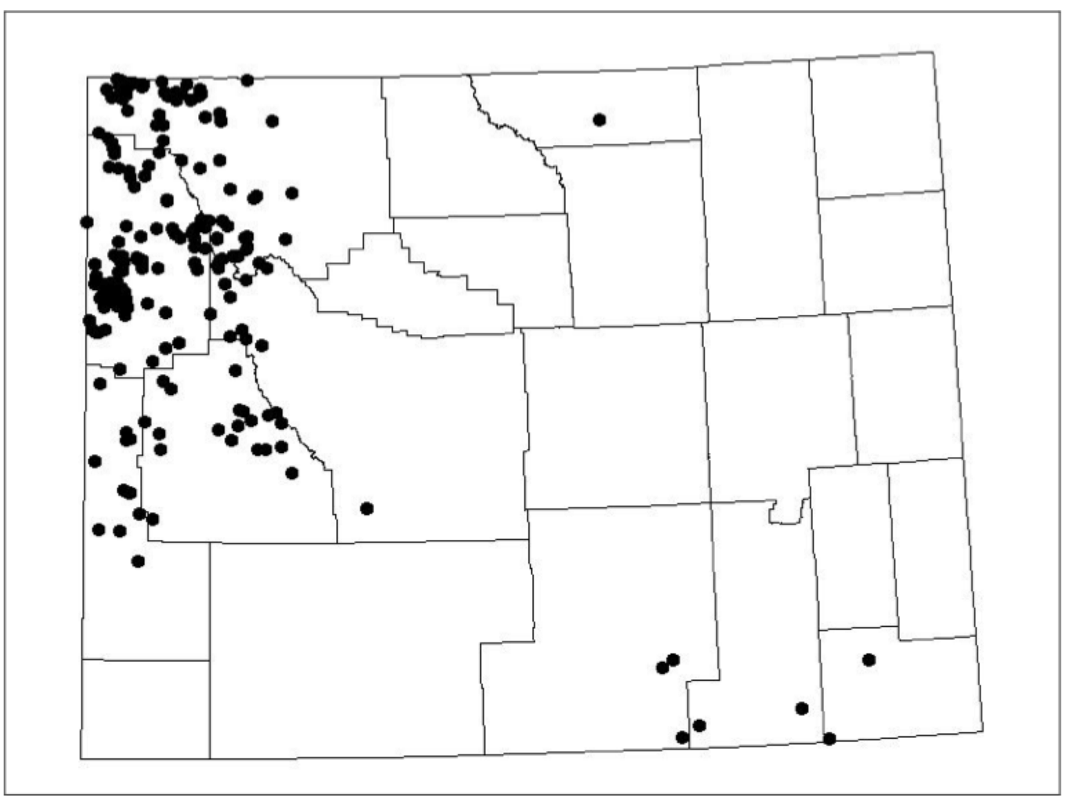

Figure BA- 3. Documented occurrences of wolverines in Wyoming, 1857 to 2004. Each black dot represents 1 of 205 observation records on file at the Wyoming Natural Diversity Database (University of Wyoming).

Habitat Requirements, Home Range, Food Habits

Denning

Snow cover that persists through the spring denning period appears vital to reproduction, and Copeland et al. (2010) showed that nearly 100 percent of documented dens (n=562) documented through worldwide research studies (primarily Fennoscandia and North America) occurred at sites with persistent snow cover. Overall, the denning period for wolverines, regardless of worldwide location is estimated to be between approximately mid-February to mid-May.

Female wolverines use natal (birthing) dens that are excavated in snow. Persistent, stable snow greater than 1.5 meters, (5 feet) deep appears to be a requirement for natal denning, because it provides security for offspring and buffers cold winter temperatures. Female wolverines go to great lengths to find secure dens sites, suggesting that predation is a concern. In Idaho, natal sites occur above 2,500 meters (8,200 feet) on rocky sites, such as north-facing boulder talus or subalpine cirques (step-walled, semicircular basin carved by a glacier) in forest openings. In Montana, natal dens occur above 2,400 meters (7,874 feet) and are located on north aspects in avalanche debris, typically in alpine habitats near timberline (Federal Register/Vol 78, No. 23, pp. 7864-7889).

Large-scale Movements and Dispersal

Wolverines are capable of large-scale movements with home use areas as well as periodic large- scale movements through and between isolated mountain ranges. Many research studies with radio-instrumented animals have observed long-distance movements, particularly of young males (Copeland and Yates 2006, Inman 2007 et al., Murphy et al. 2011, Copeland 1996). The male wolverine that made a long-distance movement from the Bridger-Teton National Forest (Gros Ventre drainage) in 2009 traveled over 500 miles, traversed relatively low and what is not considered wolverine habitat, and crossed a major interstate highway before taking up residence in high-elevation habitat in Colorado. A female wolverine that became a resident of a portion of the Wind River Range was born in and moved from the Teton Range in Wyoming (Inman et al. 2007b). In a third example, a subadult male wolverine captured and instrumented in Grand Teton National Park covered a distance of 874 kilometers (543 miles) during a 42-day period. This particular male was located in nine distinct mountain ranges in three states, two national parks, three national forests, one BLM unit, and one Bureau of Indian Affairs jurisdiction (Inman et al. 2003).

Foraging Requirements and Home Ranges

Wolverines are adapted to tundra, northern conifer forests, and high-altitude alpine regions. These areas near treeline are in rocky alpine habitats such as cirque basins and avalanche chutes, and have food sources such as marmots, voles, and carrion (Hornocker and Hash 1981; Copeland 1996; Magoun and Copeland 1998; Copeland et al. 2007; Inman et al. 2007). Wolverines are opportunistic feeders and consume a variety of foods, depending on availability. They primarily scavenge carrion, but also prey on small animals and birds, and eat fruits, berries, and insects (Hornocker and Hash 1981, Hash 1987, Banci 1994). Wolverines have an excellent sense of smell that enables them to find food beneath deep snow (Hornocker and Hash 1981).

Wolverines require a lot of space; the availability and distribution of food is likely the primary factor in determining wolverine movements and home range size (Hornocker and Hash 1981, Banci 1994). Female wolverines forage close to den sites in early summer, progressively ranging farther from dens as kits become more independent. Wolverines travel long distances over rough terrain and deep snow, and adult males generally cover greater distances than females (Hornocker and Hash 1981; Banci 1994; Copeland and Yates 2006). Home ranges of wolverines are large, and vary greatly in size depending on availability of food, gender and age of the animal, and differences in habitat quality. Home ranges of adult wolverines also vary in size depending on geographic location. Home ranges in Alaska were approximately 100 square kilometers (km2) to over 900 km2 (38.5 square miles (mi2) to 348 mi2) (Banci 1994). Average home ranges of resident adult females in central Idaho were 384 km2 (148 mi2), and average home ranges of resident adult males were 1,522 km2 (588 mi2) (Copeland 1996). Wolverines in Glacier National Park had average adult male home ranges of 496 km2 (193 mi2) and adult female home ranges of 141 km2 (55 mi2) (Copeland and Yates 2006). Wolverines in the Greater Yellowstone Ecosystem had average adult male home ranges of 797 km2 (311 mi2), and average adult female home ranges of 329 km2 (128 mi2) (Inman et al. 2007; USDI Fish and Wildlife Service 2010b). In another study in the Yellowstone system (east and south of Yellowstone National Park, including the Bridger Teton and Shoshone national forests), six estimates of annual minimum convex polygon home ranges for the two females averaged 447 km2 (278 mi2) and ranged from 261 to 782 km2 (162 to 486 mi2). Six estimates of annual minimum convex polygon home ranges for the three males averaged 908 km2 (564 mi2) and ranged from 446 to 1,268 km2 (277 to 788 mi2) (Murphy et al. 2011).

Status of the North American Wolverine on the Shoshone National Forest (Action Area)

An understanding of wolverine distribution and status within the Shoshone National Forest is limited. On the southern-most extent of wolverine range in the United States, evidence suggests that wolverines are mostly absent from Yellowstone National Park proper, except two individuals (1 male and 1 female) known to have straddled the eastern and southeastern borders of Yellowstone National Park and ranging into both the Bridger-Teton and Shoshone national forests (Murphy et al. 2011). The female mentioned here is a known disperser that originated in Montana’s Gallatin Range. Also, a wolverine “kinship group” (male and female and apparent reproduction) is known to inhabit the Absaroka Range in Montana immediately adjacent to the northern boundary of Yellowstone National Park (Murphy et al. 2011). To date, only one reproduction event has been documented in Wyoming, when two female kits were born in the Tetons in 2005 (Caribou-Targhee National Forest). Further investigation of the Wind River Range, is warranted, as are investigations into wolverine presence in the eastern Absarokas (Shoshone National Forest).

The 2009 dispersal of a young Wyoming male to Colorado suggests that Wyoming’s population could be critical to recolonization of the southern Rockies, but this is contingent upon reproductive-aged females successfully dispersing to Colorado. In turn, Wyoming’s current and potential future wolverine inhabitants may be dependent upon dispersing wolverines from Montana (which has some of the lowest wolverine reproduction rates reported in the literature), central Idaho, successful reproduction more locally in the Tetons, or of unknown more regional or local origin. Wolverines of reproductive age could certainly be present in all the areas mentioned above, but to date confirmation of residency is not available. In summary, the Shoshone probably does have wolverines present, but the best available information suggests that numbers and density are extremely limited, and there are large tracts of the Shoshone where wolverine residency status is simply unstudied and unknown.

Due to the wide use of habitats, there is no limiting habitat association (topography or vegetation type) for wolverines. It is assumed that pockets of mature forest with abundant coarse woody debris is beneficial,

along with open areas supporting big game foraging, coupled with boulder fields for denning. The Shoshone contains abundant potential habitat for wolverines, especially in wilderness (Wildlife Conservation Society 2010, Beauvais and Johnson 2004, Hoak et al. 1982).

If wilderness areas represent optimal wolverine habitat, then the Shoshone contains about 1,365,154 acres of potential habitat (Figure BA-8). One large area of potential wolverine habitat that is not in wilderness is the Beartooth Plateau. Winter motorized recreational use of this area is high.

On the Shoshone, spruce/fir habitat is relatively abundant. There are about 309,442 acres of spruce/fir on the Forest with about 30 percent of it being mature (over 200 years old) (USDA Forest Service 2012). Also, due to fire suppression, the spruce/fir forest type has likely increased on the Shoshone.

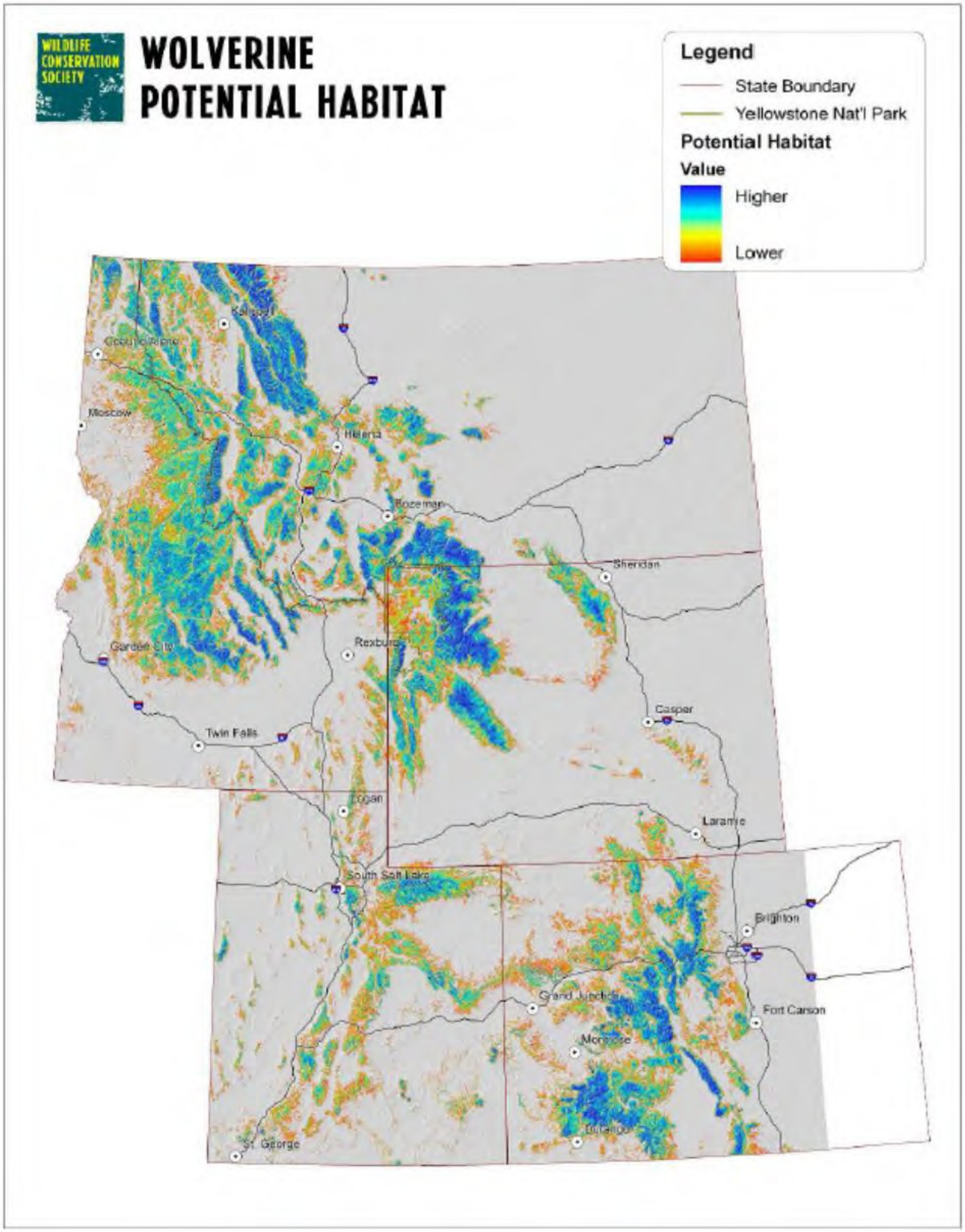

Figure BA- 8. Wolverine habitat identified by Wildlife Conservation Society (WCS) habitat model across the wolverine's historical range in the Rocky Mountains (WCS 2010)

Details of US Fish and Wildlife Service Proposed Listing Rule

(The following information was extracted directly from the U.S. Fish and Wildlife Service February 4, 2013 Proposed Listing Rule; Federal Register Vol. 78, No. 23, pp. 7874-7886).

The USFWS considered the following factors in their finding: Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range, Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes, Factor C. Disease or Predation, Factor D. Inadequacy of Existing Regulatory Mechanisms, and Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence. Factor A. was further broken down into a variety of impacts to wolverine habitat including: (1) Climate change, (2) human use and disturbance, (3) dispersed recreational activities, (4) infrastructure development, (5) transportation corridors, and (6) land management.

This proposed rule identified threats to the contiguous U.S. population of the North American wolverine attributable to Factors A, B, D, and E. The primary threat to the DPS is from habitat and range loss due to climate warming (Factor A). Climate changes are predicted to reduce wolverine habitat (persistent spring snow loss) in the northern Rockies by 32 percent over the next 30 years and 63 percent over the next 75 years, rendering remaining wolverine habitat significantly smaller and more fragmented. The USFWS anticipates that, by 2045, maintenance of the contiguous U.S. wolverine population in the currently occupied area will require human intervention to facilitate genetic exchange and possibly also facilitate metapopulation dynamics by moving individuals between habitat patches that are no longer accessed regularly by dispersers.

Other threats are minor in comparison to the driving primary threat of climate change; however, they could become significant when working in concert with climate change if they further suppress an already stressed population. These secondary threats include harvest (Factor B), disturbance, infrastructure, and transportation corridors (Factor D), and demographic stochasticity and loss of genetic diversity due to small effective population sizes (Factor E). All of these factors affect wolverines across their current range in the contiguous United States.

Summary of Risk Factors to the Conservation of the Wolverine

Climate Change

Predicted effects of climate change on the distribution of late spring snowpack is expected to reduce the overall acreage of wolverine habitat in the contiguous United States. Areas delineated by persistent snowpack are deemed important for reproductive denning as well as movements between high-altitude patches. The anticipated reduction in snowpack is anticipated to not only reduce available residency habitat (these patches might become too small to support individual wolverines due the large home use areas generally required), but also and thereby increase the distance between habitat parcels and the loss of connective snow covered areas between parcels, reducing the probability of dispersal between isolated habitat patches. Loss of genetic exchange between habitat areas is expected to lead to further genetic drift and a loss of the “rescue effect” of immigration, not only genetically, but simply due to a loss of new animals for breeding and occupancy of available habitat areas. No Federal or State regulatory mechanisms exist that address the threat of modification of wolverine habitat due to climate change.

Human Disturbance via Dispersed Recreation

Dispersed recreation in winter and late spring, shown to be occurring at a higher rate than in the past (backcountry skiing, snowmobiling, etc.), may have an effect on wolverines by disturbance. The primary concern is if disturbance from dispersed recreation may cause a reproductive female to abandon the den, resulting in the death of kits and then overall lower reproductive rates (reducing the potential for population growth) for wolverine. It has been established that wolverines are very sensitive to adult mortality in a local setting (Squires et al. 2007), and that low reproductive rates can have a profound effect on overall population. Importantly, it is not known if, and if so, to what degree, human dispersed recreation has a negative impact on the reproductive success of female wolverines. The Central Idaho Wolverine Project is an active project looking to learn more about the spatial and temporal relationship between dispersed recreation and wolverine reproductive rates. This project recently finished its second field season (as of spring 2012), and is on course to continue these investigations. At the time this biological assessment was prepared, there are no peer reviewed results to report from this project. (Krebs et al. (2007) documented a negative association between male wolverine habitat use and helicopter skiing, and a negative association between female wolverine habitat use and helicopter and backcountry skiing. The authors suggest that wolverines negatively responded to human disturbance within occupied habitat. However, the best scientific information available does not substantiate dispersed recreational activities as a threat to wolverine.

Infrastructure

Generally, infrastructure development in this area tends to be in lower-elevation areas than those habitats potentially occupied by wolverines. Infrastructure development in lower elevation areas is of unknown significance to wolverine movements. May et al. (2006), hypothesize that wolverine distribution may be partly influenced by direct disturbance or higher risk of human- caused mortality associated with infrastructure, and that increased human development may make current habitat less optimal due to disturbance and subsequent avoidance of human activity by wolverines. The authors suggest, however, that low levels of infrastructural development may not restrict wolverine recovery in suitable areas. There is no evidence that wolverine dispersal is affected by infrastructure development. Considering infrastructure development options may be important in the context of putatively unoccupied but quality wolverine habitat available on the Shoshone, and where wolverines may in the future immigrate to via lower-lying areas that are more susceptible to infrastructure development.

Transportation Corridors

While wolverines have been documented to have been killed by automobiles in the Rockies (near Kemmerer, Wyoming (WGFD 2005) and Madison Valley Montana (Packila et al. 2007); however, this has not been extensively documented, and population effects are not clear.

Wolverines have been documented successfully crossing highways, National Forest System roads, and interstate highways without a lethal outcome (Packila et al. 2007).

Research near Yoho and Banff National Parks showed wolverine avoidance of areas within 100 meters (328 feet) of the Trans-Canada Highway (a major highway) and preference for areas greater than 1,100 m (3,608 feet) from the highway. The Trans-Canada Highway currently appeared to have a significant impact on wolverine movements, and the author suggests that roads with narrow rights-of-way (less than 50 meters or 164 feet) have less impact on wolverine movements than roads with wide rights-of-way (greater than l00 meters or 328 feet), and that the impact of the highway on wolverines was greater during the summer when

traffic volume was higher (Austin1998). How this assessment may be generalized to transportation corridors of much less volume is unclear.

Squires et al. (2006) suggested that since wolverine movements are not strongly constrained by topography or habitat within their primary use areas, wolverines are not highly predictive in the their response to landscape features, and therefore, predicting movement or linkage corridors and those intersections with human transportation corridors is not a reasonable endeavor. Further, they suggest that secondary roads were not barriers to wolverine movements in their study area. Seven of eight secondary road crossings documented occurred in areas where crossings were composed of constricted, forested, or river canyon landscapes and where human development was minimal. Wolverines may be vulnerable to highway collisions not only during crossing, but while scavenging road-killed ungulates.

Copeland et al. (2007) found no relationship between wolverine presence and maintained trail systems in central Idaho. Distance to road statistics indicated nonuse of areas near roads, but because most roads occur at lower elevations, this relationship may be an artifact of unequal availability of habitat. The spatial separation of wolverine and human-related infrastructure is well documented, but it remains unclear whether this is a causal relationship or a description of wolverines inhabiting areas inhospitable to human development.

Although wolverines tend to avoid transportation corridors in their daily movements, studies of the few areas where transportation corridors are located in wolverine habitat led the USFWS to conclude that the effects are most likely local in scale. There are no studies that address potential effects of transportation corridors in linkage areas. In the few documented long-distance movements by wolverines, the animals successfully crossed transportation corridors.

Timber Harvest

Krebs et al. (2007) documented a negative association between female wolverine habitat use and roaded and recently logged areas in British Columbia. Copeland et al. (2007) suggest that wolverines indicate a preference for subalpine habitats rather than an avoidance of anthropogenic features at lower elevations, and wolverines may be impacted by management practices in subalpine communities, particularly those that reduce the presence and opportunity to scavenge carrion.

Hornocker and Hash (1981) noted no difference in wolverine movements, habitat use, or behavior by comparing unlogged and previously logged areas, though they did note on a more local scale a tendency of wolverines to rapidly move through clearcuts in straight lines versus a more leisurely meandering movement pattern in forested areas.

Intensive land management activities such as timber harvest do occur in wolverine habitat; however, for the most part, wolverine habitat tends to be located at high elevations and in rugged topography that is unsuitable for intensive timber management. Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species.

Wildfire, Prescribed Fire and Fuels, Livestock Grazing, Oil, Gas and Minerals

The local effect on wolverine in regard to the management of fire, fuels, grazing, and resource extraction is not well established. The primary consideration for wolverine conservation should be whether proposed

activities are to take place in upper montane, subalpine, and alpine habitats and whether wolverines have adequate refugia in high elevation, cold, and remote areas inhospitable to human development and have adequate food (carrion, etc.) availability. Management needs should be considered at large scales for this wide-ranging and low-density species.

Wolverines tend to select areas in the Greater Yellowstone Area (therefore the Shoshone National Forest) at elevations higher than approximately 8,500 feet and higher, and avoid areas lower than approximately 7,000 feet year round. This elevation band (also related to the persistence of spring snowpack at higher elevations) can be used as a crude, but helpful, reference when determining the potential impacts to wolverine habitat through land management activities. Land management activities in those areas below the elevation band of expected wolverine occupancy may serve as linkage habitat or movement corridors between core habitats, but the effect of specific treatments on the quality of those movement areas to wolverines is unknown. Resource extraction (including timber harvesting), backcountry skiing and snowmobiling, roads, and other forms of human disturbance merit careful consideration by those concerned about wolverine conservation. Regulating snowmobile use in important denning areas and deterring wilderness trespassing by snowmobiles are important.

3.0 Effects of action and determination of the effects

North American Wolverine

The potential primary risk factor from forest management is winter recreational activities. A review of the potential effects of Alternative G was completed for this analysis and is discussed below.

Effects Analysis: Plan revision activities that could potentially influence the wolverine involve road construction/reconstruction, motorized and nonmotorized recreation, and ski area development. Differences in projected outputs for alternative G for these activities are displayed in Table BA- 14.

Table BA- 14. Activities and outputs that could Influence the North American wolverine by alternative

	Alt. A Existing Condition	**Alt. G Preferred Alt**
Motorized Recreation-Winter(Acres available)	887,590	441,527
Motorized Recreation-Winter(Acres not available)	1,550,440	1,914,623
Motorized Recreation-Summer (Acres available)	570,555	519,544
Motorized Recreation-Summer (Acres not available)	1,867,475	1,918,488
Ski Area Development Or Expansion	0	1,145
Wilderness Acres	1,358,592	1,358,592

Direct and Indirect Effects

As displayed in Table BA- 14, the preferred alternative (alternative G) increases the amount of solitude (less human disturbance) and undeveloped terrain potentially available for the wolverine compared to the existing condition. Alternative G offers a balance of motorized recreational use, but also provides more undisturbed habitat and less potential disturbances than the existing condition.

In regard to undeveloped habitat, alternative G is the same as the existing condition (alternative A) where no expansion of the ski area boundary is proposed. Although the existing condition did not recognize Sleeping Giant Ski Area, nonetheless the effects of the ski area under alternative A are the same as the preferred alternative.

Cumulative Effects of the Preferred Alternative on Wolverine

A considerable amount of wilderness and unfragmented habitat remains in the Shoshone. Recreational use on the Forest has increased to a point that previously undisturbed areas are now supporting various types of extreme sports and other recreational pursuits. These activities have the potential to reduce the amount of undisturbed habitat available for species such as the wolverine.

In Wyoming, wolverines are a species of greatest conservation need and trapping of wolverines is illegal. Fur trapping has historically been a large source of mortality. Trapping wolverines is still allowed in Montana. Given the wolverine’s large home ranges, it’s possible that some wolverines in northwestern Wyoming are at risk to trapping in Montana.

Increasing global temperatures may degrade habitat quality and quantity in the conterminous United States during the 21st century, triggering reductions in the size of wolverine habitat patches and their connectivity. Because of its high average elevation and location, the Greater Yellowstone Ecosystem (including the Shoshone) has some of the largest and most contiguous patches of wolverine habitat in the conterminous United States. Thus, the ecosystem is likely to play an increasingly important role in the population dynamics and persistence of wolverine populations as the regional-scale coverage of spring snow declines.

A lack of reliable information regarding distribution, density, occupancy of predicted habitat, demographic rates (reproduction, survivorship, recruitment, and mortality), habitat selection, disturbance thresholds, and dispersal areas is an acute problem in terms of wolverine management.

Determination of Effects and Rationale for the Determination on Wolverine

Based on this analysis, it is determined that Revised Forest Plan alternative G "**may adversely impact individuals (wolverines), but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide**." Alternative G could be expected to provide a "**Beneficial Impact**" to the species. The rationale for this determination is as follows:

- The Shoshone and its connectivity with the Greater Yellowstone Ecosystem provide an abundance of suitable habitat for the wolverine.
- In general, implementation of the Northern Rockies Lynx Management Direction (USFS 2007) would benefit wolverines as well. Especially, standards and guidelines related to vegetation management and winter recreation.
- Alternative G provides for motorized recreational activities that may impact the species, but decreases the amount of acres available to human disturbance compared to the existing condition.

Rocky Mountain Bighorn Sheep

Disease transmission has had a devastating effect on bighorn sheep populations across the west. In April 2012, utilizing existing bighorn sheep herd information and existing domestic sheep and goat (including pack goat) use, a qualitative analysis was prepared to determine the likelihood of contact and disease transmission from domestic sheep and goats (including pack goats) to the Shoshone's bighorn sheep herds. Qualitative risk assessment is a commonly used method to attempt to determine where risks exist and how they can be mitigated. The complexity of this issue on the Shoshone NF is lower than other forests in the western United States due to the limited amount of domestic sheep and goat use in occupied bighorn habitat. However there is some pack goat use that does occur.

Wildlife biologists from the Wyoming Game and Fish Department with considerable knowledge of bighorn sheep biology and management along with SNF land managers assisted in the 2012 risk assessment. The 2012 analysis was updated in February 2013 as a result of the Bighorn Sheep Risk of Contact Tool that became available in January 2013.

The result was the *Risk Analysis of Disease Transmission between Domestic Sheep and Goats and Rocky Mountain Bighorn Sheep* (June 2013). This document provides a thorough assessment of the risks to wild sheep from domestic sheep and goats. It reports that although there is no direct evidence of domestic

goats and specifically pack goats infecting wild sheep with life threatening diseases, there is an abundance of connected evidence that lead to a reasonable conclusion that domestic sheep and goats are the vectors. The analysis also provides evidence that wild sheep are unpredictable in their movements and have been shown to travel great distances which can bring them into contact with domestic sheep and goats as well as other wild sheep. Further results are reported below.

Cumulative Effects of the Preferred Alternative on Bighorn Sheep

Management of bighorn sheep and domestic sheep and goats (including pack goats) to avoid physical interactions is often complex. It is important that separation of the three species is maintained at all times; however, the distance needed to attain this can be different in each situation, and collaboration between all parties is needed to achieve this. Currently, the Shoshone is working with other State, Federal, and local partners (State-wide Bighorn Sheep/Domestic Sheep Interaction Working group) to better identify where bighorns occur, where they wander, and how they might interact with other herds and domestics. In managing both domestic sheep and goats and bighorns, the Shoshone is using a nationally recognized collaborative process for resolving bighorn/domestic sheep management conflicts. The approach outlined in the process has been incorporated into the management of domestics and bighorn sheep through the Plan design criteria and Plan components. It is anticipated that this approach will help Forest Service range and wildlife specialists work with interested individuals and organizations to develop site-specific solutions to potential conflicts amongst the species. This effort is expected to help reduce potential cumulative effects to bighorn sheep on the Shoshone.

Currently, there are no documented cases of disease transmittals from domestic sheep or goats to bighorns on the Shoshone. However, Monello et al. (2001) analyzed population records of 99 bighorn sheep herds ranging from the southwestern US to Alaska, in an investigation designed to discover the ecological correlates of pneumonia epizootics. They found that bighorn sheep populations that had suffered a pneumonia-induced-die-off were located on average significantly closer to domestic sheep allotments (24.1 ± 11.5 km) than either those that had not suffered a die-off (39.6 ± 8.5 km) or those that had suffered a die-off not induced by pneumonia.

Domestic sheep herds on the Shoshone are all outside the 26 km foray distance (used in the 2013 *Risk Analysis of Disease Transmission Between Domestic Sheep and Goats and Rocky Mountain Bighorn Sheep, Shoshone National Forest*) of any bighorn sheep herd <u>on</u> the Shoshone. However, 4 of the 6 core native herds on the Shoshone <u>are</u> within 26 km of domestic sheep herds that are on lands adjacent to the Shoshone (Table A). The presence of domestic sheep on lands outside of the jurisdiction of the Shoshone, yet still within the 26 km foray distance of bighorn sheep, adds to the risk of contact between bighorn sheep on the Shoshone and domestic sheep. For example, bighorn sheep from the Whiskey Mountain herd have made forays to active domestic sheep allotments on the Bridger-Teton. These forays, and documented domestic sheep in core native habitat on lands adjacent to the Shoshone, increase the likelihood of contact and increase the risk of disease transmission to these herds.

Table A. Proximity of Shoshone NF's bighorn sheep herds to closest domestic sheep (DS) herd by land ownership and herd status (from *Risk Analysis of Disease Transmission Between Domestic Sheep and Goats and Rocky Mountain Bighorn Sheep, Shoshone National Forest 2013*)[1]

	Proximity to DS (km) on Shoshone NF	Proximity to DS (km) on adjacent lands	Land Ownership of adjacent lands	Herd Status	Risk of Contact from Shoshone	Risk of Contact from adjacent lands
Francs Peak	112.7	3.2	BLM, private	Core Native Herd	Very Low	Low to Moderate
Younts Peak	136.8	41.8	BLM	Core Native Herd	Very Low	Very Low
Whiskey Mountain	80.5	9.7	Bridger-Teton NF, private	Core Native Herd	Low	Very Low to Moderate
Trout Peak	220.8	19.3	BLM	Core Native Herd	Very Low	Very Low
Wapiti Ridge	179.2	29	BLM	Core Native Herd	Very Low	Very Low
Clarks Fork	240	20.9	BLM	Core Native Herd	Very Low	Very Low
Temple Peak	28.9	3.2	Bridger-Teton NF, private	Cooperative Review Herd	Low	Low to Moderate

[1]Wildlife biologists from WGFD and the Shoshone, with considerable local knowledge of actual grazing practices in the area, agreed to the risk of contact from adjacent lands for the core native herds in 2012; see related conservation measure and recommendation below.

Determination of Effects and Rationale for the Determination on Bighorn Sheep

Based on this analysis, it is determined that Revised Forest Plan alternatives A, E, and F "**may adversely impact individuals (bighorn sheep), but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide**." Alternatives B, C, D, and G could be expected to provide a "**Beneficial Impact**" to the species. The rationale for this determination is as follows:

- Ranges of bighorn and domestic goats (including pack goats) overlap on the Shoshone, therefore, a risk of disease transmittal occurs in alternatives A, E, and F.

- To date, there is no documented case of disease transmittals from domestics to bighorns on the Shoshone. However, there is no known "safe distance" between the three species so the risk of a future transmittal cannot be discounted. (See *Risk Analysis of Disease Transmission Between Domestic Sheep and Goats and Rocky Mountain Bighorn Sheep, Shoshone National Forest 2013*.)

- Alternatives B, C, D, and G include similar conservation measures to reduce the risk of contact and disease transmittal.

Summary of Conclusions

The higher the conservation value of a wild sheep population (e.g "sensitive species" status, core native herds), the more aggressive and comprehensive wild sheep and domestic sheep or goat separation management strategies should be (Wild Sheep Working Group 2012). Although scientific literature on the risk of disease transmission between domestic goats (including pack goats) and bighorn sheep is limited, some information is available. For this amended BE, we reviewed 9 additional papers on disease

transmission from domestic sheep and goats to wild sheep (Herndon et al. 2011, Miller et al. 2011, Wehausen et al. 2011, Besser et al. 2014, Drew et al. 2014, O'brien et al. 2014, Shannon et al. 2014, Fox et al. 2015, Sells et al. 2015,). Among other things, these papers support the evidence that domestic sheep and goats carry disease organisms with serious consequences for bighorn sheep. The central role of domestic sheep and goats in bighorn sheep exposure to pathogens is well documented; pathogen transmission from domestics to bighorn sheep is the only hypothesis supported in experimental trials. Even minimal direct contact is believed to contribute to the death of individual wild sheep, herds of wild sheep, and entire populations. After review of these additional papers, the conclusions in the original BE regarding risk of disease transmission to bighorn sheep from domestic sheep and goats remain unchanged.

Furthermore, it is the Western Association of Fish and Wildlife Agencies' collective opinion that enough is known about potential pathogen transmission from domestic sheep or goats to wild sheep that efforts toward achieving effective separation are necessary and warranted (Wild Sheep Working Group 2012). Therefore, it is only prudent to err on the side of caution and to remove the potential for disease transmission from domestic sheep and goats to bighorn sheep on the Shoshone. Until further scientific information is available to prove otherwise, the conservation value of the Shoshone's native bighorn sheep herds is far too great to allow domestic sheep and goat use within core native bighorn sheep habitat. Even one disease transmission event could be catastrophic to a bighorn sheep herd.

All core native bighorn sheep herds on the Shoshone N.F. are at **Very Low** risk of disease transmission from domestic sheep on the Forest due to the distance their occupied habitat is from domestic sheep allotments on the Forest. The one exception is the Whiskey Mountain herd. Due to the lack of sufficient literature about disease transmission from domestic goats to bighorn sheep, the likelihood of direct contact and risk of disease transmission as a result of activities on the SNF is increased from **Very Low to Low** for this herd. No further conservation measures are needed related to domestic sheep grazing on the Shoshone and bighorn sheep. However, concerns remain regarding the risk of Shoshone bighorn sheep contacting domestic sheep on adjacent lands.

The Temple Peak herd will continue to be managed within the "Cooperative Review Area" as a remnant herd. Any change in management of this herd would be cooperatively agreed upon by the Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group (Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group 2004a).

Conservation Measures and Recommendations

1. Close all occupied core native bighorn sheep (BHS) habitat to domestic goat (includes pack goat) use. This is needed to protect core native BHS herds from the potential for contact with domestic goats. This measure effectively closes the entire Shoshone N.F., except the Washakie R.D. to domestic goat use, including pack goats.
2. Work with relevant partners (e.g.,Wyoming State-wide Bighorn/Domestic Interaction Working Group, BLM, Bridger-Teton National Forest) to explore options for mitigating the potential for

disease transmission from domestic sheep on lands adjacent to, but outside the jurisdiction of the Shoshone. to core native herds of bighorn sheep on the Shoshone.

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