# Appendix D

# American Indian Background

Consistent with 36 CFR §219.20(a), this section will be added to Appendix D of the 2003 Payette National Forest Land and Resource Management Plan.

# Appendix D
# American Indian Background Information

This appendix provides background information about the American Indian tribes with off-reservation interests and rights in the lands now administered by the Boise, Payette, and Sawtooth National Forests.

In response to tribal comments and consultation with the Shoshone-Paiute Tribes of the Duck Valley Reservation in Nevada, the following names of Tribes and Bands will update those found in the Draft Forest Plan Amendment to the 2003 Payette Land and Resource Management Plan.

## SHOSHONE-PAIUTE TRIBES OF THE DUCK VALLEY RESERVATION, NEVADA

**Tribes and Bands**

Northern Paiute, and Northern Shoshone/Bannock.

# Appendix F

# Fish and Wildlife

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Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan.

# Terrestrial Management Indicator Species for the Payette National Forest

## INTRODUCTION

This paper presents the legal requirements for identification of Management Indicator Species (MIS) from the 1982 National Forest Management Act (NFMA) implementing planning regulation 36 CFR 219.19, and describes the implications of this project on MIS selected in the *Payette National Forest Land and Resource Management Plan* (Forest Plan) (USDA Forest Service 2003a).

## LEGAL REQUIREMENTS FOR MANAGEMENT INDICATOR SPECIES

Federal regulation 36 CFR 219.19 requires that habitats be managed to support viable populations of all native and desirable non-native vertebrate at the planning area level (generally considered the Forest). The regulations recommend the use of MIS population trends to reflect the effects of management activities. MIS may be selected from plant and animal species that are: threatened or endangered; sensitive; ecological indicators; important for recreational, commercial, subsistence, or aesthetic values; representative of special habitats, habitat components, or plant and animal communities; and/or species that are of high concern.

The following are some of the key elements related to MIS from the Federal regulation:

"Each alternative shall establish objectives for the maintenance and improvement of habitat for MIS – to the degree consistent with overall multiple use objectives of the alternative" 219.19(a)

*"In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and /or invertebrate species present in the area shall be identified and selected as MIS and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities." 219.19(a)(1)*

*"Planning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and animal population trends of the MIS" 219.19(a)(2)*

*"Populations trends of MIS will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with State fish and wildlife agencies, to the extent practicable." 219.19(a)(6)*

The NFMA also directs national forests to identify MIS whose populations and habitat conditions indicate potential impacts from forest management. By monitoring and assessing habitat conditions of indicator species, managers can estimate effects on other species with similar habitat needs.

The MIS for the Payette National Forest (Forest) are the pileated woodpecker (*Dryocopus pileatus*) and the white-headed woodpecker (*Picoides albolarvatus*).

## PILEATED WOODPECKER

The pileated woodpecker is native to North America and is a resident species. It is found in forested portions of all the eastern states. It is also known to occur across southern Canada. In the western United States they occur in Washington, Oregon, California, Nevada, Montana, and Idaho in forests that grow large diameter trees. Wisdom et al. (2000) estimated a 21% decrease in source habitat in the Columbia River Basin and a 21% increase within the Central Idaho Mountains Ecological Reporting Unit

(ERU) (which includes the Forest) from historical levels. Breeding Bird Surveys in Idaho show an increasing trend for this species during the last 30 years and support the conclusions of Wisdom et al. (2000) that habitat has increased. Pileated woodpeckers inhabit areas under private, state, and other Federal administrations, however most of their habitat is on forested lands administered by the Forest Service.

Pileated woodpeckers occur on all ranger districts within the Forest. Habitat primarily occurs in mixed conifer forests, including spruce-fir (*Picea* spp.) and lodgepole pine (*Pinus contorta*) that are capable of growing large diameter trees (>20 inch diameter) with multi-storied stands. Pileated woodpeckers nest in standing snags and are the largest woodpeckers occurring within the Ecogroup area (Payette, Sawtooth, and Boise National Forests). Because the bird is so large, this species needs snags of sufficient diameter to accommodate their body size when excavating nest cavities. Studies in Montana and Idaho have shown that old and mature larch (*Larix* spp.), ponderosa pine (*Pinus ponderosa*), grand fir (Abies grandis), and Douglas fir (*Pseudotsuga menziesii*) are used for nest cavities (Burleigh 1972, Groves et al. 1997). Carpenter ants (*Camponotus* sp.) are a major food source. Dead and dying trees, snags, logs, and stumps are important foraging substrates containing carpenter ants. Pileated woodpeckers also dig directly into anthills (Groves et al. 1997).

The pileated woodpecker is a long-lived and wide-ranging non-migratory resident species. It nests and roosts in large diameter dead trees or snags that are found most commonly in mesic mature and older mixed conifer forests with a high canopy closure and numerous down logs. This association is predominantly a result of the species' need for large dead trees for nesting, large hollow trees for roosting, and standing and down dead trees for foraging on carpenter ants. It favors dense coniferous forest, but also uses open forests and second growth, particularly if there are isolated, large dead trees and down logs amid the younger forest (Burleigh 1972, Groves et al. 1997). This woodpecker may be affected by changes in successional stages of forest habitat that removes large diameter dead trees or snags, alters forests with high canopy closure, convert forest to an earlier successional stage and removal of down logs that are used as foraging sites.

This species will forage in younger forests, particularly outside of the nesting season if adequate standing and down dead trees are available with carpenter ants present as prey. As a non-migratory resident species, population changes may be a result of forest management activities and natural events occurring within the home range (Burleigh 1972, Groves et al. 1997).

At least 14 other species of birds within the Forest are dependent on cavities that these woodpeckers excavate for nesting because they are not able to excavate their own cavities.

Cavities created by pileated woodpeckers are used by some of the large species that need cavities but do not excavate them. In addition to cavity nesting birds, mammals such as fisher, bats, and flying squirrels use cavities excavated by pileated woodpeckers for nesting, denning, and roosting sites (Thomas et. al. 1979, ICBEMP 1996, Bull et al. 1997, Wisdom et al. 2000). The pileated woodpecker is a species whose presence can be correlated with certain habitat characteristics important to a number of other species (e.g., large diameter dead and downed wood, cavities). These particular habitat components are directly influenced by vegetative management activities on the Forest.

The analysis of forested vegetation current conditions for the Forest Plan revision revealed a reduction in the extent of large tree structure over many localized areas of the Ecogroup Forests from levels that may have occurred historically.

Monitoring plans for the Forest include monitoring for this species (USDA Forest Service 2003a, page IV-11). Monitoring transects/plots were established on the Forest during spring 2003 and have been conducted annually since that time. The overall trend across North America and for the Central Idaho Mountains has been increasing primarily as the result of long-term fire exclusion. (USDA Forest Service 2003b, Appendix 2, Volume 2, page F-10 and-F11).

Chapter 3 of the Supplemental Environmental Impact Statement (SEIS) models source habitat and source environments for bighorn sheep on the Forest. Bighorn sheep habitats are primarily in non-forested areas. Similarly, domestic sheep utilize open habitats for forage and typically avoid forested habitats. Given the habitat requisites for pileated woodpeckers (i.e., mature forested habitats), changes in domestic sheep grazing to conserve bighorn sheep habitats will have negligible effects on pileated woodpecker populations and their habitats.

## WHITE-HEADED WOODPECKER

The Forest Plan designated the white-headed woodpecker as an MIS for Potential Vegetation Groups (PVGs) 1, 2, 3, and 5 with sufficient snags and large trees with low crown density. White-headed woodpeckers are found mainly in open and mature ponderosa pine and mixed ponderosa pine/Douglas fir forests in Idaho (Frederick and Moore 1991, Groves et al. 1997). The birds feed on conifer seeds during the fall and winter. Cone crops are different from year-to-year, and large trees usually produce more cones than small trees. Flying insects are an important food source during other times of the year. Nests are usually excavated in large diameter snags that have a moderate degree of decay (Bull et al. 1986, Bull et al. 1997). Nesting snags need to be greater than 20 inches in diameter (Wisdom et al. 2000). Nesting stands of ponderosa pine used by white-headed woodpeckers typically have less than 30% canopy cover (Frederick and Moore 1991). Based on studies done in Idaho, the white-headed woodpecker rarely migrates and the bird is considered year-round residents.

The white-headed woodpecker’s habitat has changed during the last 100 years, largely due to human activities (Sloan 1998, Morgan and Parsons 2001). Major habitat changes have occurred on the Forest from selective harvesting of large diameter ponderosa pine, snag removal in harvest areas, and composition and density changes of remaining stands due to long-term fire exclusion (Geier-Hayes 1995, ICBEMP 1997, Sloan 1998, Wisdom et al. 2000, Morgan and Parsons 2001). These and other changes have reduced the quality, quantity, and distribution of white-headed woodpecker habitats and populations.

Management of large, low-density ponderosa pine, including snags, is an important consideration in mid- to low elevation Forest habitat for this species (Wisdom et al. 2000). Wisdom et al. (2000) estimate a 62% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The extent of large tree and snag reduction on the landscape has had a negative effect on species such as the white-headed woodpecker. Stephans and Sturts (1991) list the bird as breeders in this latitude/longitude but without confirmed records.

Suitable habitat for this species is found in the lower elevation ponderosa pine stands. Snags are an important component of woodpecker habitat. High open road densities have lead to many of these snags being lost to firewood cutters.

Monitoring plans for the Forest include monitoring for this species (USDA Forest Service 2003a, page IV-11). Monitoring transects/plots were established on the Forest during spring 2003 and have been conducted annually since that time.

Chapter 3 of the SEIS models source habitat and source environments for bighorn sheep on the Forest. Bighorn sheep habitats are primarily in non-forested areas. Similarly, domestic sheep utilize open habitats for forage and typically avoid forested habitats. Given the habitat requisites for white-headed woodpeckers (i.e., mature ponderosa pine) and the limited amount of white-headed woodpecker habitat in the project area, changes in domestic sheep grazing to conserve bighorn sheep habitats will have negligible effects on white-headed woodpecker populations and their habitats.

Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan Final Environmental Impact Statement.

# Migratory Birds

Migratory bird species inhabit various habitat types including a diverse range of forest successional stages. Executive Order (EO) 13186 (01-10-2001) (Sec. 3.) directs each Federal agency taking actions having or likely to have a negative impact on migratory bird populations to work with the U.S. Fish and Wildlife Service (FWS) to develop a Memorandum of Understanding (MOU) to promote the conservation of migratory bird populations. Each agency is encouraged to immediately begin implementing the conservation measures set forth in subparagraphs of Sec 3. (e) of the EO as appropriate and practicable. For the purposes of this order, “migratory bird” means any of the 700-plus birds listed in 50 Code of Federal Regulations (CFR) 10.13. Except for the mountain quail, sage grouse, and the Columbian sharp-tailed grouse, all of the sensitive and management indicator species (MIS) bird species in this document are on this list of migratory birds.

In addition to requiring consultation with the FWS and consideration of migratory bird conservation for agency actions, the EO specifies in Sec. 3.(e):

> (1) support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse

> impacts on migratory bird resources when conducting agency actions;
> (2) restore and enhance the habitat of migratory birds, as practicable;
> (6) ensures that environmental analyses of Federal actions required by the NEPA or other established environmental review process evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern;

"As practicable" (*able to be done*) implies (1) the potential to restore or enhance habitat exist, (2) the means to achieve restoration or enhancement of habitat exists, and (3) the opportunity to achieve restoration or enhancement of habitat is timely. If these three factors are attainable, then the assumption is that vegetative manipulation projects that do not restore or enhance will require documentation and adequate rationale for noncompliance with the EO. Restoring is a key word in the Forest's desired condition. Another basic assumption is that habitat requirements of migratory birds are very diverse, and an action that benefits some species many not be beneficial to others. Priority should be given to threatened, endangered, and sensitive species, MIS, species of special concern, and Partners in Flight (PIF) priority bird species.

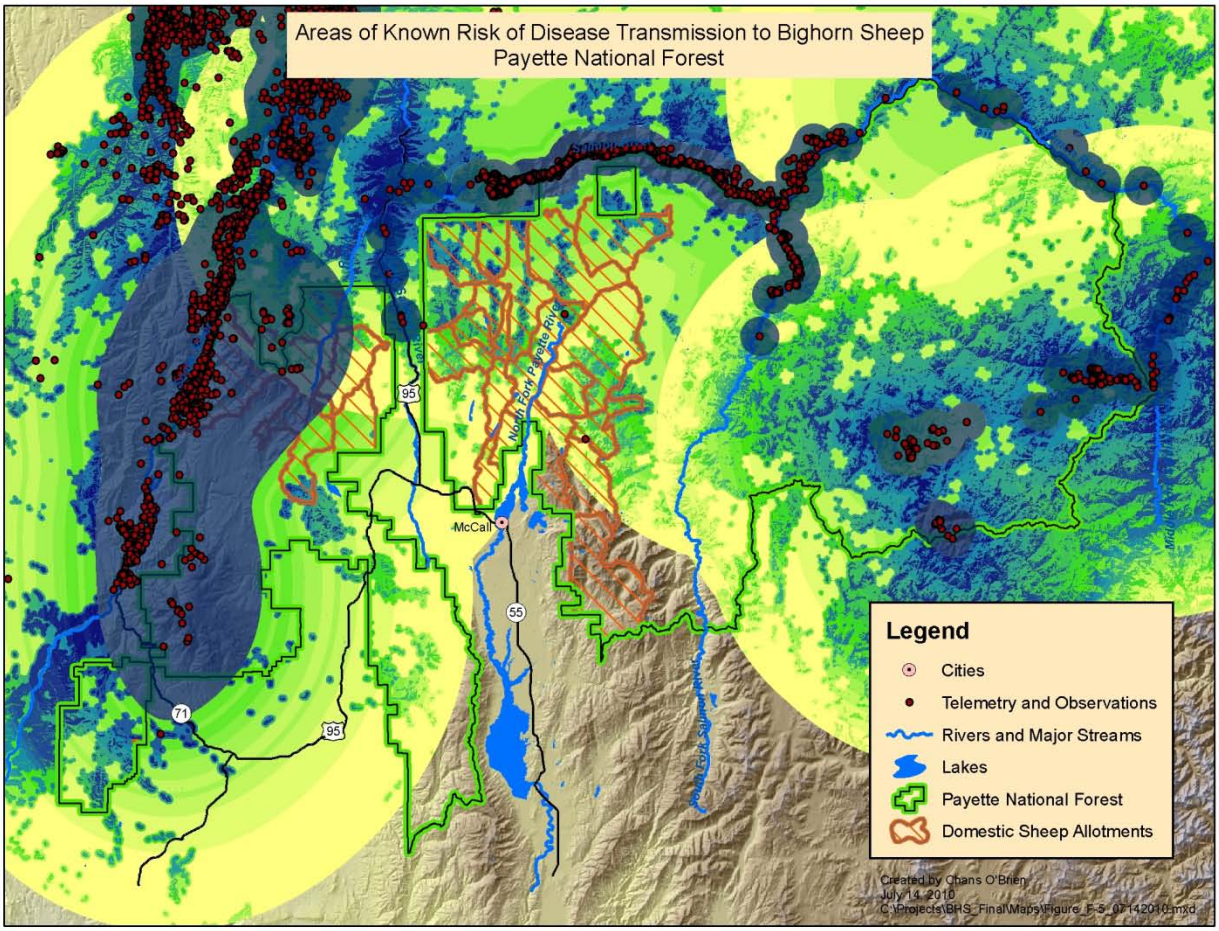
Compliance with the Migratory Bird Treaty Act (MBTA) of 1918 and EO 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," requires that environmental analyses of Federal actions and plans consider the effects on migratory birds, particularly species of concern. In discussions between the FWS and Region 4 Forest Service wildlife ecologists and biologists, it was recommended that State Bird Conservation Plans developed by interagency working groups be used to help identify relevant migratory bird species and habitats for project analysis. In January 2000, the PIF program published the Idaho Bird Conservation Plan (IDBCP), which takes a habitat-based approach to conserving bird populations. The plan identified 14 priority habitats and associated bird species in Idaho (Idaho Partners in Flight 2000).

Information concerning migratory birds is reviewed with the FWS but there is no mechanism in place for that agency to consult on project effects. Use of the IDBCP supports the goal of maintaining the long-term sustainability of migratory bird species and their habitats, as specified by EO 13186 and the MBTA.

None of the proposed alternatives would affect migratory birds or their habitat. None of the proposed alternative would change direction in the Forest Plan to provide for snags or large trees.

Consistent with 36 CFR §219.20(a), this figure will supplement Appendix F of the 2003 Payette National Forest Land and Resource Management Plan Final Environmental Impact Statement.

**Figure F-6. Areas of known Risk of Disease Transmission to Bighorn Sheep on the Payette National Forest**



Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan Final Environmental Impact Statement.

# Evaluation of "Best Management Practices:" Position Statement Prepared by Tim Schommer, Wallawa-Whitman National Forest

## BACKGROUND

The Payette National Forest asked me to complete a position statement on the value of "best management practices" (BMPs) related to my past experience. This task is in preparation for their Final Supplemental Environmental Impact Statement (Final SEIS) to the Final Environmental Impact Statement (FEIS) for the Land and Resource Management Plan (Forest Plan). The Final SEIS is being prepared for their response to appeal direction received from the Chiefs Office of the Forest Service pertaining to bighorn sheep *(Ovis canadensis)* viability, transmission issues between domestic sheep *(Ovis aries)* and bighorn sheep and compliance with the National Forest Management Act and the Hells Canyon National Recreation Area Act.

## WHAT ARE BEST MANAGEMENT PRACTICES

The grazing term "Best Management Practice" has recently been utilized by Idaho State Agencies and the domestic sheep industry as a means to describe on-the-ground practices that reduce the risk of contact between domestic sheep and bighorn sheep where bighorn sheep exist. Many National Forest domestic sheep permittees have been using these practices in some form or another for at least 30 years. In some cases they have been added as terms and conditions to Federal Grazing Permits. Forest Plans or Comprehensive Management Plans (CMP) may also include the practices as direction in the form of standards or guidelines. To my knowledge they have not been called BMPs until just recently.

## OBJECTIVES OF BEST MANAGEMENT PRACTICES

BMPs would be applied to grazing activities on permitted Federal allotments for several reasons, ranging from utilization levels and range readiness to resource protection. For the issue of disease transmission between domestic sheep and bighorn sheep, the objective of implementing BMPs is simply to avoid contact at any time between the two sheep species. Any contact may effectively transmit disease, and result in mortality of bighorn sheep. BMPs are designed to reduce the risk of contact by providing for adequate separation. Implemented BMPs that result in contact are ineffective.

Some Forest Service biologists and range conservationists have extensive field experience of where and when these practices are effective. During my role as National Bighorn Sheep Biologist for the Forest Service for the last 18 years, I worked with range conservationists using several of these grazing practices to increase the potential for effective separation. I have assisted approximately 28 National Forests in the western United States in developing and evaluating grazing practices in the field to increase effective separation between bighorn and domestic sheep. I believe I have a unique

set of skills and experiences for evaluating BMPs.

## HOW TO DETERMINE BEST MANAGEMENT PRACTICES

Most annual operating plans/instructions for domestic sheep allotments contain some of these grazing practices. Each allotment includes grazing practices specific to the allotment and permittee and each allotment carries its own set of unique circumstances that need to be evaluated. What works in one location may not work in another. The following factors affect the success or failure of a grazing practice: topography, bighorn sheep source habitat connectivity, bighorn sheep population size, proximity of domestic sheep grazing allotments to bighorn sheep populations, timing of allotment use, density of vegetation, and escape terrain. None of the BMPs discussed below can be determined effective without an active monitoring effort to detect the presence or absence of bighorn sheep near domestic sheep bands. To my knowledge, no peer reviewed literature exists that evaluates the effectiveness of these grazing practices for reducing the risk of contact between the two species.

## EVALUATION OF BEST MANAGEMENT PRACTICES

The following is a list of BMPs that I have used, and the effectiveness that I have seen with each type:

1) ***Guard Dogs:*** Guard dogs are typically added to a band of sheep to help control predators and monitor the domestic sheep. Using guard dogs for keeping bighorn sheep away from domestic sheep has had limited success. These dogs are designed to protect domestic sheep and goats from predators, not other sheep. Some dogs have been quite tolerant of bighorn sheep (Figure F-7). It is also hard for guard dogs to be at every location of domestic sheep if they are loosely herded across forested and irregular steep terrain.

**Figure 7. Photo illustrating the ineffective use of guard dogs to keep bighorn sheep and domestic sheep separated**

2) ***Extra Herders:*** Some operators have added an extra herder. This practice may be of value in open gentle terrain with good visibility. Extra observers will help locate bighorn sheep and improve domestic sheep control during daylight hours.
3) ***Propane Guns:*** Using propane guns at the edge of domestic sheep flocks to scare away bighorn sheep has not been successful because most states do not shoot females and young bighorns and have very restrictive ram hunting. Also, bighorn sheep do not regularly associate negative effects with loud noise. Our experience in northeastern Oregon is that deer and elk become conditioned to the noise in 2–3 days and continue to damage crops. Continually moving these propane guns with the bands of sheep is also costly.
4) ***Trucking of Sheep:*** Trucking of domestic sheep instead of trailing has been effective in reducing strays. Strays increase the probability of contact with a bighorn sheep. However, because of cost and the potential for domestic sheep disease associated with this practice, most operators prefer to not truck their sheep.
5) ***Bedding of Sheep at Night:*** Although domestic sheep herders may want to bed the sheep together in a 5-acre area at night, this practice is difficult in steep terrain because sheep are

spread out in a "loose herd" fashion and having fenced pens is not realistic. Predators such as coyotes, cougar, and wolves are very effective at killing or scattering domestic sheep at night. In open gentle terrain, this practice can be helpful in controlling domestic sheep.

6) ***Counting of Sheep:*** Most National Forests conduct a 100% count of all domestic sheep onto the allotment at the beginning of the grazing season. Normally, the sheep are not counted during or after the grazing season by the Forest Service. Counting at the end of the season can give an approximation of how many have been killed or lost. Looking for strays during and after the season can reduce the risk of contact with bighorn sheep. Marking domestic sheep is difficult and expensive for the operators. Some operators provide one marker sheep for every 25 head of domestic sheep and count the marker sheep daily. This practice can tell the operator if they are missing any large numbers of domestic sheep. However, this technique has limited effectiveness because it may only take one domestic sheep to transmit disease to bighorn sheep.
7) ***Herder Communication:*** Some operators are now equipping their herders with cell or satellite phones so they can immediately call authorities when bighorn sheep are observed in or close to domestic sheep. Authorities can either shoot, remove, or haze bighorn sheep. These practices can be helpful in preventing contact. However, some operators do not report to authorities when bighorn sheep are near their domestic sheep.
8) ***Bighorn Monitoring:*** Having observers out looking for bighorn sheep is always helpful in keeping the two species apart and radio collars on bighorn sheep can make that effort more productive. However, bighorn sheep monitoring is expensive and not all bighorn sheep are collared. Most of the radio collaring has been with conventional collars (VHF) which are usually monitored only twice a month. The new GPS collars report locations several times a day and are more beneficial than VHF collars. However, people need to be mindful of the following aspects: (1) only a sample of the bighorn sheep population is collared; (2) collaring is typically skewed toward ewes, which do not foray as far or as often as rams; (3) nobody knows where the bighorn sheep have been between monitoring efforts with VHF collars; and (4) collaring is expensive.
9) ***Sick Domestics:*** Not turning sick domestic sheep out on the allotment is standard practice. Unfortunately, the diseases that are transmitted from domestic to bighorn sheep do not make domestic sheep appear sick. While helpful, this practice does not reduce risk of contact or disease transmission.
10) ***Stray Domestics:*** Stray domestic sheep off the allotment need to be quickly removed. Unfortunately, most Forest allotments are in big areas of remote country with some timber where it is hard to detect strays. Many examples exist of strays being out for several weeks without detection. When they are detected, they are often very hard to find and remove. Grazing operators are usually very busy and can't redirect their attention to finding a few strays. Recently, a few operators have been willing to let authorities remove sheep for them under certain conditions. This practice can be helpful in reducing risk of contact, but many strays go undetected.

When all or most of the BMPs are implemented on an allotment, will enough separation be provided to effectively reduce the risk of contact and avoid contact? The key to successful BMPs depends on whether or not BMPs are consistently implemented on the ground, the operators have the ability to maintain tight control of domestics, the allotment is connected to quality bighorn sheep habitat, and bighorn sheep are in or adjacent to the allotment (up to 9 miles).

1) **Implementation:** Agreeing to BMPs on paper is easier; implementing them on the ground for the entire grazing season year after year is more difficult. Many examples of BMPs not always being implemented on the ground exist. And BMPs can only be effective if fully implemented and readily adapted if not working.
2) **Maintaining Control of Domestics:** Controlling domestic sheep in terrain that is forested, steep. or rocky is very difficult. In allotments such as the Allison-Berg on the Nez Perce National Forest, the best possible way to manage vegetation with domestic sheep in this steep rocky terrain is to "loose herd" the domestic sheep-spreading the sheep out over large areas during the day and not tightly controlling them. Such a practice makes it is easy for domestic sheep to stray from the herder(s). Visibility is very difficult for the herders, especially in forested habitat and predators such as wolves can cut into the herd and scatter them for miles. Under these situations BMPs are not likely to be effective. The Rock Creek allotment on the Inyo National Forest is open gentle terrain where a herder can see for miles and can detect bighorn sheep. The Rock Creek Allotment is not in bighorn sheep habitat. BMPs implemented on these types of allotments can be effective in keeping the two species separate and reducing the risk of contact.
3) **Bighorn Sheep Habitat and Presence:** Bighorn sheep source habitat is usually in steep, open, rocky terrain as described above where tight control of domestic sheep is usually difficult and herder visibility is limited. In and around the Payette National Forest, high quality source habitat is not a limiting factor. Habitat is well connected and well distributed across the Payette National Forest and no natural barriers exist to dissuade bighorn sheep from pioneering, colonizing, and exploring their landscapes as demonstrated by the telemetry and sighting data. This ease of movement for bighorns across the Payette National Forest leaves questions about the effectiveness of BMPs to successfully provide for avoiding contact or reducing the risk of contact between the two species. Bighorn sheep presence in habitat that is in or adjacent to an allotment makes developing effective BMPs even more difficult. Separation is highly unlikely, and if the allotment is within the herd home range of the bighorn sheep population, contact with the allotment is all but a guarantee. Last year's mixing of a radio-collared ram with domestics on the Allison-Berg Allotment, despite the implementation of BMPs, is an example of their limitations. When bighorn sheep habitat is high quality and continuous for many miles, keeping the two species separate is very difficult.

Although bighorn sheep do not favor timbered areas, they will pass through them and are extremely hard to detect when this happens. Such was the case when a band of domestics was grazing near Josephine Lake on the Payette National Forest; no one noticed the bighorn sheep ram until it was caught in a wolf snare trap. Without radio collars, bighorn sheep can be very difficult to detect. Even with radio collars, detection on the ground can be difficult. On the Smith Mountain Allotment on the Payette National Forst, radio collar data showed bighorn sheep located within the allotment during the grazing season without detection by the permittee.

On the Temperance Creek Allotment in Hells Canyon in the 1980s and early 1990s, domestic and bighorn sheep were separated by over 20 air miles and almost all of the BMPs described above were implemented. Despite these grazing practices and large separation distances, the two species could not be kept apart. Detecting bighorn and domestic sheep in this open, rocky, continuous bighorn sheep habitat was very difficult. Known mixing of the two species approximately every other year resulted in large catastrophic bighorn sheep die-offs.

## CONCLUSION

To avoid disease transmission between domestic and bighorn sheep, contact between the two sheep species should be avoided. In limited situations, implementing BMPs can lead a reduced risk for contact. BMPs that work in one situation may, or may not, work in another so all BMPs need to be developed for site-specific situations. Connectivity of bighorn sheep source habitat, terrain, density of vegetation, and ruggedness all affect the ability to successfully implement BMPs. Monitoring bighorn sheep presence should be conducted in areas of high risk for contact. Based on my experience, the only significant reduction in risk of contact that I have witnessed is when BMPs are implemented in open, gentle, non-bighorn sheep habitat where domestic sheep can be easily controlled and monitored, and a large buffer exists between the two species.

Consistent with 36 CFR §219.20(a), this section will be added to the References section of Appendix F, page F-35, of the 2003 Payette National Forest Land and Resource Management Plan Final Environmental Impact Statement.

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# Appendix F

# Migratory Birds

Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan.

## MIGRATORY BIRDS

Migratory bird species inhabit various habitat types including a diverse range of forest successional stages. Executive Order (EO) 13186 (01-10-2001) (Sec. 3.) directs each Federal agency taking actions having or likely to have a negative impact on migratory bird populations to work with the U.S. Fish and Wildlife Service (FWS) to develop a Memorandum of Understanding (MOU) to promote the conservation of migratory bird populations. Each agency is encouraged to immediately begin implementing the conservation measures set forth in subparagraphs of Sec 3. (e) of the EO as appropriate and practicable. For the purposes of this order, "migratory bird" means any of the 700-plus birds listed in 50 Code of Federal Regulations (CFR) 10.13. Except for the mountain quail, sage grouse, and the Columbian sharp-tailed grouse, all of the sensitive and management indicator species (MIS) bird species in this document are on this list of migratory birds.

In addition to requiring consultation with the FWS and consideration of migratory bird conservation for agency actions, the EO specifies in Sec. 3.(e):

> (1) support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions;
> (2) restore and enhance the habitat of migratory birds, as practicable;
> (6) ensures that environmental analyses of Federal actions required by the NEPA or other established environmental review process evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern;

"As practicable" (*able to be done*) implies (1) the potential to restore or enhance habitat exist, (2) the means to achieve restoration or enhancement of habitat exists, and (3) the opportunity to achieve restoration or enhancement of habitat is timely. If these three factors are attainable, then the assumption is that vegetative manipulation projects that do not restore or enhance will require documentation and adequate rationale for noncompliance with the EO. Restoring is a key word in the Forest's desired condition. Another basic assumption is that habitat requirements of migratory birds are very diverse, and an action that benefits some species many not be beneficial to others. Priority should be given to threatened, endangered, and sensitive species, MIS, species of special concern, and Partners in Flight (PIF) priority bird species.

Compliance with the Migratory Bird Treaty Act (MBTA) of 1918 and EO 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," requires that environmental analyses of Federal actions and plans consider the effects on migratory birds, particularly species of concern. In discussions between the FWS and Region 4 Forest Service wildlife ecologists and biologists, it was recommended that State Bird Conservation Plans developed by interagency working groups be used to help identify relevant migratory bird species and habitats for project analysis. In January 2000, the PIF program published the Idaho Bird Conservation Plan (IDBCP), which takes a habitat-based approach to conserving bird populations. The plan

identified 14 priority habitats and associated bird species in Idaho (Idaho Partners in Flight 2000).

Information concerning migratory birds is reviewed with the FWS but there is no mechanism in place for that agency to consult on project effects. Use of the IDBCP supports the goal of maintaining the long-term sustainability of migratory bird species and their habitats, as specified by EO 13186 and the MBTA.

None of the proposed alternatives would affect migratory birds or their habitat. None of the proposed alternative would change direction in the Forest Plan to provide for snags or large trees.

## LITERATURE CITED

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# Appendix F

# Terrestrial Management Indicator Species for the Payette National Forests

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Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan.

## INTRODUCTION

This paper presents the legal requirements for identification of Management Indicator Species (MIS) from the 1982 National Forest Management Act (NFMA) implementing planning regulation 36 CFR 219.19, and describes the implications of this project on MIS selected in the *Payette National Forest Land and Resource Management Plan* (Forest Plan) (USDA Forest Service 2003a).

## LEGAL REQUIREMENTS FOR MANAGEMENT INDICATOR SPECIES

Federal regulation 36 CFR 219.19 requires that habitats be managed to support viable populations of all native and desirable non-native vertebrate at the planning area level (generally considered the Forest). The regulations recommend the use of MIS population trends to reflect the effects of management activities. MIS may be selected from plant and animal species that are: threatened or endangered; sensitive; ecological indicators; important for recreational, commercial, subsistence, or aesthetic values; representative of special habitats, habitat components, or plant and animal communities; and/or species that are of high concern.

The following are some of the key elements related to MIS from the Federal regulation:

"Each alternative shall establish objectives for the maintenance and improvement of habitat for MIS – to the degree consistent with overall multiple use objectives of the alternative" 219.19(a)

*"In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and /or invertebrate species present in the area shall be identified and selected as MIS and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities." 219.19(a)(1)*

*"Planning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and animal population trends of the MIS" 219.19(a)(2)*

*"Populations trends of MIS will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with State fish and wildlife agencies, to the extent practicable." 219.19(a)(6)*

The NFMA also directs national forests to identify MIS whose populations and habitat conditions indicate potential impacts from forest management. By monitoring and assessing habitat conditions of indicator species, managers can estimate effects on other species with similar habitat needs.

The MIS for the Payette National Forest (Forest) are the pileated woodpecker (*Dryocopus pileatus*) and the white-headed woodpecker (*Picoides albolarvatus*).

## PILEATED WOODPECKER

The pileated woodpecker is native to North America and is a resident species. It is found in forested portions of all the eastern states. It is also known to occur across southern Canada. In the western United States they occur in Washington, Oregon, California, Nevada, Montana, and Idaho in forests that grow large diameter trees. Wisdom et al. (2000) estimated a 21% decrease in source habitat in the Columbia River Basin and a 21% increase within the Central Idaho Mountains Ecological Reporting Unit (ERU) (which includes the Forest) from historical levels. Breeding Bird Surveys in Idaho show an increasing trend for this species during the last 30 years and support the conclusions of Wisdom et al. (2000) that habitat has increased. Pileated woodpeckers inhabit areas under private, state, and other Federal administrations, however most of their habitat is on forested lands administered by the Forest Service.

Pileated woodpeckers occur on all ranger districts within the Forest. Habitat primarily occurs in mixed conifer forests, including spruce-fir (*Picea* spp.) and lodgepole pine (*Pinus contorta*) that are capable of growing large diameter trees (>20 inch diameter) with multi-storied stands. Pileated woodpeckers nest in standing snags and are the largest woodpeckers occurring within the Ecogroup area (Payette, Sawtooth, and Boise National Forests). Because the bird is so large, this species needs snags of sufficient diameter to accommodate their body size when excavating nest cavities. Studies in Montana and Idaho have shown that old and mature larch (*Larix* spp.), ponderosa pine (*Pinus ponderosa*), grand fir (Abies grandis), and Douglas fir (*Pseudotsuga menziesii*) are used for nest cavities (Burleigh 1972, Groves et al. 1997). Carpenter ants (*Camponotus* sp.) are a major food source. Dead and dying trees, snags, logs, and stumps are important foraging substrates containing carpenter ants. Pileated woodpeckers also dig directly into anthills (Groves et al. 1997).

The pileated woodpecker is a long-lived and wide-ranging non-migratory resident species. It nests and roosts in large diameter dead trees or snags that are found most commonly in mesic mature and older mixed conifer forests with a high canopy closure and numerous down logs. This association is predominantly a result of the species' need for large dead trees for nesting, large hollow trees for roosting, and standing and down dead trees for foraging on carpenter ants. It favors dense coniferous forest, but also uses open forests and second growth, particularly if there are isolated, large dead trees and down logs amid the younger forest (Burleigh 1972, Groves et al. 1997). This woodpecker may be affected by changes in successional stages of forest habitat that removes large diameter dead trees or snags, alters forests with high canopy closure, convert forest to an earlier successional stage and removal of down logs that are used as foraging sites.

This species will forage in younger forests, particularly outside of the nesting season if adequate standing and down dead trees are available with carpenter ants present as prey. As a non-migratory resident species, population changes may be a result of forest management activities and natural events occurring within the home range (Burleigh 1972, Groves et al. 1997).

At least 14 other species of birds within the Forest are dependent on cavities that these woodpeckers excavate for nesting because they are not able to excavate their own cavities. Cavities created by pileated woodpeckers are used by some of the large species that need cavities but do not excavate them. In addition to cavity nesting birds, mammals such as fisher, bats, and

flying squirrels use cavities excavated by pileated woodpeckers for nesting, denning, and roosting sites (Thomas et. al. 1979, ICBEMP 1996, Bull et al. 1997, Wisdom et al. 2000). The pileated woodpecker is a species whose presence can be correlated with certain habitat characteristics important to a number of other species (e.g., large diameter dead and downed wood, cavities). These particular habitat components are directly influenced by vegetative management activities on the Forest.

The analysis of forested vegetation current conditions for the Forest Plan revision revealed a reduction in the extent of large tree structure over many localized areas of the Ecogroup Forests from levels that may have occurred historically.

Monitoring plans for the Forest include monitoring for this species (USDA Forest Service 2003a, page IV-11). Monitoring transects/plots were established on the Forest during spring 2003 and have been conducted annually since that time. The overall trend across North America and for the Central Idaho Mountains has been increasing primarily as the result of long-term fire exclusion. (USDA Forest Service 2003b, Appendix 2, Volume 2, page F-10 and-F11).

Chapter 3 of the Supplemental Environmental Impact Statement (SEIS) models source habitat and source environments for bighorn sheep on the Forest. Bighorn sheep habitats are primarily in non-forested areas. Similarly, domestic sheep utilize open habitats for forage and typically avoid forested habitats. Given the habitat requisites for pileated woodpeckers (i.e., mature forested habitats), changes in domestic sheep grazing to conserve bighorn sheep habitats will have negligible effects on pileated woodpecker populations and their habitats.

## WHITE-HEADED WOODPECKER

The Forest Plan designated the white-headed woodpecker as an MIS for Potential Vegetation Groups (PVGs) 1, 2, 3, and 5 with sufficient snags and large trees with low crown density. White-headed woodpeckers are found mainly in open and mature ponderosa pine and mixed ponderosa pine/Douglas fir forests in Idaho (Frederick and Moore 1991, Groves et al. 1997). The birds feed on conifer seeds during the fall and winter. Cone crops are different from year-to-year, and large trees usually produce more cones than small trees. Flying insects are an important food source during other times of the year. Nests are usually excavated in large diameter snags that have a moderate degree of decay (Bull et al. 1986, Bull et al. 1997). Nesting snags need to be greater than 20 inches in diameter (Wisdom et al. 2000). Nesting stands of ponderosa pine used by white-headed woodpeckers typically have less than 30% canopy cover (Frederick and Moore 1991). Based on studies done in Idaho, the white-headed woodpecker rarely migrates and the bird is considered year-round residents.

The white-headed woodpecker’s habitat has changed during the last 100 years, largely due to human activities (Sloan 1998, Morgan and Parsons 2001). Major habitat changes have occurred on the Forest from selective harvesting of large diameter ponderosa pine, snag removal in harvest areas, and composition and density changes of remaining stands due to long-term fire exclusion (Geier-Hayes 1995, ICBEMP 1997, Sloan 1998, Wisdom et al. 2000, Morgan and Parsons 2001). These and other changes have reduced the quality, quantity, and distribution of white-headed woodpecker habitats and populations.

Management of large, low-density ponderosa pine, including snags, is an important consideration in mid- to low elevation Forest habitat for this species (Wisdom et al. 2000). Wisdom et al. (2000) estimate a 62% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The extent of large tree and snag reduction on the landscape has had a negative effect on species such as the white-headed woodpecker. Stephans and Sturts (1991) list the bird as breeders in this latitude/longitude but without confirmed records.

Suitable habitat for this species is found in the lower elevation ponderosa pine stands. Snags are an important component of woodpecker habitat. High open road densities have lead to many of these snags being lost to firewood cutters.

Monitoring plans for the Forest include monitoring for this species (USDA Forest Service 2003a, page IV-11). Monitoring transects/plots were established on the Forest during spring 2003 and have been conducted annually since that time.

Chapter 3 of the SEIS models source habitat and source environments for bighorn sheep on the Forest. Bighorn sheep habitats are primarily in non-forested areas. Similarly, domestic sheep utilize open habitats for forage and typically avoid forested habitats. Given the habitat requisites for white-headed woodpeckers (i.e., mature ponderosa pine) and the limited amount of white-headed woodpecker habitat in the project area, changes in domestic sheep grazing to conserve bighorn sheep habitats will have negligible effects on white-headed woodpecker populations and their habitats.

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# Appendix K

# Biological Evaluation

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Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan.

# Introduction

This biological evaluation (BE) documents the potential effects of the proposed supplement to the *Payette National Forest Land and Resource Management Plan* (Forest Plan) (USDA Forest Service 2003a) to threatened, endangered, and sensitive (TES) species.

The Final Supplemental Environmental Impact Statement (FSEIS) (USDA Forest Service 2010) for the Forest Plan is based on an analysis of nine alternatives, which were issued for public review in a Draft Supplemental Environmental Impact Statement (DSEIS). The FSEIS incorporated the public comments and suggestions that warranted further analysis or clarification.

Currently, 27 TES species (9 mammals, 13 birds, 1 amphibian, and 4 aquatic species) 3 critical habitat areas are known or suspected to exist on the Payette National Forest (Forest) (Table K-1). This list is updated annually. The TES species and their management considerations are described below:

**Table K-1. Threatened, endangered, and sensitive species**

| *Type* | *Common Name* | *Scientific Name* | *Global Rank* [a] | *Federal Status* | *State Rank* [b] | *Management Considerations* |
|---|---|---|---|---|---|---|
| *Mammal* | *Northern Idaho ground squirrel* | *Spermophilus brunneus brunneus* | *G2T2* | *Threatened* | *S1* | *Habitat fragmentation* |
| | *Canada lynx* | *Lynx canadensis* | *G5* | *Threatened* | *S1* | *Vulnerable during denning* |
| | *Southern Idaho ground squirrel* | *Spermophilus brunneus endemicus* | *G2* | *R-4 sensitive* | *S2* | *Habitat fragmentation* |
| | *Wolverine* | *Gulo gulo luscus* | *G4T4* | *R-4 sensitive* | *S2* | *Vulnerable during denning* |
| | *Fisher* | *Martes pennati* | *G5* | *R-4 sensitive* | *S1* | *Habitat fragmentation, snags, and logs* |
| | *Townsend'sWestern big-eared bat* | *Corynorhinus townsendii townsendii* | *G4* | *R-4 sensitive* | *SC* | *Vulnerable to disruption* |
| | *Spotted bat* | *Euderma maculatum* | *G4* | *R-4 sensitive* | *SC* | *Vulnerable to disruption* |
| | *Rocky Mountain bighorn sheep* | *Ovis canadensis canadensis* | *G4* | *R-4 sensitive* | *S3* | *Vulnerable to disease* |
| | *Gray wolf* | *Canis lupus* | *G4* | *R-4 sensitive* | *S2* | *Human caused mortality* |
| *Bird* | *Northern goshawk* | *Accipter gentilis* | *G5* | *R-4 sensitive* | *S3* | *Nest stand, prey availability* |
| | *Bald eagle* | *Haliaeetus leucocephalus* | *G5* | *R-4 sensitive* | *S3* | *Nest stand, prey availability* |
| | *White-headed woodpecker* | *Picoides albolarvatus* | *G4* | *R-4 sensitive* | *S2* | *Large snags, low crown density* |
| | *Flammulated owl* | *Otus flammeolus* | *G4* | *R-4 sensitive* | *S3B* | *Large snags and trees* |
| | *Harlequin duck* | *Histrionicus histrionicus* | *G4* | *R-4 sensitive* | *G/SC* | *Forest riparian* |
| | *Mountain quail* | *Oreortyx pictus* | *G5* | *R-4 sensitive* | *S1* | *Shrubby riparian* |
| | *Boreal owl* | *Aegolius funereus* | *G5* | *R-4 sensitive* | *S2* | *Large snags* |
| | *Three-toed woodpecker* | *Picoides tridactylus* | *G5* | *R-4 sensitive* | *S2* | *Abundant snags* |
| | *Great gray owl* | *Strix nebulosa* | *G5* | *R-4 sensitive* | *S3* | *Forested areas with meadows* |

| Type | Common Name | Scientific Name | Global Rank [a] | Federal Status | State Rank [b] | Management Considerations |
|---|---|---|---|---|---|---|
| | *Columbian sharp-tailed grouse* | *Tympanuchus phasianellus columbianus* | *G4T3* | *R-4 sensitive* | *S3* | *Shrubby wintering areas* |
| | *Common loon* | *Gavia immer* | *G5* | *R-4 sensitive* | *SC* | *Vulnerable during nesting, abundant small fish for prey* |
| | *Peregrine falcon* | *Falco peregrines anatum* | *G4T3* | *R-4 sensitive* | *E* | *Vulnerable during nesting* |
| | *Yellow-billed cuckoo* | *Coccyzus americanus* | G5 | *R-4 sensitive* | S2B | *Habitat fragmentation* |
| *Amphibian* | *Columbia spotted frog* | *Rana luteiventris* | *G4Q* | *R-4 sensitive* | *Not ranked* | *Still or ponded water* |
| *Aquatic* | *Snake River spring/summer and fall Chinook salmon and designated critical habitat* | *Oncorhynchus tshawytscha* | | *Threatened* | | *Aquatic cold water* |
| | *Snake River Basin steelhead and designated critical habitat* | *Oncorhynchus mykiss* | | *Threatened* | | *Aquatic cold water* |
| | *Columbia River bull trout and proposed critical habitat* | *Salvelinus confluentus* | | *Threatened* | | *Aquatic cold water* |
| | *Westslope cutthroat trout* | *Oncorhynchus clarki lewisi* | *G4T3* | *R-4 sensitive* | *S3* | *Aquatic cold water* |

[a] Global Rank = globally imperiled ranking, from Nature Serve (2009) 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure
[b] State Ranked, SC = species of concern, G/SC = game species and species of concern, S1 = Critically imperiled, S2 = imperiled, S3 = Vulnerable, S3B = Breeding vulnerable (Idaho and Utah Conservation Data Center)

The FSEIS reanalyzes the effects of current and proposed Forest management on Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) within the Forest. Specifically, the FSEIS presents additional information concerning the following issues:

- Manage habitats that support viable populations of bighorn sheep at the planning-unit scale
- Compliance with the Hells Canyon National Recreation Area (HCNRA) Act (PL 94-199)
- Compliance with 36 CFR 292.48 (Domestic Livestock Grazing Activities on Other Lands, Wild and Scenic Rivers, and Wilderness Lands in the HCNRA)
- Compliance with the National Forest Management Act (NFMA)
- Compliance with 36 CFR 219.19 (Ecological, Social, and Economic Sustainability)

# Alternative Description

## ALTERNATIVES 1B, 2, 5, AND 7

The seven alternatives evaluated in the Final Environmental Impact Statement (FEIS) for the Forest Plan can be combined into two categories based on how they affected the risk of contact between domestic and bighorn sheep. The first category contains Alternatives 1B, 2, 5, 7, which designates all acres on the Forest as suitable for domestic sheep grazing. All trailing routes remained open in these alternatives.

Alternative 7 was chosen as the alternative to be implemented in the Record of Decision for the FEIS, which was subsequently appealed. The portion of Alternative 7 tied to bighorn sheep viability, disease transmission between domestic sheep and bighorn sheep, and compliance with the HCNRA Act was remanded to the Regional Forester for improved and additional analysis. To meet the appeal requirements related to the potential impacts of disease transmission from domestic sheep on the Forest, modifications to Alternative 7 were developed and are analyzed in Chapter 3. Because this alternative was found to not be compliant with the NFMA, it cannot be selected as the final decision. For Alternative 7, zero acres are identified as unsuitable for domestic sheep.

## ALTERNATIVES 3, 4, AND 6

These alternatives were also proposed in the FEIS and are grouped together as the second category of alternatives. These alternatives would designate zero acres of suitable rangeland portions of the Smith Mountain Allotment overlapping current bighorn sheep habitat are available for domestic sheep grazing. All trailing routes would remain open.

## ALTERNATIVE 7E

Alternative 7E would designate zero acres within the Forest as suitable for domestic sheep grazing and would leave no trailing routes open to use within the entire Forest.

The following allotments would be affected by this Alternative: Smith Mountain, Curren Hill, Boulder Creek, Price Valley, Surdam, Shorts Bar, Hershey-Lava, French Creek, Bear Pete, Marshall Mountain, Vance Creek, Little French Creek, Josephine, Victor-Loon, Grassy Mountain, Slab Butte, Cougar Creek, Twenty Mile, Brundage, Bill Hunt, Fall/Brush Creek, North Fork Lick Creek, Lake Fork, and Jughandle.

## ALTERNATIVE 7G (AGENCY PREFERRED ALTERNATIVE)

In the DSEIS, populations of bighorn sheep were identified using the geographic population range (GPR) model. The GPR was developed utilizing the risk analysis (USDA Forest Service 2006a) that is no longer in effect for the FSEIS. Alternative 7G uses the GPRs as boundaries only (not tied to the risk analysis) and would designate zero acres within the Hells Canyon and Salmon River GPRs as suitable for domestic sheep grazing. This alternative would leave no trailing routes open within the GPRs.

The following allotments would be affected by this alternative: Smith Mountain, Curren Hill, Boulder Creek, Price Valley, Shorts Bar, Hershey-Lava, French Creek, Bear Pete, Marshall Mountain, Vance Creek, Little French Creek, Josephine, Victor-Loon, Twenty Mile, Fall/Brush Creek, North Fork Lick Creek, and Lake Fork.

## ALTERNATIVE 7L

Alternative 7L was developed using the updated quantitative risk analysis and landmarks, such as watershed divides, streams, roads, and allotment boundaries, to make implementation easier. This alternative would attempt to remove only the very highest risk areas from domestic sheep grazing while keeping suitable range land open.

On the west zone of the Forest, zero acres of the Curren Hill and Surdam Allotments would be designated suitable for domestic sheep grazing, while the eastern 35 percent of the Smith Mountain Allotment and all of Boulder Creek and Price Valley Allotments would be designated as suitable for domestic sheep grazing. On the east zone of the Forest, zero acres of the Shorts Bar and North Fork Lick Creek Allotments would be designated suitable for domestic sheep grazing. The southwest 25 percent of the Hershey-Lava Allotment, the very eastern 15 percent of the French Creek Allotment, the eastern 40 percent of the Bear Pete Allotment, and the western 70 percent of the Marshal Mountain Allotment would be designated suitable for domestic sheep grazing.

## ALTERNATIVE 7M

Alternative 7M was developed using the updated quantitative risk analysis and landmarks, such as watershed divides, streams, roads, and allotment boundaries, to make implementation easier. This alternative was designed to remove more risk from the landscape and keep grazing outside of the core herd home range areas.

On the west zone of the Forest, zero acres of the Curren Hill, Surdam, and Boulder Creek Allotments would be designated suitable for domestic sheep grazing. The eastern 25 percent of the Smith Mountain Allotment would be designated suitable for domestic sheep grazing. The eastern 85 percent of the Price Valley Allotment would be designated suitable for domestic sheep grazing. On the east zone of the Forest, zero acres of the Shorts Bar, French Creek, Marshall Mountain, North Fork Lick Creek, and Lake Fork Allotments would be designated suitable for domestic sheep grazing. The southwestern 25 percent of the Hershey-Lava Allotment and eastern 30 percent of the Bear Pete Allotment would be designated suitable for domestic sheep grazing. The northern 50 percent of the Victor-Loon Allotment, western 25 percent of the Twenty Mile Allotment, and southern 90 percent of the Jughandle Allotment would be designated suitable for domestic sheep grazing.

## ALTERNATIVE 7N

Alternative 7N was developed using the updated quantitative risk analysis and landmarks, such as watershed divides, streams, roads, and allotment boundaries, to make implementation easier. This alternative was designed to remove most of the high risk area and replace grazing areas of lower risk.

On the west of the Forest, zero acres of the Curren Hill, Surdam, and Boulder Creek Allotments are designated suitable for domestic sheep grazing. The eastern 25 percent of the Smith Mountain allotment and eastern 85 percent of the Price Valley Allotment are designated suitable for domestic sheep grazing. On the east zone of the Forest, zero acres of the Shorts Bar, Grassy Mountain, Vance Creek, Hershey-Lava, Little French Creek, French Creek, Marshall Mountain, and North Fork Lick Creek Allotments would be designated suitable for domestic sheep grazing. The western 85 percent of the Josephine

Allotment, eastern 25 percent of Bear Pete Allotment, northern 50 percent of the Victor-Loon Allotment, and western 25 percent of the Twenty Mile Allotment would be designated suitable for domestic sheep grazing.

### ALTERNATIVE 7O

Alternative 7O was developed using the updated quantitative risk analysis and landmarks, such as watershed divides, streams, roads, and allotment boundaries, to make implementation easier. This alternative was designed to remove all areas of major risk and keep allotments as intact as possible while reducing monitoring to minimal levels.

On the west zone of the Forest, zero acres of the Curren Hill, Surdam, and Boulder Creek Allotments would be designated suitable for domestic sheep grazing. The eastern 25 percent of the Smith Mountain Allotment and eastern 85 percent of the Price Valley Allotment would be designated suitable for domestic sheep grazing. On the east zone of the Forest, zero acres of the Shorts Bar, Grassy Mountain, Vance Creek, Hershey-Lava, Little French Creek, French Creek, Josephine, Bear Pete, Marshall Mountain, Victor-Loon, North Fork Lick Creek, and Lake Fork Allotments would be designated suitable for domestic sheep grazing. The western 25 percent of the Twenty Mile Allotment and southern 90 percent of the Jughandle Allotment would be designated suitable for domestic sheep grazing.

### ALTERNATIVE 7P

Alternative 7P was developed using the updated quantitative risk analysis and landmarks, such as watershed divides, streams, roads, and allotment boundaries, to make implementation easier. This alternative was designed to designate many of the high risk area as unsuitable for domestic sheep grazing but retain lower risk areas, thus maximizing bighorn sheep protection and the amount of suitable range land available.

On the west zone of the Forest, zero acres of the Curren Hill, Surdam, and Boulder Creek Allotments would be designated suitable for domestic sheep grazing. The eastern 35 percent of the Smith Mountain Allotment and eastern 85 percent of the Price Valley Allotment would be designated suitable for domestic sheep grazing. On the east zone of the Forest, zero acres of the Shorts Bar, Little French Creek, French Creek, Marshall Mountain, and North Fork Lick Creek Allotments would be designated suitable for domestic sheep grazing. The southwest 25 percent of the Hershey-Lava Allotment, western 85 percent of the Josephine Allotment, eastern 25 percent of Bear Pete Allotment, northern 50 percent of Victor-Loon Allotment, and western 25 percent of the Twenty Mile Allotment would be designated suitable for domestic sheep grazing.

## Species Descriptions

### FEDERALLY LISTED SPECIES

The Idaho Fish and Wildlife Office of the U.S. Fish and Wildlife Service (FWS) provided the Forest with an updated list of threatened, endangered, and proposed species (list number 14420-2009-SL-0039) that occur or potentially occur on the Forest. Listed species include the northern Idaho ground squirrel, Canada lynx, Snake River spring/summer and fall Chinook salmon, Snake River Basin steelhead, and Columbia River bull trout.

## Northern Idaho Ground Squirrel

The northern Idaho ground squirrel is a threatened species under the Endangered Species Act of 1973 (ESA), as amended (61 FR 7596). The Final Rule for this listing (65 FR 17779) is dated April 5, 2002. A recovery plan was completed in 2003 (USDI FWS 2003).

The northern Idaho ground squirrel emerges in late March or early April and ceases above-ground activity in late July or early August (Yensen 1991). Adult (>2 years old) males emerge first, followed by adult females and then yearlings. Entrance into seasonal torpor occurs in the same order, with pups active approximately 1 month later than adult males. Northern Idaho ground squirrels are diurnally active. Newly emerged females remain near their hibernacula, where they are courted by adult males. Females are sexually attractive to males for only a few hours on the first or second afternoon following their emergence. The northern Idaho ground squirrel diet consists of forbs, grasses, seeds, and various green vegetation (Yensen 1991).

The habitat of the northern Idaho ground squirrel is drier meadows surrounded by ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) forests between 1,150 and 1,550 meters (3,773.15 and 5,085.55 feet) elevation. The xeric meadows typically have a shallow (<1 meter [<3.281 feet] to bedrock), reddish-brown to yellowish-red skeletal-loam or clay-loam soil (Yensen 1991). These drier portions of meadows are occupied by the northern Idaho ground squirrel only in the absence of the Columbia ground squirrel (*Spermophilus columbianus*). Vegetation in these drier meadows is often dominated by scabland sagebrush (*Artemisia rigida*) or mountain big sage (*A. tridentata vaseyana*), with desert parsley (*Lomatium* sp.), wormleaf stonecrop (*Sedum stenopetalum*), scarlet gilia (*Gilia aggregata*), largeflower triteleia (*Brodiaea douglasii*), various bunchgrasses, and other forbs.

The northern Idaho ground squirrel occupied 47 sites in 2008. Combining the modeled population estimates from the intensive monitoring sites with the 1,017 squirrels detected on surveys, and assuming not all squirrels were detected, the minimum adult/yearling (i.e., pre-pup) population estimate for 2008 was 1,512.

Of the 47 occupied sites, 25 (53%) were on Federally managed land, 16 (34%) on privately owned land, and 6 (13%) on State-managed or mixed State-managed/privately owned land. Approximately half of the occupied sites supported 20 adults and yearlings. Only 3 sites—Lost Valley Reservoir, Squirrel Manor, and Squirrel Valley—supported >100 squirrels, although Price Valley and Round Valley may support this many as well if the 2006 numbers remained stable. Overall, the northern Idaho ground squirrel population appears to be increasing in both numbers and distribution (IDFG 2008).

The recovery plan for the northern Idaho ground squirrel was completed in 2003 (USDI FWS 2003). The plan summarizes objectives, criteria, and strategies for recovery of the species. The goal of the recovery plan is to increase population size and establish a sufficient number of viable metapopulations so that the species can be delisted—10 metapopulations consisting of more than 500 individuals for 5 consecutive years (USDI FWS 2003).

## Canada Lynx

The Canada lynx was listed as threatened under the ESA on March 24, 2000. Canada lynx are not common in Idaho and are primarily restricted to northern Idaho. This species is associated with boreal subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus contorta*)

forested environments. Primary habitat criteria are forested elevations above 1,524 meters (5,000 feet) composed of stands of spruce (*Picea* spp.), subalpine fir, and lodgepole pine. Primary foraging habitat is young pole–stage lodgepole pine. Optimum denning habitat is mature spruce and subalpine fir forest with extensive downfalls. Useable denning habitat is lodgepole pine with extensive downfalls.

Canada lynx are usually more active at night as their eyes are well adapted for night hunting. The species forages on snowshoe hares (*Lepus americanus*), mice, voles, squirrels, and birds. Preferred winter food consists primarily of snowshoe hares, rodents (e.g., red squirrels [*Sciurus vulgaris*]), and birds. Habitat for snowshoe hares generally consists of young conifer stands with relatively dense and interconnected canopies that provide both understory cover and food. Predation rates of snowshoe hares are high (>80%). Snowshoe hare populations tend to be cyclical in nature; however, there is limited evidence that population cycles occur in the southern portion of their range because of high predation rates (Wirsing et al. 2002). Snowshoe hares are nocturnal during the winter (Foresman and Pearson 1999).

Forest management practices—such as commercial harvest, road construction, and post-harvest thinning—can influence Canada lynx habitat and prey. Fire was historically a dominant influence in the northern Rocky Mountains (Gruell 1983; Agee 1999) so many decades of aggressive fire suppression have likely reduced the quality and quantity of Canada lynx and snowshoe hare habitat by altering the amount and pattern of vegetation types and structural stages. Snowshoe hares may reach highest densities in young, dense coniferous or coniferous-deciduous forest and forest with a dense understory of shrubs, aspen, and/or conifers. Red squirrels appear in the later stages of forest development when mature cone-bearing trees are common. Wisdom et al. (2000) did not evaluate source habitat changes for the Canada lynx.

## Snake River Spring/Summer and Fall Chinook Salmon

This BE is tiered to previous biological assessments (BAs) and supplements for each Section 7 watershed on the Forest, specifically those defined in Faurot and Nelson (2008), Faurot and Burns (2007a, 2007b), and Olson and Burns (2007a, 2007b). Baseline distribution conditions and habitat conditions for Snake River spring/summer and fall Chinook and designated critical habitat have been described in the previously mentioned BAs. All acronyms, phrases, references, and associated documents from these BAs are included by reference. No substantive new information regarding the distribution or populations of these species is available.

Snake River spring/summer and fall Chinook salmon were listed under ESA in 1992 (57 FR 14653) and are listed as threatened. Hereinafter, all references to Chinook salmon are to the listed species. Chinook salmon are widespread in the South Fork Salmon River, main stem Salmon River, Little Salmon River, and Deep Creek Section 7 watersheds. Detailed maps of known and suspected existence are provided in each BA previously listed and incorporated here by reference. Designated critical Chinook salmon habitat was identified in 1993 (58 FR 68543) and includes “areas consisting of the water, waterway bottom, and adjacent riparian zone of specified lakes and river reaches in hydrologic units presently or historically accessible” to the fish (50 CFR 226.205). We interpret these to comprise all of the main stem upper South Fork Salmon River and in tributaries at least as far upstream as designated critical habitat for Snake River Basin steelhead (below).

Essential fish habitat is defined and analyzed in accordance with applicable requirements of section 305(b) of the Magnuson–Stevens Act (MSA), implementing regulations in 50 CFR part 600.920. Essential fish habitat is coincident with designated critical habitat for Chinook salmon on the Forest.

### Snake River Steelhead

This BE is tiered to previous BAs and supplements for each Section 7 watershed on the Forest, specifically those defined in Faurot and Nelson (2008), Faurot and Burns (2007a, 2007b), and Olson and Burns (2007a, 2007b). Baseline distribution conditions and habitat conditions for Snake River steelhead and designated critical habitat have been described in the previously mentioned BAs. All acronyms, phrases, references, and associated documents from these BAs are included by reference. No substantive new information regarding the distribution or populations of this species is available.

The Snake River steelhead is listed as threatened by the National Marine Fisheries Service (NMFS) (62 FR 43937). Hereinafter, all references to steelhead are for the listed species. Steelhead are widespread in the South Fork Salmon River, main stem Salmon River, Little Salmon River, and Deep Creek Section 7 watersheds; detailed maps of known and suspected occurrence are provided in each BA listed above and incorporated here by reference. The final rule designating critical habitat for steelhead was published by the NMFS on September 2, 2005, and took effect on January 2, 2006 (70 FR 52629) and occurs widely across the Forest in the Salmon River Basin.

### Columbia River Bull Trout

This BE is tiered to previous BAs and supplements for each Section 7 watershed on the Forest, specifically those defined in Faurot and Burns (2001, 2007a, 2007b), Olson and Burns (2007a, 2007b), Zurstadt and Burns (2007, 2009), and Faurot and Nelson (2008). Baseline distribution conditions and habitat conditions on Columbia River bull trout and proposed critical habitat have been described in the before mentioned BAs. All acronyms, phrases, references, and associated documents from these BAs are included by reference. No substantive new information regarding the distribution or populations of this species is available.

Columbia River bull trout were listed as threatened in 1998 (63 FR 31647) with all coterminous populations listed together in 1999 (64 FR 58930); detailed maps of known and suspected occurrence are provided in BAs listed above and incorporated here by reference. Hereinafter, all references to bull trout are to the listed species. Designated critical habitat was identified in 2005 (70 FR 56211) but none was designated on the Forest. Critical habitat for bull trout was again proposed by the FWS in January 2010 (75 FR 2270).

## SENSITIVE SPECIES

Forest Service Manual 2670.32 and 2672.1 directs the National Forests to avoid or minimize impacts to species whose viability has been identified as a concern and listed by the Regional Forester as a sensitive species. If impacts cannot be avoided, the Forest must analyze the significance of the potential adverse effects on the population or its habitat within the area of concern and on the species as a whole. Sensitive species must receive special management emphasis. Impacts may be allowed, but the decision must not result in a trend toward Federal listing. Since the DSEIS, two species were added to the sensitive species list, southern Idaho

ground squirrel and yellow-billed cuckoo that potentially occur on the Forest. Although some suitable habitat exists, neither of these species are known to occur on the Forest.

#### SOUTHERN IDAHO GROUND SQUIRREL

The southern Idaho ground squirrel was added to the sensitive species list in March 2010 so therefore was not discussed in the Forest Plan BE (USDA Forest Service 2003a, Appendix E).

This species inhabits rolling foothills at elevations between 671 and 1,097 meters (2,200 and 3,600 feet). Habitat in this area was originally dominated by big sagebrush, bitterbrush, and native bunchgrasses and forbs. The majority of native shrub and bunchgrass habitat has been replaced with stands of invasive annual plants, such as cheatgrass and medusahead rye. Populations in this altered habitat are usually restricted to the least disturbed or most productive sites (Yensen 2001a). Individuals hibernate and estivate for 7 to 8 months per year and, depending on winter conditions, are active between January and June. Long periods of inactivity require large energy reserves, and individuals can enter estivation with 40-50% body fat. Breeding occurs immediately after emergence from hibernation, and juveniles appear above ground 6 weeks after conception.

Habitat has been altered through livestock grazing, agricultural development, invasive plants, and a shift of the fire regime to more frequent and severe range fires (Pellant 1989, Whisenant 1990, Knick and Rotenberry 1997, Belsky and Gelbard 2000). An understanding of population trend is currently lacking, as is landscape-scale patterns of distribution and abundance.

IDFG (2005) estimate approximately 90% of the population has been lost since the mid-1980s. The decline may have stabilized during recent years, possibly in response to mild winters and wet springs, but colonies remain small and fragmented. The population has been extirpated or is exceptionally small in the northern portions of the former range. The species is locally abundant near Emmett and Payette, where colonies are associated with anthropogenic habitat, such as agricultural land and golf courses. Populations are sparse and fragmented in formerly occupied native habitat, which is found primarily on public lands. There are no known populations of southern Idaho grounds squirrels on the Forest.

### Wolverine

The wolverine is a species suited to extensive, usually high-elevation areas. Threats to wolverine include motorized and nonmotorized travel during winter and spring denning, especially in forested and alpine ecosystems where human use is presently low and habitats have not been greatly modified. Wolverines are primarily scavengers that forage on carcasses of large ungulates such as elk (*Cervus Canadensis*), moose (*Alces alces*), deer (*Odocoileus* spp.), mountain goats (*Oreamnos americanus*), and bighorn sheep. They also hunt hares, marmots (*Marmota* spp.), ground squirrels, and grouse (*Tetraoninae* spp.), but will eat fruits and insects when other items are unavailable.

Wolverine home range sizes are influenced by prey remains and other food sources. Individual animals have large territories and can cover large distances quickly. In central Idaho, home ranges have been documented as large as 2,079 square kilometers (802 square miles) for males, although female ranges tend to be smaller. Wolverines do not show strong territorial behavior and have overlapping ranges. They use several habitats and have been

located in forested drainage bottoms to high-elevation, sparsely timbered cirque basins. Two natal dens were located in subalpine cirque areas on north-facing slopes, suggesting that this type of habitat is important in central Idaho (Copeland and Harris 1994).

Due to their large home range size and habitat needs, this species is rare and uncommon and most likely always has been. Lands within known wolverine habitat are the least modified by human activities, due to their remote, steep, and harsh environments (Sallabanks 1996). Wilderness and roadless lands account for much of the areas wolverines are known to use (Copeland and Harris 1994). Some very large fires have burned in the type of habitat wolverines prefer. These fires were generally characteristic (large, infrequent, and stand-replacing) for the plant communities and elevations in which they burned.

Human intrusion within denning habitat during the winter is probably the primary threat to this species (Wisdom et al. 2000). Human activities during denning may cause wolverines to relocate to inferior habitat, which may reduce reproductive success. Moving vulnerable wolverine young can also expose them to predators and harsh weather. Recent technological advances in snowmobile capabilities have raised concerns about human intrusion in previously isolated areas where natal denning may occur (Wisdom et al. 2000).

No known population trends exist for the wolverine within the Forest. Wisdom et al. (2000) estimate a 32% increase in source habitat from historic to current levels for this species within the Central Idaho Mountains Ecological Reporting Unit (ERU), which includes a majority of the Boise, Payette, and Sawtooth National Forests (Ecogroup). The Idaho Conservation Data Center (IDCDC) has 26 wolverine records for the Forest (IDCDC 2009).

### Fisher

Fishers are an uncommon predator found in mature-to-old forests with high canopy closure and large tree (both live and dead) structure. Fishers avoid large openings and are associated with mesic forest conditions and forested riparian areas. Natal dens have been located in pileated woodpecker (*Dryocopus pileatus*) cavities and other forest structures. Fishers eat small mammals, birds, fish, amphibians, insects, carrion, fruit, and nuts (Idaho State Conservation Effort 1995). Fishers hunt for prey on the forest floor and in trees and snags (Spahr et al. 1991). Vegetation management and fire suppression have influenced fisher habitat and prey by altering forest composition and structure.

No known population trends exist for fishers on the Forest. Wisdom et al. (2000) estimate a 35% increase in source habitat from historical to current times within the Central Idaho Mountains ERU, which includes an estimated 87% of the Ecogroup area. The IDCDC has 14 fisher records for the Forest (IDCDC 2009).

### Townsend's Western Big-eared Bat

Townsend's western big-eared bat is nocturnal and feeds primary on moths along forest edges. The species roosts in caves, old mines, canyons with cliffs, and buildings. Maternity and hibernation colonies exist almost exclusively in caves and mine tunnels (Groves et al. 1997). Unlike other species of bats that seek refuge in crevices, Townsend's western big-eared bats congregate in clusters on open surfaces, making them more vulnerable to disturbance (Idaho State Conservation Effort 1995). Most of the Townsend's western big-eared bat records have been in lower elevations outside large expanses of forest cover

(Groves et al. 1997). This species is sensitive to human disruption during roosting and will abandon roost sites, which may increase mortality.

No known population trends exist for Townsend's western big-eared bat on the Forest, but these bats have been found on the Forest. Wisdom et al. (2000) estimate a 20% increase in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 7 Townsend's western big-eared bat records for the Forest (IDCDC 2009).

### Spotted Bat

Spotted bats forage nocturnally and feed mainly on moths in open ponderosa pine stands and meadows. They roost in cracks in steep, rocky outcrops and cliff faces (L. Lewis 2000, personal communication). This type of habitat does occur in some of the steep basalt canyons on the Forest. Spotted bats are known to exist in the southwestern portion of Idaho, south of the Snake River (Groves et al. 1997). The spotted bat's wintering areas are unknown. This species is sensitive to human disruption during roosting and will abandon roost sites, which may increase mortality.

No known population trends exist for spotted bats on the Forest. Wisdom et al. (2000) estimate an 18% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 2 spotted bat records for the Forest (IDCDC 2009).

### Rocky Mountain Bighorn Sheep

See Chapter 3 of the bighorn sheep *Southwest Idaho Ecogroup Land and Resource Management Plans Final Supplemental Environmental Impact Statement* (USDA Forest Service 2010).

### Gray Wolf

Gray wolves are native to Idaho and were historically common in most parts of the state with abundant big game. The basic social unit in gray wolf populations is the pack. A pack can consist of 2–20 wolves, with an average of 11 per pack. Pack members have a strong social bond to each other and establish and defend territories. Home range size varies from 207 square kilometers (80 square miles) in Minnesota to more than 1,553 square kilometers (600 square miles) in Alberta, Canada. Home ranges over the last several years for central Idaho packs have ranged from 129 square kilometers (50 square miles) to 932 square kilometers (360 square miles) (USDI FWS 2000a).

Gray wolves are primarily limited by nonhabitat factors. The primary threat to gray wolves is human-caused mortality from shooting and vehicle collisions (USDI FWS 1994, Quigley and Arbelbide 1997, Wisdom et al. 2000). New and existing roads increase the likelihood that humans can come into contact with gray wolves. Maintaining habitat for populations of large ungulate prey species is also an important management consideration.

Over the long term, human social pressures will most likely restrict the distribution of gray wolves to areas of limited human occupation and domestic livestock production. Human tolerance and lack of persecution will be needed to achieve long-term successful recovery. Both regulatory and educational efforts will be important parts of gray wolf conservation and management efforts (USDI FWS 2002).

The gray wolf is a forest habitat generalist and is found in most parts of Idaho that contain big game populations (i.e., elk, moose, and deer) able to support the species' prey needs. As social carnivores at the top of the ecological food web, gray wolves need comparatively large spaces to find sufficient and abundant prey. Wisdom et al. (2000) did not evaluate source habitat changes for the gray wolf.

### Northern Goshawk

The northern goshawk is a forest habitat generalist that uses a variety of forest types, ages, structural conditions, and seral stages (Graham and Jain 1998). It preys on small- to medium-sized birds and mammals (e.g., robins [*Turdus migratorius*], chipmunks [*Tamias* spp.], grouse [*Tetraonidae* spp.], and hares), which it captures on the ground, in trees, or in the air. Goshawks and their prey require a variety of forest structures dispersed across large areas (Graham and Jain 1998).

Northern goshawks have nested on all Forest ranger districts and in all forest habitat types. For this species, a change in population may not represent changes in habitat conditions on the Forest. Populations may be influenced by activities off the Forest, particularly in wintering areas, which are largely unidentified.

The major changes in habitat that have occurred on the Forest include selective harvesting of large-diameter trees, snag removal in harvest areas, mortality in ponderosa pine area from wildfires the last 15 years, and a change in composition and density of remaining stands because of long-term fire exclusion (Sloan 1998, Wisdom et al. 2000).

Nest areas usually include one or more forest stands, several nests, and several landform characteristics. Nest areas are occupied by breeding northern goshawks from early March to late September. The nesting area's size, typically 8.1 to 10 hectares (20 to 25 acres), and shape depend on topography and the availability of patches of dense, large trees.

Northern goshawks have a high fidelity to nest areas, which are often used multiple years and sometimes used intermittently for decades (Reynolds et al. 1992, Wisdom et al. 2000). Many pairs of northern goshawks have 2 to 4 alternate nest areas within their home range. All previously occupied nest areas may be important for maintaining nesting populations because they contain the habitat elements that originally attracted northern goshawks. Replacement nest areas are advantageous because northern goshawk nest stands are susceptible to catastrophic events and natural tree mortality.

Northern goshawk nest areas typically have high tree canopy cover and a higher proportion of larger trees than surrounding areas. Studies suggest that dense vegetation provides relatively mild and stable microenvironments and protection from predators. Nest areas are usually classified as mature and late structural forest stands (Reynolds et al. 1992, Graham and Jain 1999). Human activity during the nesting period may cause nest abandonment and subsequent nest failure (Reynolds et al. 1992, Braun et al. 1996).

Post-fledging family areas (PFAs) are used by adults and young from the time the young leave the nest until they are no longer dependent on the adults for food. The PFA surrounds the nest area and, although it generally includes a variety of forest conditions, the vegetation structure resembles that within nest stands. PFAs vary in size from 121 to 242 hectares (300 to 600 acres). PFAs provide young northern goshawks with cover from predators and sufficient prey to develop hunting skills so they learn to feed themselves before dispersing

during mid-summer to fall. Therefore, PFAs should contain habitat attributes for producing prey species.

No known population trends exist for northern goshawks on the Forest. Wisdom et al. (2000) estimate a 7% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 90 northern goshawk records for the Forest (IDCDC 2009).

## Bald Eagle

The bald eagle was previously analyzed as a threatened species in the 2003 Forest Plan BA (USDA Forest Service 2003b). The species was delisted in 2006 and subsequently listed as a sensitive species.

During the breeding season, bald eagles eat mainly fish, but also waterfowl, shorebirds, upland birds, and small mammals. Bald eagles are opportunistic foragers, especially during the winter when they will eat whatever is available, including live fish, waterfowl, small mammals, and carrion. Wintering bald eagles tend to congregate near bodies of unfrozen water and roost communally. Major rivers and large reservoirs constitute the majority of the bird's winter habitat, although the temporary presence of high-quality foods may entice bald eagles to areas far removed from aquatic zones. Roost sites are usually located in stands or clumps of mature or old conifers (*Pinophyta* spp.) or cottonwoods (*Populus* spp).

Nests are commonly found in large trees, mainly conifers and cottonwoods, and usually near water. Bald eagles build large nests. To accommodate these large nests, nest trees are often found in multistoried, older forest stands with open canopies (Quigley and Arbelbide 1997). Nests also appear in single, isolated trees if the trees are large and strong enough to support the bald eagle's large nests.

Two known bald eagle nests exist on the Forest, and birds are regularly seen in winter along major river systems. The IDCDC has 79 bald eagle records on the Forest (IDCDC 2009). Wisdom et al. (2000) did not evaluate source habitat changes for the bald eagle.

## White-headed Woodpecker

In Idaho, white-headed woodpeckers are found mainly in open and mature ponderosa pine and mixed ponderosa pine / Douglas-fir forests (Frederick and Moore 1991, Groves et al. 1997). White-headed woodpeckers feed on conifer seeds during fall and winter. Cone crops are different from year to year, and large trees usually produce more cones than small trees. Flying insects are an important food source other times of the year. Nests are usually excavated in large-diameter snags with a moderate degree of decay (Bull et al. 1986, Bull et al. 1997). Nesting snags need to be >50 centimeters (20 inches) in diameter (Wisdom et al. 2000). Nesting stands of ponderosa pine used by white-headed woodpeckers have a low canopy cover, generally <30% (Frederick and Moore 1991). Based on studies done in Idaho, white-headed woodpeckers rarely migrate and are considered year-round residents.

White-headed woodpecker habitat has changed during the last 100 years due to human activities (Sloan 1998, Morgan and Parsons 2001). Major changes in habitat have occurred within the Ecogroup area from selective harvesting of large-diameter ponderosa pine, snag removal in harvest areas, ponderosa pine mortality from wildfires during the last 15 years, and a change in composition and density of remaining stands because of long-term fire

exclusion (Geier-Hayes 1995, ICBEMP 1997a, Sloan 1998, Wisdom et al. 2000, Morgan and Parsons 2001). These and other changes have reduced the quality, quantity, and distribution of white-headed woodpecker habitat.

White-headed woodpeckers are restricted to areas dominated by ponderosa pine. Management of large, low-density ponderosa pine, including snags, is an important consideration in mid- to low-elevation forest habitat for this species (Wisdom et al. 2000). Wisdom et al. (2000) estimate a 62% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The extent of large-tree and snag reduction on the landscape has probably had a negative effect on species such as the white-headed woodpecker. The IDCDC has 84 white-headed woodpecker records on the Forest (IDCDC 2009). Monitoring for this species occurs every year. The monitoring results are available in a report published annually by the Forest and also available on the Forest's Web site.

### Flammulated Owl

Flammulated owls are on the Forest only during the breeding season and migrate off the Forest to winter. The habitat components considered most important for flammulated owls include the following:

- Mature and old forests of Douglas-fir, ponderosa pine, and mixed conifer, including lodgepole pine and aspen
- A moderate density of large trees
- Snags created by larger woodpeckers and sapsuckers (Spahr et al. 1991, Groves et al. 1997)

The entire home range of a flammulated owl pair during the breeding and nesting period is 12 hectares (30 acres). Flammulated owls feed almost entirely on flying insects.

Occupied flammulated owl habitat has changed during the last 100 years due to human activities (Sloan 1998, Morgan and Parsons 2001). Major changes in habitat have occurred within the Forest from selective harvesting of large-diameter ponderosa pine, snag removal in harvest areas, ponderosa pine mortality from wildfires during the last 15 years, and a change in composition and density of remaining stands due to long-term fire exclusion (Geier-Hayes 1995, ICBEMP 1997a, Sloan 1998, Wisdom et al. 2000, Morgan and Parsons 2001). These and other changes have reduced the quality, quantity, and distribution of flammulated owl habitat.

The flammulated owl has been documented on all Forest ranger districts. Important management considerations for this species include retaining or restoring older mid- to lower-elevation forests dominated by ponderosa pine and Douglas fir and retaining or restoring snags and down logs (Wisdom et al. 2000).

No population trends exist for flammulated owls on the Forest. Wisdom et al. (2000) estimate a 52% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 169 flammulated owl records on the Forest (IDCDC 2009).

## Harlequin Duck

The harlequin ducks observed on the Forest are part of the Idaho-Wyoming population. The total estimated breeding population in the Pacific Northwest is 524 and is distributed between Washington (274), Oregon (50), Idaho (50), Montana (110), and Wyoming (40). Harlequin ducks are present in these states during the nesting and brood-rearing seasons; they migrate to the coasts of Oregon and Washington to winter. For nesting and brood rearing, harlequin ducks require undisturbed, low-gradient, meandering mountain streams with dense, shrubby riparian areas and large woody debris. They also need log jams and overhanging vegetation for cover and loafing areas.

Harlequin ducks have been observed along the East Fork of the South Fork Salmon River. No harlequin duck nesting habits on the Forest have been documented. Harlequin ducks feed primarily on crustaceans, mollusks, insects, and small fish (Groves et al. 1997). Since harlequin ducks are migratory species, a change in population may not represent changes in habitat conditions on the Forest. Populations may be influenced by activities off the Forest, particularly in wintering areas. Logging in riparian areas may make riparian areas unsuited for this species.

The IDCDC has 3 harlequin duck records for the Forest (IDCDC 2009). The entire Idaho breeding population is estimated to be fewer than 100 birds located on approximately 30 streams in northern Idaho (Groves et al. 1997).Wisdom et al. (2000) did not evaluate source habitat changes for the harlequin duck.

## Mountain Quail

Mountain quail are found in dense shrub areas of coniferous forest and shrubby areas adjacent to meadows and riparian areas. They exist on the Forest on brushy, low-elevation mountain slopes. Mountain quail have steadily declined in central and southwestern Idaho the last 30 years (Spahr et al. 1991) for unknown reasons. Predation by feral cats is known to be a problem in areas near human habitation. Management of shrub cover adjacent to riparian areas needs to be considered as important low-elevation habitat feature of this species.

No known population trends exist for mountain quail on the Forest. Wisdom et al. (2000) estimate a 12% reduction in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 15 mountain quail records for the Forest (IDCDC 2009).

## Boreal Owl

Boreal owls nest in old woodpecker cavities in live and dead trees. Boreal owls are found in high-elevation spruce-fir, mixed conifer, and aspen forests year-round and do not migrate. They prey extensively on red-backed voles. The largest nest sites recorded for boreal owls are 12 hectares (30 acres). Winter home ranges encompass approximately 1,456 hectares (3,600 acres), and summer home ranges are slightly smaller (USDA Forest Service 1991). Forest management can change the composition and structure of vegetation used by this species. Management activities that affect large snags and down logs are important habitat considerations for this species.

No known population trends exist for boreal owls on the Forest. Wisdom et al. (2000) estimate a 1% increase in source habitat from historical to current times for this species

within the Central Idaho Mountains ERU. The IDCDC has 34 boreal owl records on the Forest (IDCDC 2009).

### Three-toed Woodpecker

Three-toed woodpeckers are primarily associated with mature forests with outbreaks of bark beetles and stand-replacing fires. They have been observed on the Forest mostly in lodgepole pine stands with mountain pine beetles and in burned-over areas (Groves et al. 1997). American three-toed woodpeckers forage mainly in dead trees, and a large percentage of their diet is wood-boring insect larvae. Three-toed woodpeckers excavate nesting cavities in snags or occasionally in live trees (Groves et al. 1997). This species is considered nonmigratory. Management for abundant snag densities is an important habitat consideration. The processes that generate these high densities of snags (i.e., fire, insects, and disease) are essential to produce abundant habitat for this species.

No known population trends exist for three-toed woodpeckers on the Forest. Wisdom et al. (2000) estimate a 77% increase in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 23 three-toed woodpecker records on the Forest (IDCDC 2009).

### Great Gray Owl

The habitat components considered most important for the great gray owl are mature or older forest that provide suitable nesting sites and suitable foraging areas, including nonstocked and seedling forests, meadows, and open riparian habitats adjacent to meadows. Great gray owls hunt from perches and capture their prey, usually small rodents, on the ground (Groves et al. 1997). They do not build their own nests but use existing nests built by other species, debris platforms, or broken-topped trees and snags (Bull et al. 1997, Groves et al. 1997). Great gray owl nest sites average 137 meters (150 yards) from the nearest forest opening. The largest home range recorded for a great gray owl is 6.5 square kilometers (1,622 acres) (USDA Forest Service 1991).

The great gray owl is a year-round resident on portions of the Forest. Compared to other owls on the Forest, this owl is considered rare in terms of abundance because its preferred habitat (mid- to high-elevation old forests near meadows) is somewhat uncommon. Important concerns for this species include intensive timber harvest, snag removal, and removal of trees with broken tops in forested areas with meadows.

No known population trends exist for great gray owls on the Forest. Wisdom et al. (2000) estimate a 32% increase in source habitat from historical to current times for this species within the Central Idaho Mountains ERU. The IDCDC has 49 great gray owl records for the Forest (IDCDC 2009).

### Columbian Sharp-tailed Grouse

Columbian sharp-tailed grouse exist in the Weiser River drainage (Mann Creek) but have not been detected on the Forest.

Columbian sharp-tailed grouse need low-elevation native shrub/grassland year-round. Abundant grass composition appears to be important within shrub/grassland communities during all life stages. During the summer, the shrubs are used for cover, and the grass and forbs, including insects that are available in these habitats, are used as food. During the

winter, shrubs (i.e., serviceberry [*Amelanchier arborea*], chokecherry [*Prunus virginiana*], bitterbrush [*Purshia* spp.], bitter cherry [*Prunus emarginata*], hawthorn [*Crataegus* spp.], and aspen) are important food because they are above snow cover. In an Idaho study, winter food and cover were regarded as the most limiting habitat factors for long-term maintenance of grouse (Spahr et al. 1991, Groves et al. 1997, Apa 1998).

Columbian sharp-tailed grouse populations statewide have been increasing during the past 10 years, but most populations are still small and isolated. Most of this increase has been attributed to the Conservation Reserve Program (CRP) on private lands (Apa 1998, Wisdom et al. 2000). Birds are making extensive seasonal use of the CRP seedlings that are annually maintained in grass/shrub cover year-round. In some locations, CRP fields are adjacent to National Forest System (NFS) lands. Livestock grazing management of native shrub/grassland and shrub-dominated riparian areas is also an important management consideration for this species. Many areas of shrub/grassland were historically burned, sprayed, plowed, and planted to nonnative grasses to improve conditions for livestock grazing and reduce erosion. These practices would be detrimental to Columbian sharp-tailed grouse if they take place on wintering areas where shrubs used as food and cover protrude above the snow level. Additional threats to Columbian sharp-tailed grouse habitat include habitat fragmentation and invasion of exotic plants (Wisdom et al. 2000).

Columbian sharp-tailed grouse currently occupy <10% of their former range in the northwest United States. Wisdom et al. (2000) estimate a 24–56% decrease in source habitat in the Ecogroup area. The IDCDC has no Columbian sharp-tailed grouse records on the Forest (IDCDC 2009).

### Common Loon

The common loon is a large diving bird that weighs 3.2-4.1 kilograms (7–9 pounds). Like many other diving birds, the common loon must run across the water surface to achieve enough speed to become airborne. Nests are made of mud and vegetation and are usually close to the shoreline in shallow natural lakes without rapidly fluctuating water levels. Nests can be located on small islands that are mostly composed of emergent vegetation. Nesting usually occurs in early May just after ice breakup. Common loons have a high fidelity to nest sites year after year. Common loons avoid lakes with high levels of human activity, fluctuating water levels, turbid water, and no protective coves for nesting. The birds feed mostly on small fish such as yellow perch and various minnow species. They may also consume other aquatic organisms. Feeding occurs mainly under water (Spahr et al. 1991). Common loons are not a high- or moderate-priority breeding bird species for Idaho Partners in Flight (2000) in Idaho.

The IDCDC has 1 common loon record for the Forest (IDCDC 2009). Wisdom et al. (2000) did not evaluate source habitat changes for the common loon.

### Peregrine Falcon

Peregrine falcons occupy a wide range of habitats and are typically found in open country near water. They capture prey by striking from above with their talons after a high-speed dive. Foraging habitat includes wetlands and riparian habitats; meadows and parklands; croplands such as hay fields and orchards; gorges and mountain valleys; and lakes that support populations of small- to medium-sized terrestrial birds, shorebirds, and waterfowl.

Cliffs are preferred nesting sites (known as eyries), although reintroduced birds now regularly nest on man-made structures such as towers and high-rise buildings. Peregrine falcons may travel more than 29 kilometers (18 miles) from the nest site to hunt for food. However, a 16.1-kilometer (10-mile) radius around the nest is an average hunting area, with 80% of foraging occurring within 1.6 kilometer (1 mile) of the nest. Peregrine falcons migrate south for the winter to the Gulf of Mexico and into Mexico and Central America, or to large rivers and wildlife refuges in the southern United States (USDA Forest Service 1991).

Peregrine falcons declined precipitously in North America following World War II. Research indicates that certain pesticides—particularly DDT, DDE, and dieldrin applied in the United States and Canada during this same period—caused the decline, which was linked to weakened eggshells (USDI FWS 1984). Use of these chemicals peaked in the 1950s and early 1960s, continuing through the early 1970s (USDI FWS 1995).

The most significant event in peregrine falcon recovery was pesticide restrictions. DDT use was restricted in Canada in 1970 and in the United States in 1972. Restrictions that controlled the use of aldrin and dieldrin were imposed in the United States in 1974. Since these restrictions were implemented, pesticide residues have significantly decreased in many regions where they were previously used. Consequently, reproductive rates in most surviving peregrine falcon populations in North America improved, and numbers began to increase (USDI FWS 1984; ICBEMP 1997b). In Idaho, the peregrine falcon population has been increasing during the last 10 years.

Other known factors in the historical population decline—such as illegal shooting and collisions with wires, fences, cars, and buildings—are much less significant to population levels of the peregrine falcon in the West. On an individual nest-site basis, human-caused disturbance or habitat alterations close to an active peregrine falcon nest can be a problem. For example, rock climbing is a growing sport in some areas and has resulted in nest failure due to abandonment (ICBEMP 1997b). Closure of rock-climbing cliffs in proximity to nesting peregrine falcons has recently prevented adverse effects. Power lines, especially distribution lines, can cause peregrine falcon mortality. However, many peregrine falcons nest successfully each year near power lines, especially in urban areas. Land-use practices adjacent to peregrine falcon eyrie that do not result in extensive habitat changes or excessive disturbance appear to have little adverse effect on nesting success.

The IDCDC has 1 peregrine falcon record for the Forest (IDCDC 2009). Wisdom et al. (2000) did not evaluate source habitat changes for the peregrine falcon.

### Yellow-Billed Cuckoo

The yellow-billed cuckoo is found in disjunct fragments of riparian habitats from northern Utah, western Colorado, southwestern Wyoming, and southeastern Idaho, southward into New Mexico and northwestern Mexico, and westward into Arizona and California. It is considered to be extirpated from British Columbia, Washington, Oregon, and possibly Nevada (Hughes 1999).

In Idaho, the yellow-billed cuckoo is a rare visitor and local breeder that occurs in scattered drainages primarily in the southern portion of the state (Taylor 2000, IDCDC 2005). No population trend data are available for Idaho because populations of yellow-billed cuckoos

are too low to make valid statistical conclusions. Major declines have been documented throughout this species' range in the western U.S. such that it is now extremely rare in most areas (Laymon and Halterman 1989).

Yellow-billed cuckoos are usually found in large tracts of cottonwood and willow habitats with dense sub-canopies (Hughes 1999, USDI FWS 2001). In Idaho, they are reported to occur most frequently and consistently in cottonwood forests with thick understory (Groves et al. 1997, Taylor 2000, Idaho CDC 2005). Moist riparian habitats are thought to provide humidity requirements for successful hatching and rearing of young. Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat (Laymon et al. 1993). Yellow-billed cuckoos are generally absent from heavily forested areas and large urban areas (Eaton 1988), and very scarce in the extensive high elevation zones of the Rocky Mountains above 2,000 meters (6,600 feet) (USDI FWS 2001).

Yellow-billed cuckoos primarily eat large insects such as caterpillars, katydids, cicadas, grasshoppers, and crickets. Occasionally, they eat bird eggs and young, snails, frogs, and lizards. Yellow-billed cuckoos also will consume small fruits and seeds, but more frequently in fall and on their wintering grounds (Hughes 1999).

No population trend data are available for Idaho because populations of yellow-billed cuckoos are too low to make valid statistical conclusions. Major declines have been documented throughout this species' range in the western U.S. such that it is now extremely rare in most areas (CWCS 2006)

### Columbia Spotted Frog

Columbia spotted frogs are most often found near permanent water, such as the marshy edges of ponds or lakes; in algae-grown overflow pools of streams; or in wet areas with emergent vegetation. They may move considerable distances from permanent water during rainy periods after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and shrublands if puddles, seeps, or other waters are available. Columbia spotted frogs are thought to hibernate in holes near springs or other areas where water remains unfrozen and is constantly renewed. The Columbia spotted frog uses a muddy or soft substrate in streams or ponds for hibernation (Spahr et al. 1991). The species feeds on invertebrates generally close to ponds or standing water in riparian areas.

Columbia spotted frogs have been documented on the Forest in habitats that have standing or slow-moving water during the summer. Predation by bullfrogs (*Rana catesbeiana*), a nonnative species, is thought to be a major reason for Columbia spotted frog declines. Populations of Columbia spotted frogs may have also declined and fragmented because of introduced fish in systems that historically had no fish. These fish prey on both young and adult frogs. Alteration of riparian and wetland habitats is also an important management consideration for this species.

No known population trends exist for Columbia spotted frogs on the Forest, but they are commonly observed in areas of shallow, standing, and ponded water during the summer. Wisdom et al. (2000) did not evaluate source habitat changes for the Columbia spotted frog. The IDCDC has 12 Columbia spotted frog records for the Forest (IDCDC 2009). Groves et

al. (1997) thought this species was declining in parts of its range, but it appears widespread and abundant in Idaho.

### Westslope Cutthroat Trout

This BE is tiered to previous BAs and supplements for each Section 7 watershed on the Forest, specifically those defined in Zurstadt and Burns (2007, 2009), Faurot and Nelson (2008), Faurot and Burns (2001, 2007a, 2007b), and Olson and Burns (2007a, 2007b). Baseline conditions for distribution and habitat conditions of westslope cutthroat trout have been described in those BAs. All acronyms, phrases, references, and associated documents from these BAs are included by reference. No substantive new information regarding the distribution or populations of this subspecies is available.

BEs for sensitive species are prepared by direction of the Forest Service Manual (FSM 2670). Westslope cutthroat trout are designated by the Regional Forester as a sensitive species. Westslope cutthroat trout were petitioned for listing (63 FR 31691) but FWS determined in 2000 that the species was not warranted for listing (65 FR 20120). Detailed maps of known and suspected occurrences are provided in the BAs above and incorporated here by reference. Westslope cutthroat trout are widely distributed throughout the Forest, particularly in the South Fork Salmon River watershed. Hereinafter, all references to westslope cutthroat trout are for the petitioned species. Designated critical habitat is not applicable to westslope cutthroat trout.

## Direct, Indirect, and Cumulative Effects

### FEDERALLY LISTED SPECIES

### Northern Idaho Ground Squirrel

A conservation strategy and agreement for the Forest was developed in 1996 to improve conditions for this species. The northern Idaho ground squirrel is Idaho's only endemic animal, with an estimated population of 250–500 individuals. Individual populations are small, disjunct, and isolated—a situation that challenges future management where the species exists and historically existed.

In the Forest Plan, specific direction is contained at the management area level in the three management areas where the species is known to exist. The direction is not always specific to ground squirrels, but reduces threats to ground squirrels through the management of Forest resource programs that may affect the species (Table K-2).

**Table K-2. Forest Plan direction designed to reduce threats to northern Idaho ground squirrel**

| Threats | Management Direction in Forest Plan (USDA Forest Service 2003a, Chapter III) |
|---|---|
| Habitat loss, modification | TEPC Species: Goals 1, 3, 4, 5, 6; Objectives 1, 2, 3, 4, 5, 7, 14, 18, 22, 25, 26, 27; Standards 1, 2, 3, 5, 29; Guidelines 4, 6, 8, 10 |
| Over-utilization | TEPC Species: Objectives 2, 5<br>Wildlife Resources: Objective 5,6<br>Recreation Resources: Standard 5 |
| Disease or predation | Wildlife Resources: Objectives 4, 5, 6 |

| | |
|---|---|
| Inadequacy of regulatory mechanisms | TEPC Species: Goals 1, 3, 4, 5, 6; Objectives 1, 2, 3, 4, 5, 7, 14, 18, 22, 25, 26, 27; Standards 1, 2, 3, 5, 29; Guidelines 1, 2, 4, 6, 8<br>Rangeland Resources: Goal 1; Objective 1<br>Recreation Resources: Goals 4, 5; Objective 18; Standard 5<br>Lands and Special Uses: Goal 1; Objective 1; Guideline 1<br>Facilities and Roads: Goal 1; Objectives 4, 6; Guidelines 4, 9 |
| Other natural or human-caused concerns | TEPC Species: Standard 5 |

Of the management direction in Table K-2, Standard 3 in the TEPC Species section may provide the most all-around protection for the northern Idaho ground squirrel. This standard directs managers to "Design and implement projects to meet the terms of Forest Service approved portions of recovery plans" (USDA Forest Service 2003a, Chapter III, TEPC Species section).

The Forest is managing for northern Idaho ground squirrels under a conservation strategy and agreement with the FWS that was approved in 1996 (USDA Forest Service and USDI FWS 1996), a Habitat Restoration Plan (2001–2006) approved by both agencies in November 2002, and the northern Idaho ground squirrel Recovery Plan that was approved in 2003. These documents provide comprehensive direction for protecting the species and restoring northern Idaho ground squirrel habitat.

***Determination***

None of the proposed alternatives would change the effects analysis and range of effects disclosed in the 2003 Forest Plan BA (USDA Forest Service 2003b). Similarly, none of the alternatives would change current Forest Plan direction for conservation of northern Idaho ground squirrel. The 2003 Forest Plan BA determination for Forest Plan implementation was "May Affect, Likely to Adversely Affect" the northern Idaho ground squirrel (USDA Forest Service 2003b). The Forest Plan FSEIS would not change this determination.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for northern Idaho ground squirrel. Since this species is Federally listed, further habitat assessment will occur with local information for any project proposed under the direction in the Forest Plan that may affect northern Idaho ground squirrel habitat. The Forest Plan does not describe or mandate site-specific activities or projects. Determination of effects for site-specific activities will require further Section 7 consultation as those site-specific activities are proposed under Forest Plan direction.

## Canada Lynx

Forest-wide management direction meets the intent of the standards specified in the Canada lynx conservation strategy (USDI FWS 2000b). The Forest Plan provides direction to protect this species and its habitat, including retention of mature forest conditions and coarse woody debris for denning and rearing habitat. A predicted reduction in roads under the Forest Plan would also reduce disturbance and vulnerability to hunting, trapping, and vehicle collisions.

In addition to direction for wildlife species in Forest Service Manual 2670, as amended, (1995) and Handbook 2609, as amended (1992), the Forest Plan has Forest-wide

management direction to reduce potential threats to Canada lynx. This direction appears in the Forest Plan (USDA Forest Service 2003a, Chapter III) and is summarized in Table K-3. The direction is not always specific to Canada lynx but will reduce threats to Canada lynx through the management of Forest resource programs that may affect the species.

**Table K-3. Forest Plan direction designed to reduce threats for Canada lynx**

| Evaluation Criteria/Threats | Management Direction in the Forest Plan (USDA Forest Service 2003a, Chapter III) |
|---|---|
| Denning habitat | TEPC Species: Goals 1, 3, 4; Objectives 12, 13, 18; Standards 1, 2, 3, 12, 14<br>Wildlife Resources: Standard 1 |
| Foraging habitat | TEPC Species: Goals 1, 3, 4; Objectives 12, 13, 23; Standards 1, 2, 3 14<br>Vegetation: Objective 1<br>Rangeland Resources: Goals 1, 6; Objective 1; Standard 1; Guidelines 2, 9 |
| Vegetation conversion[a] | TEPC Species: Goal 4; Objective 13; Standards 1, 2, 3, 14, 15; Guidelines 1, 2, 6<br>Wildlife Resources: Guideline 1<br>Vegetation: Goals 1, 2, 4, 7<br>Timberland Resources: Goal 3 |
| Pre-commercial thinning | TEPC Species: Goals 3, 4; Standards 1, 2, 3, 14, 15; Guidelines 1, 2, 6 |
| Fire management[a] | TEPC Species: Goal 4; Objectives 13, 18; Standards 1, 2, 3, 14, 15; Guidelines 1, 2, 6, 8<br>Wildlife Resources: Guideline 1<br>Fire Management: Goal 2, Objectives 1, 2, 5 |
| Landscape patterns[a] | TEPC Species: Goal 4; Objective 13; Standards 1, 2, 3, 14, 15, 16<br>Vegetation: Goals 1, 2, 4, 7; Objectives 5, 7<br>Fire Management: Goal 2; Objectives 1, 2, 5<br>Timberland Resources: Goal 3 |
| Forest roads[a] | TEPC Species: Objectives 3, 27; Standards 1, 2, 3; Guidelines 1, 2, 6<br>Wildlife Resources: Objective 5; Guidelines 1, 4<br>Facilities and Roads: Goal 1, Objectives 4, 6; Standard 3; Guidelines 4, 9 |
| Developed recreation[a] | TEPC Species: Objectives 7, 27, 29, 31, 32; Standards 1, 2, 3, 14, 34; Guidelines 1, 2, 6<br>Recreation Resources: Goals 4, 5, 6; Objectives 18, 24, 25; Standard 5 |
| Non-winter dispersed recreation | TEPC Species: Objectives 7, 27; Standards 1, 2, 3; Guideline 6<br>Recreation Resources: Goals 4, 5; Objective 18; Standard 5 |
| Winter dispersed recreation[a] | TEPC Species: Objectives 7, 27, 28, 29; Standards 1, 2, 3, 34<br>Recreation Resources: Goals 4, 5, 6; Objectives 18, 24, 25; Standard 5 |
| Minerals and energy development | TEPC Species: Objectives 7, 26; Standards 1, 2, 3, 14, 29, 34; Guidelines 1, 2 |
| Land adjustments | TEPC Species: Goal 1; Objective 25; Standards 1, 2, 3, 14, 15, 16; Guidelines 1, 2, 10<br>Wildlife Resources: Guideline 1<br>Lands and Special Uses: Goal 1; Objective 1; Guideline 1 |
| Lack of habitat connectivity[a] | TEPC Species: Goal 5; Objectives 12, 23, 30, 32; Standards 1, 2, 3<br>Wildlife Resources: Objective 5; Guidelines 1, 4 |
| Lack of coordination between jurisdictions and agencies[a] | TEPC Species: Goal 1; Objectives2, 25; Standard 16; Guideline 4<br>Wildlife Resources: Objectives 4, 5; Guideline 4<br>Vegetation: Goal 7; Objective 5<br>Facilities and Roads: Objectives 2, 4, 6 |
| Lack of monitoring[a] | TEPC Species: Objective 1, 5, 11; Guidelines 2, 4 |

[a] One of nine risk factors for the northern rocky mountain geographic area from the Biological Opinion

***Determination***

None of the proposed alternatives would change the effects analysis and range of effects disclosed in the Forest Plan BA. Similarly, none of the alternatives would change current Forest Plan direction for conservation of Canada lynx. The 2003 Forest Plan BA determination for Forest Plan implementation was "May Affect, Likely to Adversely Affect" the Canada lynx (USDA Forest Service 2003b). The Forest Plan FSEIS would not change this determination.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for Canada lynx. The Forest Plan provides for Canada lynx and its habitat by providing direction that meets the intent of the 15 evaluation criteria identified in the Biological Opinion (BO) (USDI FWS 2000b). Since the Canada lynx is Federally listed, further habitat assessment will occur with local information for any project proposed under the direction of the revised Forest Plan that may affect Canada lynx habitat.

## Snake River Spring/Summer and Fall Chinook Salmon, Snake River Basin Steelhead, and Columbia River Bull Trout

The Forest Plan provides direction to protect these species and their habitat. Forest Plan direction is very generic but has been focused by recent individual assessments of the effects of sheep grazing across the Forest, where potential effects are fully disclosed and specific mitigations provided to minimize effects to the extent practicable (Faurot and Burns 2001, 2007a, 2007b; Zurstadt and Burns 2007, 2009; Olson and Burns 2007a, 2007b; and Faurot and Nelson 2008).

***Determination***

None of the proposed alternatives would change the effects analysis and range of effects disclosed in the Forest Plan BA (USDA Forest Service 2003b). Similarly, none of the alternatives would change current Forest Plan direction for protection of these species or their habitat. The 2003 Forest Plan BA determination for Forest Plan implementation was "May Affect, Likely to Adversely Affect" all three of these species. The Forest Plan FSEIS would not change this determination, although more recent consultations have determined that some specific grazing actions have been mitigated to "May Affect, not Likely to Adversely Affect"; the Forest Plan FSEIS would not change these determinations either.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for these three ESA-listed fish species. The Forest Plan provides for listed fish and their habitat by providing direction to help recover and maintain the viability of listed fish populations and to protect and restore habitat conditions as needed. Since these species are Federally listed, further population and habitat assessment will occur with local information for any project proposed under the direction of the revised Forest Plan that may affect them or their designated critical habitat.

## SENSITIVE SPECIES

### Southern Idaho Ground Squirrel

There are no known occupied southern Idaho ground squirrel sites on the Forest. A conservation strategy and agreement on the Forest was developed in 1996 to improve conditions for northern Idaho ground squirrel, which should also help this species. The Forest is currently managing for the northern Idaho ground squirrel under a Conservation Strategy and Agreement with the FWS that was approved in 1996 (USDI FWS 1996), the Habitat Restoration Plan (2001–2006) that was approved by both agencies in November 2002, and the *Recovery Plan for the Northern Idaho Ground Squirrel* that was approved in 2003. These documents provide comprehensive direction for protecting the northern Idaho ground squirrel and restoring its habitat, in addition to providing guidance for the southern Idaho ground squirrel.

#### *Determination*

None of the proposed alternatives would affect this species or its habitat, therefore there is a determination of "No Impact" for all alternatives.

#### *Rationale*

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for southern Idaho ground squirrel. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

### Wolverine

Wolverines are considered habitat generalists, and their home ranges are so large they are usually measured in hundreds of square miles rather than thousands of acres. Therefore, specific habitat needs are not as critical as reducing human disturbance, particularly in natal den sites (i.e., subalpine talus cirques) during the denning period.

Because this species prefers high-elevation, remote areas to den and forage, wolverine habitat is found mostly on NFS lands and, in general, has been minimally affected by management activities due to road construction, timber harvest, and altered fire regimes. It has been suggested that large, roadless areas are needed to maintain or improve conditions for wolverine to minimize disturbance and vulnerability from trappers, hunters, predators, and collision with vehicles. None of the proposed alternatives would affect wolverine management or habitat.

#### *Determination*

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of wolverine. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the wolverine. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the wolverine. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Fisher

Key components for fisher habitat are forested riparian areas, mature to old forests with moderate moisture conditions, and snags and coarse woody debris. Riparian forest communities are critical for fisher habitat.

The Forest Plan provides direction to increase the extent of large trees on the landscape and protect forested riparian areas. Much of the habitat where this species lives has limited amounts of mechanical management activities, and succession is producing additional multistoried stands with large trees. None of the proposed alternatives would affect this management direction.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of fisher. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the fisher. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the fisher. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Townsend's Western Big-eared Bat

The Townsend's western big-eared bat is known to exist on the Forest. Forest-wide standards and guidelines exist for surveying and protecting big-eared bat hibernacula. In addition, management direction has been developed to protect roosting sites and hibernacula from disturbance when Townsend's western big-eared bats are detected.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of the Townsend's western big-eared bat. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a

Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the Townsend's western big-eared bat. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the western big-eared bat. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Spotted Bat

Spotted bats roost in crevices of high cliffs and forage in sagebrush shrub and low-elevation forest. This species is sensitive to human disturbance during roosting. Forest-wide direction for surveying and protecting spotted bat hibernacula exists. If spotted bats were detected, actions would be taken to protect these sites from disturbance. Direction for habitat protection will decrease the risk to continued persistence and improve viability for this species.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of the spotted bat. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the spotted bat. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the spotted bat. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Gray Wolf

Prey abundance is an important consideration for managing gray wolves. The Forest Plan provides direction to work cooperatively with states and tribes to manage big-game populations that would benefit wolves (USDA Forest Service 2003a, Wildlife Resources section: Goals 2 and 3; Objectives 11 and 12; Standards 6 and 7; and Guidelines 8, 11, 13, and 14).

In addition, the Forest Plan includes a standard (TEPC Species Standard 12) to avoid or minimize impacts from management actions within known denning sites if those actions would disrupt reproductive success during the denning period.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of gray wolves. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the gray wolves. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the gray wolf. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Northern Goshawk

Northern goshawks use all forest types within the Ecogroup and select nesting sites that usually have larger trees than surrounding areas and an abundant prey base. An estimated 570,606 hectares (1,410,000 acres) of habitat for this species currently exists within the Ecogroup.

Forest Plan direction will increase the extent of area with large trees, which will benefit this species. Forest Plan direction for snag management will also benefit this species because many of its prey use snags as habitat. This increasing habitat trend should decrease the risk to continued persistence and improve northern goshawk's viability. Management direction will also avoid or mitigate human activities within nesting stands and fledging areas.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of northern goshawks. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the northern goshawk. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the northern goshawk. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Bald Eagle

Bald eagle nesting, perching, roosting, and wintering sites are typically near riparian areas close to large bodies of water because this species relies primarily on fish for food during the

spring, summer, and fall. During the winter, the bald eagle feeds on waterfowl and scavenges on dead animals such as deer and elk. Because of this dependence, riparian area loss or modification is an important management consideration. The Forest Plan provides management direction to protect riparian areas. Improved riparian and aquatic resource management direction within Riparian Conservation Areas (RCAs) should maintain or restore fish populations important for bald eagle prey over the short and long term and provide large trees for nesting and roosting. This direction also includes goals to maintain or restore large trees where possible for other resource needs, such as enhancing shade and providing bank stabilization, large woody debris recruitment, and pool habitat. Large trees would also provide nesting, perching, and roosting habitat for bald eagles over the short and long term, in both existing and potential bald eagle territories.

#### *Determination*

None of the proposed alternatives would change the effects analysis and range of effects disclosed in the Forest Plan BA. Similarly, none of the alternatives would change current Forest Plan direction for conservation of bald eagles. The 2003 Forest Plan BA determination for Forest Plan implementation was "May Affect, Likely to Adversely Affect" for the bald eagle. The Forest Plan FSEIS would change the wording of the determination because the bald eagle is now analyzed as a sensitive species, but it would not change the intent of analysis and rationale. The determination is now "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the bald eagle.

#### *Rationale*

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the bald eagle. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

### White-headed Woodpecker

White-headed woodpeckers exist in forest types with a high proportion of large ponderosa pine with low tree densities (potential vegetation groups 1, 2, 3, and 5). Many unharvested areas (mostly unsuited timberlands) often do not benefit the white-headed woodpecker due to high tree densities. These areas likely have higher tree densities due to fire exclusion and little or no past stand treatments.

#### *Determination*

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of white-headed woodpecker. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the white-headed woodpecker. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the white-headed woodpecker. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Flammulated Owl

Flammulated owls use lower-elevation forested areas that contain large ponderosa pine and Douglas-fir trees of moderate densities, large-diameter aspen, and large snags for nesting.

Flammulated owl habitat will benefit from Forest Plan direction to increase the extent of large ponderosa pine, Douglas-fir, and aspen and reduce tree densities. Restoration and fire use emphases benefit this species because thinning and nonlethal fire-reduced tree densities. Direction for snag management will also benefit this species. Revised management direction for the appropriate numbers and sizes of snags incorporated the needs of species dependent on these habitat attributes. In addition, road decommissioning will benefit the flammulated owl by increasing snag retention and restricting access. This increasing habitat trend should decrease the risk to continued persistence and improve the species' viability. Forest Plan direction includes the appropriate numbers and sizes of snags and down logs.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of flammulated owl. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the flammulated owl. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the flammulated owl. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Harlequin Duck

Harlequin ducks nest along low-gradient mountain streams in north-central Idaho. No nesting has been documented during surveys for this species on the Forest. Observed birds are believed to be passing through to nesting areas outside the area. The locations where harlequin ducks have been observed are within forested riparian areas. Riparian area protection for RCAs provided by Forest Plan direction will maintain or restore riparian habitat conditions and provide for continued migration to and from nesting areas. Forest Plan direction for habitat protection should decrease the risk to continued persistence and improve viability for this species as it passes through the Forest.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of the harlequin duck. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the harlequin duck. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the harlequin duck. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Mountain Quail

These birds use low-elevation dense shrub areas of coniferous forest and shrubby riparian area at the forest/nonforest interface. No estimate of habitat amount is available for the Forest. Population numbers can be reduced by habitat degradation caused by human activities such as urbanization, predation by cats, and livestock overgrazing. The Forest Plan provides for protection of riparian areas from overgrazing and other management-related disturbances.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of mountain quail. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the mountain quail. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the mountain quail. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Boreal Owl

Boreal owls inhabit mid- to higher-elevation forests that are capable of growing large-diameter trees. Snags and down logs are also necessary habitat attributes for denning sites and access to prey.

Large-scale management activities are not anticipated in extensive areas of boreal owl habitat, so succession and fire will cause most of the vegetation and habitat changes.

Forest Plan direction includes managing for the appropriate numbers and sizes of snags and down logs, direction that incorporated the needs of species dependent on these habitat attributes. None of the proposed alternatives would change management direction for this species.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of boreal owl. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the boreal owl. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the boreal owl. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Three-toed Woodpecker

Three-toed woodpeckers take advantage of areas with tree mortality. They reside in most of the higher-elevation forests. These birds have evolved with forest systems where disturbances such as insects, disease, and fire create conditions (abundant snags and insects) for nesting and feeding. It is believed that wildfire was historically the disturbance that had the greatest impact on modifying these communities (Agee 1998, 1999). Species abundance cycles in response to these disturbances and should have benefited greatly from the hundreds of thousands of acres that burned during the last 10–20 years. Recent increasing insect activity in many of the lodgepole pine communities should also benefit this species in the near future.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of the three-toed woodpeckers. The 2003 Forest Plan BE determination for the Forest Plan was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the three-toed woodpecker. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the three-toed woodpecker. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Great Gray Owl

The habitat components considered most important for the great gray owl are mature or older open forest habitat to provide suitable nesting sites and suitable foraging habitat. These habitats include nonstocked and seedling forests, meadows, and open riparian habitats adjacent to forested vegetation.

### *Determination*

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of great gray owls. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the great gray owl. The Forest Plan FSEIS would not change this determination and supporting rationale.

### *Rationale*

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the great gray owl. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Columbian Sharp-tailed Grouse

In the past, some mountain shrub communities were converted and seeded to nonnative grasses to increase livestock forage. These types of actions no longer occur due to the importance of these habitats to the Columbian sharp-tailed grouse and other species. Another concern has been the recent extensive modification of some of these communities due to wildfire in the five management areas where Columbian sharp-tailed grouse exist. It is believed that wildfire was historically the disturbance that had the greatest impact on modifying these communities (Agee 1998). Once these areas burn, it takes an estimated 20-30 years before Columbian sharp-tailed grouse can use the areas as wintering habitat. Fire is not undesirable in these communities, but the fire's extent and timing can be a concern in localized areas and some management areas where habitat is limited or recently burned.

### *Determination*

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of Columbian sharp-tailed grouse. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the Columbian sharp-tailed grouse. The Forest Plan FSEIS would not change this determination and supporting rationale.

### *Rationale*

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the Columbian sharp-tailed grouse. As this species is listed as

sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Common Loon

Common loons nest in extreme eastern Idaho in natural lakes. No nesting has been documented for this species on the Forest. The observed birds on some of the natural and man-made lakes are believed to have been passing through to nesting areas outside the Forest. Wintering birds are mostly found on bays and coves along the Pacific Ocean's coast. Common loons and humans (at moderate densities) can coexist on lakes that provide some undisturbed suitable shoreline or islands for nesting. If nesting is documented on the Forest, appropriate direction is in place for sensitive species nesting habitat protection. No activity would influence the common loon's ability to pass through the area to nesting and wintering areas. Riparian area protection provided by Forest-wide direction will maintain or restore riparian habitat conditions. Direction for habitat protection should decrease the risk to continued persistence and improve viability for this species.

### *Determination*

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for conservation of the common loon. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the common loon. The Forest Plan FSEIS would not change this determination and supporting rationale.

### *Rationale*

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the common loon. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Peregrine Falcon

Peregrine falcon nesting habitat is typically on cliffs in natural environments. Open stands created through fire or vegetation management would likely increase foraging opportunities for peregrine falcons since they hunt small birds. Management direction is in place to protect nesting birds from disturbance while nesting and raising their young. This management direction will contribute to habitat conditions for the species' viability and persistence.

### *Determination*

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BA. Similarly, none of the alternatives would change current Forest Plan direction for conservation of peregrine falcons. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or

Cause a Loss of Viability to the Population or Species" for the peregrine falcon. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the peregrine falcon. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

## Columbia Spotted Frog

Forest Plan direction is expected to maintain the current distribution of Columbia spotted frogs on the Forest, and habitat conditions are expected to improve. The Forest Service will follow legal direction (Executive Order 11190) mandating that wetlands will not be destroyed or negatively affected. Management direction in RCAs/Riparian Habitat Conservation Areas (RHCAs) provides additional protection to Columbia spotted frog habitat. The Columbia spotted frog has been eliminated in some high-elevation lakes because of past fish stocking. The current direction for habitat protection should decrease the risk to continued persistence and improve viability for this species.

***Determination***

None of the proposed alternatives would change the effects analysis and range of direct, indirect, and cumulative effects disclosed in the Forest Plan BE. Similarly, none of the alternatives would change current Forest Plan direction for Columbia spotted frog conservation. The 2003 Forest Plan BE determination for Forest Plan implementation was "May Impact Individuals or Habitat, but is Not Likely to Contribute to a Trend Toward Federal Listing or Cause a Loss of Viability to the Population or Species" for the Columbia spotted frog. The Forest Plan FSEIS would not change this determination and supporting rationale.

***Rationale***

None of the proposed alternatives would change the scope of the effects analysis to alter management direction for the Columbia spotted frog. As this species is listed as sensitive, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction in the Forest Plan. The Forest Plan does not describe or mandate site-specific activities or projects.

### Yellow-Billed Cuckoo

No nesting has been documented for this species on the Forest. Available breeding habitat throughout this birds range has been substantially reduced in area and quality by activities that have lowered the water table (e.g., water diversion, ground water pumping) and the replacement of native riparian vegetation with invasive non-native plants, particularly tamarisk. Disturbances imposed by humans, such as vegetation removal, grazing, and flooding, have facilitated the invasion of tamarisk. Because it is a Neotropical migrant, the yellow-billed cuckoo also is considered to be very vulnerable to tropical deforestation on its wintering grounds; however, the relationship between over-wintering habitat and populations has not been studied.

If nesting is documented on the Forest, appropriate direction is in place for sensitive species nesting habitat protection. No activity would influence the yellow-billed cuckoo's ability to pass through the area to nesting and wintering areas. Riparian area protection provided by Forest-wide direction will maintain or restore riparian habitat conditions. Direction for habitat protection should decrease the risk to continued persistence and improve viability for this species.

#### *Determination*

None of the proposed alternatives would affect this species or its habitat therefore there is a determination of "No Impact" for all alternatives.

#### *Rationale*

None of the proposed alternatives would affect this species or its habitat. Additional direction is in place for sensitive species in general that should benefit the yellow-billed cuckoo if additional concerns become known in the future. As this species is a Region 4 sensitive species, further habitat assessment will occur with local information for any project proposal that may affect its habitat that is proposed under the direction of the Forest Plan.

### Westslope Cutthroat Trout

None of the proposed alternatives would change the effects analysis and determinations disclosed in the BAs for ongoing actions (Faurot and Burns 2001, 2007a, 2007b; Zurstadt and Burns 2007, 2009; Olson and Burns 2007a, 2007b; Faurot and Nelson 2008). Similarly, none of the alternatives would change current Forest Plan direction for the westslope cutthroat trout.

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Consistent with 36 CFR §219.20(a), this section will be added to Appendix F of the 2003 Payette National Forest Land and Resource Management Plan.

# 1.0 INTRODUCTION

In response to a *Payette National Forest Land and Resource Management Plan* (Forest Plan) (USDA Forest Service 2003a) appeal remand by the Washington Office of the U.S. Forest Service in 2005, the Payette National Forest completed a Draft Supplemental Environmental Impact Statement (DSEIS).

In 2003, the Payette National Forest completed the *Southwest Idaho Ecogroup Land and Resource Management Plans Final Environmental Impact Statement* (FEIS) (USDA Forest Service 2003b) to implement the Forest Plan. The Intermountain Region Forester received five appeals of the decision to implement Alternative 7 as described in the Record of Decision, with appellants contending that the Regional Forester violated the National Forest Management Act and the Hells Canyon National Recreation Area Act on the Payette National Forest by allowing grazing of domestic sheep within or near the range of bighorn sheep (*Ovis canadensis*), thus threatening the viability of bighorn sheep through disease transmission.

On March 9, 2005, the Chief of the Forest Service concurred that the effects analyses and discussion of cumulative effects pertaining to bighorn sheep presented in the FEIS did not adequately address viability and reversed the Intermountain Regional Forester's 2003 decision to approve revised management direction for the Hells Canyon Management Area as it pertains to bighorn sheep and its habitat. The Regional Forester was instructed analyze bighorn sheep viability in the Payette National Forest commensurate with the concerns and questions discussed in the appeal review and amend the Forest Plan accordingly to ensure bighorn sheep viability. The analysis was to be thorough enough to determine compliance with applicable law and regulation, specifically the Hells Canyon National Recreation Area Act.

In April 2007, the Payette National Forest convened an Interdisciplinary Team (IDT) to develop a supplemental environmental impact statement to the 2003 FEIS and to supplement the Forest Plan. In August 2007, the Payette National Forest received requests from the State of Idaho, State of Oregon, State of Washington, Nez Perce Tribe, Shoshone-Bannock Tribe, Shoshone-Paiute Tribe, and Confederated Tribes of the Umatilla Indian Reservation to be involved in the DSEIS process. The process was revised to include their cooperators, and the DSEIS was published in 2008 (USDA Forest Service 2008).

Since the DSEIS was published, the Payette National Forest has developed a new method for analyzing the effects of the alternatives. Some of those differences between the analysis used for the DSEIS and the Final SEIS (FSEIS) are the result of improvements and/or adjustments to the techniques used in the DSEIS or better and more appropriate uses of models, while others are completely new methods or models developed specifically for the FSEIS. These improvements were based on field reviews conducted by the IDT, monitoring of bighorn sheep populations, discussions with scientists, and feedback on the DSEIS.

These changes are as follows:

1. An improved source habitat model and an accurate spatial depiction of bighorn sheep
2. A more useful population model of individual bighorn sheep in the Hells Canyon and Salmon River Mountain areas
3. A scientifically relevant analysis of telemetry points and temporal variability information
4. A new quantitative risk analysis model that utilizes the bighorn sheep database to determine the contact risk between bighorn sheep and domestic sheep (this new quantitative model replaces the DSEIS risk model)
5. A disease model to assist with cumulative effects analyses and determine bighorn sheep population persistence
6. An improved economic analysis explaining the benefits that a bighorn sheep population on the Payette National Forest has on the affected communities

This document details each of the models used in the analysis for the FSEIS.

# 2.0 SOURCE HABITAT MODEL

The source habitat model for bighorn sheep used in the FSEIS was originally designed by the Hells Canyon Initiative (HCI) (Table L-1). The HCI is managed by the Hells Canyon Bighorn Sheep Restoration Committee, a State, Federal, and private partnership to restore Rocky Mountain bighorn sheep in the Hells Canyon of Oregon, Idaho, and Washington. Source habitat is defined as those characteristics of macrovegetation that contribute to stationary or positive population growth, which is distinguished from habitats associated with species occurrence since such habitats may or may not contribute to long-term population persistence (Wisdom et al. 2000). The original suitable habitat model was primarily a two-component model that consisted of escape terrain and horizontal visibility. The water sources component was not used in the Payette National Forest version of this model because the criteria used in the HCI model (>3.2 kilometers [km] from a water source) encompassed every portion of the Payette National Forest. The Payette National Forest model also did not include the lambing range.

**Table L-1. Hells Canyon Initiative bighorn sheep habitat model**

| Habitat Component | Criteria | Source |
|---|---|---|
| **Escape terrain** | | |
| Slope | 31° ≤slope ≤85° | Gudorf et al. 1996;<br>Smith et al. 1991 |
| Buffer | 300 meters (m) or land areas ≤1,000 m wide bounded on ≥2 sides by escape terrain (500 m) | Smith et al. 1991;<br>Gudorf and Sweanor 1996 |
| Minimum area | 1.6 hectares (ha) | Gudorf and Sweanor 1996 |
| **Horizontal visibility** | Grassland, rock, open shrub, or forest cover <40%, from satellite imagery | Schirokauer 1996 |
| **Water sources** | ≤3.2 km | Smith et al. 1991;<br>Gudorf and Sweanor 1996 |
| **Summer range** | Suitable habitat within 300 m of escape terrain | Smith et al. 1991;<br>Gudorf and Sweanor 1996;<br>Schirokauer 1996 |
| **Winter range** | Suitable habitat all aspects below 1,463 m; aspect 135°–225°above 1,463 m | Smith et al. 1991;<br>Gudorf and Sweanor 1996;<br>Coggins pers. comm. |
| **Lambing range** | Escape terrain 45°–315° ≤1 km from water ≥2contiguous ha | Gudorf and Sweanor 1996 |

*Source*: Hells Canyon Bighorn Sheep Restoration Committee (1997)

The source habitat model used for the DSEIS needed several modifications for the FSEIS. First, the geographic range of the model only covered the Hells Canyon and not the entire Payette National Forest. The second issue concerned the vegetation layer used in the horizontal visibility component of the original model. The HCI model utilized vegetation supervised classification of Thematic Mapper satellite imagery, which was too broad and contained no canopy cover information, resulting in an insufficient level of detail for the vegetation data. To solve the problems of scale and detail, Payette National Forest modelers used a different vegetation dataset for horizontal visibility and included low canopy cover forested cover types. Using forested types is supported by the HCI's cited literature but was not used by the HCI because of limitations of the supervised classification of TM satellite imagery.

The escape terrain component was found to overmap in areas that met the steepness criterion but lacked the ruggedness to make the area source habitat. To correct this problem, Payette National Forest modelers used a ruggedness ArcGIS script (Sappington et al. 2007) to create a ruggedness surface that was then overlaid with the telemetry and observation data. From this overlay, modelers created a histogram of ruggedness to determine the ruggedness cutoff point for source habitat, which was 310 or less out of a range of 0 to 3455. Adding this new criterion changed the overall amount of mapped source habitat by 2% and reduced the correlation between the source habitat and telemetry data from 92% to 90%.

The winter version of the source habitat model was also modified for the FSEIS. The original HCI model and the version used in the DSEIS restricted the habitat to southern aspects above 4,800 feet or 1,463 m, which grossly overmapped the amount of winter source habitat. However, field reviewers found that most of the areas above 1,463 m are covered by snow and therefore not suitable habitat. To overcome this problem, Payette National Forest modelers used persistent snow data (Copeland et al. 2010) and removed from winter source habitat areas above 1,463 m that were snow covered 2 or more years out of the last 7. This change in mapping dropped the

amount of mapped winter source habitat by 18%; however, it only dropped the correlation between winter source habitat and winter telemetry points from 82% to 80%.

The horizontal visibility component used the vegetation dataset from the LANDFIRE project (The National Map LANDFIRE 2006), an interagency effort to map vegetation and fuels data in a consistent fashion and at a scale useful at an incident level nationally. The nonforest vegetation cover types from the HCI model were crosswalked into the LANDFIRE nonforested cover types by Payette National Forest staff. Documentation created by the HCI stated that forested cover types of less than 40% canopy cover can be used in the model; however, they were not used in the actual model because canopy cover was not included in the original supervised classification of TM satellite imagery. Forested cover types for canopy cover ≤30% were added to the FSEIS model using LANDFIRE. The ≤30% canopy cover for forest cover type was chosen based on review by Payette National Forest staff using the 2004 National Agricultural Imagery Program (NAIP) 1-m full-color photographs. The LANDFIRE data at ≤40% canopy cover in forested types tended to map canopy covers that appeared denser than 40% cover, particularly on the east zone of the Payette National Forest. This discrepancy would have overestimated the amount of source habitat available to bighorn sheep on the eastern portion of the Payette National Forest and may have contributed to some undermapping of source habitat on the western side where the canopy covers better matched photograph images. However, underestimating the habitat in the western side of the Payette National Forest appeared to be less of an error compared to the amount that would have been overmapped in the east. This choice of using a ≤30% canopy cover was also confirmed during a season of field reviews of the habitat data.

Modelers also decided to filter the habitat model to a minimum mapping size of 2.0 hectares. The original HCI model only filtered the escape terrain component to approximately 1.6 hectares. The overall 2.0 hectare minimum mapping area filter was a more appropriate filter because of the nature of the LANDFIRE vegetation data. The final product and the forest cover type/canopy cover choices were verified with NAIP photography and on-the-ground field reviews at several locations throughout a field season.

The source habitat model used for the FSEIS was compared with over 54,000 telemetry and observation points, mainly from Hells Canyon and the Salmon River canyon; 90% of all known bighorn sheep telemetry points fell within the modeled summer source habitat and 80% fell within the winter source habitat. A final review of all source habitat model components and outcomes was completed by the IDT and accepted as adequate to fulfill the needs of this analysis. In one area, the output of the source habitat model was manually edited. In the Lost Valley area, the model was determined to be overmapping the presence of source habitat, leading to an overestimate in the risk of contact analysis. This manual change was also accepted by the IDT. Detailed information on each input and function for bighorn sheep summer source habitat in the Hells Canyon and the Payette National Forest is found in Table L-2. Table L-3 shows winter source habitat for bighorn sheep in Hells Canyon and the Payette National Forest. Table L-4 describes the LANDFIRE cover types.

**Table L-2. Summer habitat model**

| Name | Explanation[a] |
|---|---|
| CON selection of nonforest cover types | This command creates the nonforested input for the horizontal visibility portion of the Bighorn Sheep Summer Source Habitat model. The input data is Existing Vegetation Type downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con (F:\Bighorn\Landfire\33677953\33677953 in {12, 31, 2001, 2006, 2079, 2080, 2081, 2106, 2123, 2124, 2125, 2126, 2127, 2134, 2135, 2139, 2140, 2142, 2143, 2144, 2145, 2153, 2169, 2181, 2182, 2183, 2220, 2062, 2065, 2144, 2070, 2017, 2115, 2165},1)". |
| CON selection of forest cover types and canopy covers | This command creates the forested input for the horizontal visibility portion of the Bighorn Sheep Summer Source Habitat model. The input data are Existing Vegetation Type and Existing Vegetation Cover downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con ((F:\Bighorn\Landfire\33677953\33677953 in {2008, 2009, 2011, 2012, 2016, 2018, 2019, 2020, 2035, 2036, 2037, 2038, 2039, 2041, 2042, 2045, 2046, 2047, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2060, 2061, 2063, 2154, 2156, 2157, 2158, 2161, 2166, 2167, 2173, 2174, 2178, 2200, 2203, 2205, 2206, 2208, 2227, 2228, 2232} and F:\Bighorn\Landfire\30745420\30745420 in {101, 102}), 1)". The canopy covers from LANDFIRE are as follows: 101, Tree Cover ≥10 and <20%; 102, Tree Cover ≥20 and <30%. |
| MERGE of forested and nonforest selections | This command merges the forested and nonforest components of the horizontal visibility component of the Bighorn Sheep Summer Source Habitat model. The map algebra for this command is "merge (nonforest, forest)". |
| Project Raster from Albers to Universal Transverse Mercator (UTM) | This command changes the projection of the combined forested and nonforested vegetation components. The LANDFIRE projection was Albers NAD83, which was projected to the local projection of UTM Zone 11 NAD83. |
| Region Group for minimum mapping size | This Region Group command is the first step in filtering for a minimum mapping unit. This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group. |
| CON selection of minimum mapping size of 5 acres | This command selects from the grouped input groups of cell 5 acres or larger. The map algebra for this command is "con (F:\Bighorn\Landfire\hor_vis_rg.count ≥23,1)". |
| "Slope ≥31 and ≤85 degrees" CON | This CON function selects slopes from the slope grid derived from the National Elevation Dataset elevation grid. The slopes selected are equal to or greater than 31° and less than or equal to 85° and roughness index of ≤310. This selection is as follows "C:\Projects\BHS_Final\Data\Elevations\deg_slp ≥31 AND C:\Projects\BHS_Final\Data\Elevations\deg_slp ≤85" and C:\Projects\BHS_Final\Data\Elevations\ruf_10000 ≤310. |
| Region Group | This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group. |
| CON & ZONALAREA (Single Output Map Algebra) | This command selects from the grouped input groups of cell 16000 or larger. The map algebra for this command is "con (zonalarea (slpgp) ≥16000, 1 )". |
| CON & EUCDISTANCE LE 300 (Single Output Map Algebra) | This CON function calculates the straight line distance from the input then selects all cells ≤300 m. The map algebra for this command is "con (eucdistance (escslp) ≤300, 1)". |
| CON & EUCDISTANCE GT 500 (Single Output Map Algebra) | This CON function calculates the straight line distance from the input then selects all cells greater than 500 m. The map algebra for this command is "con (eucdistance (escslp) > 500, 1)". |
| CON & EUCDISTANCE GE 500 (Single Output Map Algebra) | This CON function calculates the straight line distance from the input then selects all cells ≥500 m. The map algebra for this command is "con (eucdistance (gt500) ≥500, 1)". |
| CON & ISNULL (Single Output Map Algebra) | This CON function erases the "buff300" from "wi500" to create the final output for the escape terrain component. The map algebra for this function is "con (isnull (buff300), con (wi500 == 1, 1), 1)". |
| CON combines the two model components | This CON command combines the two model components so that on the cell and overlap from the two inputs appear in the final output. |

[a] See Table L-4 for descriptions of the LANDFIRE cover types

**Table L-3. Winter habitat model**

| Name | Explanation[a] |
|---|---|
| CON selection of nonforest cover types | This command creates the nonforested input for the horizontal visibility portion of the Bighorn Sheep Winter Source Habitat model. The input data is Existing Vegetation Type downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con (F:\Bighorn\Landfire\33677953\33677953 in {12, 31, 2001, 2006, 2079, 2080, 2081, 2106, 2123, 2124, 2125, 2126, 2127, 2134, 2135, 2139, 2140, 2142, 2143, 2144, 2145, 2153, 2169, 2181, 2182, 2183, 2220, 2062, 2065, 2144, 2070, 2017, 2115, 2165},1)". |
| CON selection of forest cover types and canopy covers | This command creates the forested input for the horizontal visibility portion of the Bighorn Sheep Winter Source Habitat model. The input data are Existing Vegetation Type and Existing Vegetation Cover downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con ((F:\Bighorn\Landfire\33677953\33677953 in {2008, 2009, 2011, 2012, 2016, 2018, 2019, 2020, 2035, 2036, 2037, 2038, 2039, 2041, 2042, 2045, 2046, 2047, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2060, 2061, 2063, 2154, 2156, 2157, 2158, 2161, 2166, 2167, 2173, 2174, 2178, 2200, 2203, 2205, 2206, 2208, 2227, 2228, 2232} and F:\Bighorn\Landfire\30745420\30745420 in {101, 102}), 1)". The canopy covers from LANDFIRE are as follows: 101, Tree Cover ≥10 and <20%; 102, Tree Cover ≥20 and <30%. |
| MERGE of forested and nonforest selections | This command merges the forested and nonforest components of the horizontal visibility component of the Bighorn Sheep Winter Source Habitat model. The map algebra for this command is "merge (nonforest, forest)". |
| Project Raster from Albers to Universal Transverse Mercator (UTM) | This command changes the projection of the combined forested and nonforested vegetation components. The LANDFIRE projection was Albers NAD83, which was projected to the local projection of UTM Zone 11 NAD83. |
| Region Group for minimum mapping size | This Region Group command is the first step in filtering for a minimum mapping unit. This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group. |
| CON selection of minimum mapping size of 5 acres | This command selects from the grouped input groups of cell 5 acres or larger. The map algebra for this command is "con (F:\Bighorn\Landfire\hor_vis_rg.count ≥23,1)". |
| "Slope ≥31 and ≤85 degrees" CON | This CON function selects slopes from the slope grid derived from the National Elevation Dataset elevation grid. The slopes selected are equal to or greater than 31° and ≤85° and roughness index of ≤310. This selection is as follows "C:\Projects\BHS_Final\Data\Elevations\deg_slp ≥31 AND C:\Projects\BHS_Final\Data\Elevations\deg_slp ≤85" and C:\Projects\BHS_Final\Data\Elevations\ruf_10000 ≤310. |
| Region Group | This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group. |
| CON & ZONALAREA (Single Output Map Algebra) | This command selects from the grouped input groups of cell 16000 or larger. The map algebra for this command is "con ( zonalarea (slpgp) ≥16000, 1 )". |
| CON & EUCDISTANCE LE 300 (Single Output Map Algebra) | This CON function calculates the straight line distance from the input then selects all cells ≤300 m. The map algebra for this command is "con (eucdistance (escslp) ≤300, 1)". |
| CON & EUCDISTANCE GT 500 (Single Output Map Algebra) | This CON function calculates the straight line distance from the input then selects all cells greater than 500 m. The map algebra for this command is "con (eucdistance (escslp) > 500, 1)". |
| CON & EUCDISTANCE GE 500 (Single Output Map Algebra) | This CON function calculates the straight line distance from the input then selects all cells ≥500 m. The map algebra for this command is "con (eucdistance (gt500) ≥500, 1)". |
| CON & ISNULL (Single Output Map Algebra) | This CON function erases the "buff300" from "wi500" to create the final output for the escape terrain component. The map algebra for this function is "con (isnull (buff300), con (wi500 == 1, 1), 1)". |
| CON combines the two model components | This CON command combines the two model components so that on the cell and overlap from the two inputs appear in the final output. |
| Southern Aspects above 4,800 feet excluded | The Map Algebra expression creates a grid that masks out area above 4,800 feet that are not on southern aspect. "con ((c:\Projects\BHS_Final\Data\Elevation\large_elev le 1463.04) OR ((c:\Projects\BHS_Final\Data\Elevation\large_elev gt 1463.04) and (c:\Projects\BHS_Final\Data\Elevation\large_asp ge 135 and c:\Projects\BHS_Final\Data\Elevation\large_asp le 225)), 1)" |

| Name | Explanation[a] |
|---|---|
| Perennial Snow Areas excluded | The Map Algebra expression masks out, of the southern aspect mask, areas that are covered by persistent snow. "con((win_area1 eq 1) and (pere_snow le 1),1)" |
| Merge winter exclusions with the escape terrain and horizontal visibility | This CON command combines the winter exclusions with the escape terrain and horizontal visibility components so that only the areas that overlap between components are the only areas in the final output. |

a See Table L-4 for descriptions of the LANDFIRE cover types

**Table L-4. LANDFIRE cover types**

| No. | Type of Vegetation |
|---|---|
| 12 | Snow/Ice |
| 31 | Barren |
| 2001 | Inter-Mountain Basins Sparsely Vegetated Systems |
| 2006 | Rocky Mountain Alpine/Montane Sparsely Vegetated Systems |
| 2008 | North Pacific Oak Woodland |
| 2009 | Northwestern Great Plains Aspen Forest and Parkland |
| 2011 | Rocky Mountain Aspen Forest and Woodland |
| 2012 | Rocky Mountain Bigtooth Maple Ravine Woodland |
| 2016 | Colorado Plateau Pinyon-Juniper Woodland |
| 2017 | Columbia Plateau Western Juniper Woodland and Savanna |
| 2018 | East Cascades Mesic Montane Mixed-Conifer Forest and Woodland |
| 2019 | Great Basin Pinyon-Juniper Woodland |
| 2020 | Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland |
| 2035 | North Pacific Dry Douglas-fir Forest and Woodland |
| 2036 | North Pacific Hypermaritime Sitka Spruce Forest |
| 2037 | North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest |
| 2038 | North Pacific Maritime Mesic Subalpine Parkland |
| 2039 | North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest |
| 2041 | North Pacific Mountain Hemlock Forest |
| 2042 | North Pacific Mesic Western Hemlock-Silver Fir Forest |
| 2045 | Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest |
| 2046 | Northern Rocky Mountain Subalpine Woodland and Parkland |
| 2047 | Northern Rocky Mountain Mesic Montane Mixed Conifer Forest |
| 2049 | Rocky Mountain Foothill Limber Pine-Juniper Woodland |
| 2050 | Rocky Mountain Lodgepole Pine Forest |
| 2051 | Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Wood |
| 2052 | Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland |
| 2053 | Northern Rocky Mountain Ponderosa Pine Woodland and Savanna |
| 2054 | Southern Rocky Mountain Ponderosa Pine Woodland |
| 2055 | Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland |
| 2056 | Rocky Mountain Subalpine Wet-Mesic Spruce-Fir Forest and Woodland |
| 2057 | Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland |
| 2060 | East Cascades Oak-Ponderosa Pine Forest and Woodland |
| 2061 | Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland |
| 2062 | Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland |
| 2063 | North Pacific Broadleaf Landslide Forest and Shrubland |
| 2065 | Columbia Plateau Scabland Shrubland |
| 2070 | Rocky Mountain Alpine Dwarf-Shrubland |
| 2079 | Great Basin Xeric Mixed Sagebrush Shrubland |
| 2080 | Inter-Mountain Basins Big Sagebrush Shrubland |
| 2081 | Inter-Mountain Basins Mixed Salt Desert Scrub |

| No. | Type of Vegetation |
|---|---|
| 2106 | Northern Rocky Mountain Montane-Foothill Deciduous Shrubland |
| 2115 | Inter-Mountain Basins Juniper Savanna |
| 2123 | Columbia Plateau Steppe and Grassland |
| 2124 | Columbia Plateau Low Sagebrush Steppe |
| 2125 | Inter-Mountain Basins Big Sagebrush Steppe |
| 2126 | Inter-Mountain Basins Montane Sagebrush Steppe |
| 2127 | Inter-Mountain Basins Semi-Desert Shrub-Steppe |
| 2134 | Columbia Basin Foothill and Canyon Dry Grassland |
| 2135 | Inter-Mountain Basins Semi-Desert Grassland |
| 2139 | Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland |
| 2140 | Northern Rocky Mountain Subalpine-Upper Montane Grassland |
| 2142 | Columbia Basin Palouse Prairie |
| 2143 | Rocky Mountain Alpine Fell-Field |
| 2144 | Rocky Mountain Dry Turf |
| 2145 | Rocky Mountain Subalpine-Montane Mesic Meadow |
| 2153 | Inter-Mountain Basins Greasewood Flat |
| 2154 | Inter-Mountain Basins Montane Riparian Systems |
| 2156 | North Pacific Lowland Riparian Forest and Shrubland |
| 2157 | North Pacific Swamp Systems |
| 2158 | North Pacific Montane Riparian Woodland and Shrubland |
| 2161 | Northern Rocky Mountain Conifer Swamp |
| 2165 | Northern Rocky Mountain Foothill Conifer Wooded Steppe |
| 2166 | Middle Rocky Mountain Montane Douglas-fir Forest and Woodland |
| 2167 | Rocky Mountain Poor-Site Lodgepole Pine Forest |
| 2169 | Northern Rocky Mountain Subalpine Deciduous Shrubland |
| 2173 | North Pacific Wooded Lava Volcanic Flowage |
| 2174 | North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest |
| 2178 | North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest |
| 2181 | Introduced Upland Vegetation—Annual Grassland |
| 2182 | Introduced Upland Vegetation—Perennial Grassland and Forbland |
| 2183 | Introduced Upland Vegetation—Annual and Biennial Forbland |
| 2200 | Pseudotsuga menziesii-Quercus garryana Woodland Alliance |
| 2203 | Juniperus occidentalis Woodland Alliance |
| 2205 | Tsuga mertensiana-Abies amabilis Woodland Alliance |
| 2206 | Pseudotsuga menziesii Giant Forest Alliance |
| 2208 | Abies concolor Forest Alliance |
| 2220 | Artemisia tridentata ssp. vaseyana Shrubland Alliance |
| 2227 | Pseudotsuga menziesii Forest Alliance |
| 2228 | Larix occidentalis Forest Alliance |
| 2232 | Abies grandis Forest Alliance |

# 3.0 RISK OF CONTACT MODEL

The sequence of events by which a disease outbreak could result from contact between a bighorn sheep and a domestic sheep in an active allotment located outside of bighorn sheep core herd home range (CHHR) can be broken down into a number of steps. First, to reach an occupied allotment, a bighorn sheep must (1) leave the CHHR; (2) travel far enough to reach the allotment; and (3) intersect the allotment (i.e., rather than some other area at the same distance from the CHHR). For disease transmission to occur, the bighorn sheep must (4) come into contact with domestic sheep in the allotment and (5) contract the disease from the domestic sheep. Finally, for an outbreak to affect the animal's home herd, the infected bighorn sheep must (6) return to the CHHR and (7) transmit the disease to other members of the herd.

The contact model described in this section aims to determine the probability that a bighorn sheep will reach an occupied allotment, steps 1–3 above. Steps 4–7, which are also necessary for an outbreak to results from such a movement, are discussed below as part of disease model.

The contact model is based on an analysis of 12 years of bighorn sheep telemetry data from the Hells Canyon and Salmon River populations, and its construction involved two distinct analyses. First, the CHHR analysis was used to delineate areas where most animals in each herd spend most of their time. Then, the analysis examined the characteristics of bighorn sheep movements or "forays" outside of the CHHR. This foray analysis examined how frequently and at what season foray movements occur, as well as how far beyond the CHHR animals are likely to travel. Together, the habitat, CHHR and foray analyses were used to estimate the probability that a ewe or a ram in any of the herds would reach any of the open allotments in a given year.

## 3.1 Risk of Contact Model

### *3.1.1 Bighorn Sheep Core Herd Home Range Analysis*

CHHR analysis was conducted as part of the major bighorn sheep herd analysis for the Hells Canyon and the Main and South Fork Salmon Rivers. The CHHR analysis made analyzing the impacts of domestic sheep grazing on the Payette National Forest to the broader bighorn sheep metapopulations possible. The analysis showed the extent of overlap between the different herds throughout the Hells Canyon and the Main and South Fork Salmon Rivers. This type of modeling also allowed the IDT to determine the core areas of bighorn sheep habitat usage.

The tools and processes used to complete this analysis are common to home range analyses used for many species. The analysis consisted of a fixed kernel home range model created with observations and telemetry data collected by the HCI from 1997 through 2008. Francis Cassirer (Idaho Department of Fish and Game [IDFG]), who is the HCI project leader responsible for the telemetry database management, used the telemetry data to divide the bighorn sheep population into herds.

The herd assignments were based on transplant locations and breeding groups of ewes that shared the same range. A population is based on the entirety of the breeding individuals independent of shared range. Identified herds in the Hells Canyon metapopulation are the Asotin, Big Canyon, Black Butte, Imnaha, Lostine, Upper Hells Canyon[1], Mountain View, Muir Creek, Myers Creek, Redbird, Sheep Mountain, and Wenaha herds (Figures L-1 through L-12). Herds in the Salmon River metapopulation are the Main Salmon/South Fork, Big Creek, and Upper Main Salmon herds (Figures L-13 through L-15). Several small herds had too few points to accurately create a CHHR or telemetry from transplants that failed to form a herd, so no home range modeling was conducted on them. These small herds are called 05IMREL, Lower Hells Canyon, Saddle Creek, Quartz Creek, Minam, and Sheep Creek.

[1] The McGraw Herd that was modeled in the draft has been renamed the Upper Hells Canyon Herd. The Upper Hells Canyon Herd has an estimated population of 45 individuals, with insufficient telemetry or observational data. Telemetry data are available from animals of the now extirpated McGraw Herd, which occupied the same part of Hells Canyon. The IDT decided to used the CHHR of the McGraw Herd and attach the current population from the Upper Hells Canyon Herd.

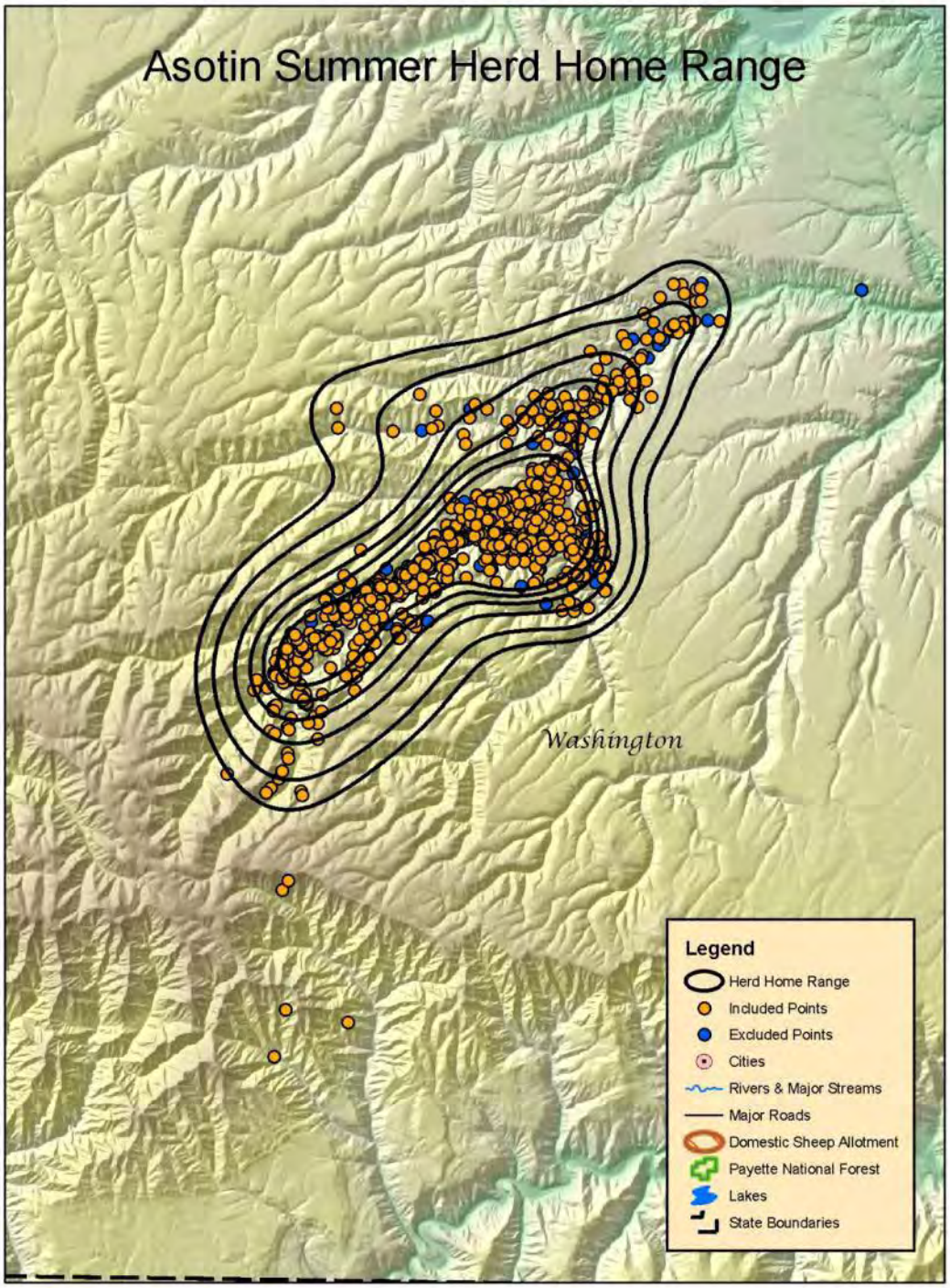



**Figure L-1. Asotin core herd home range**

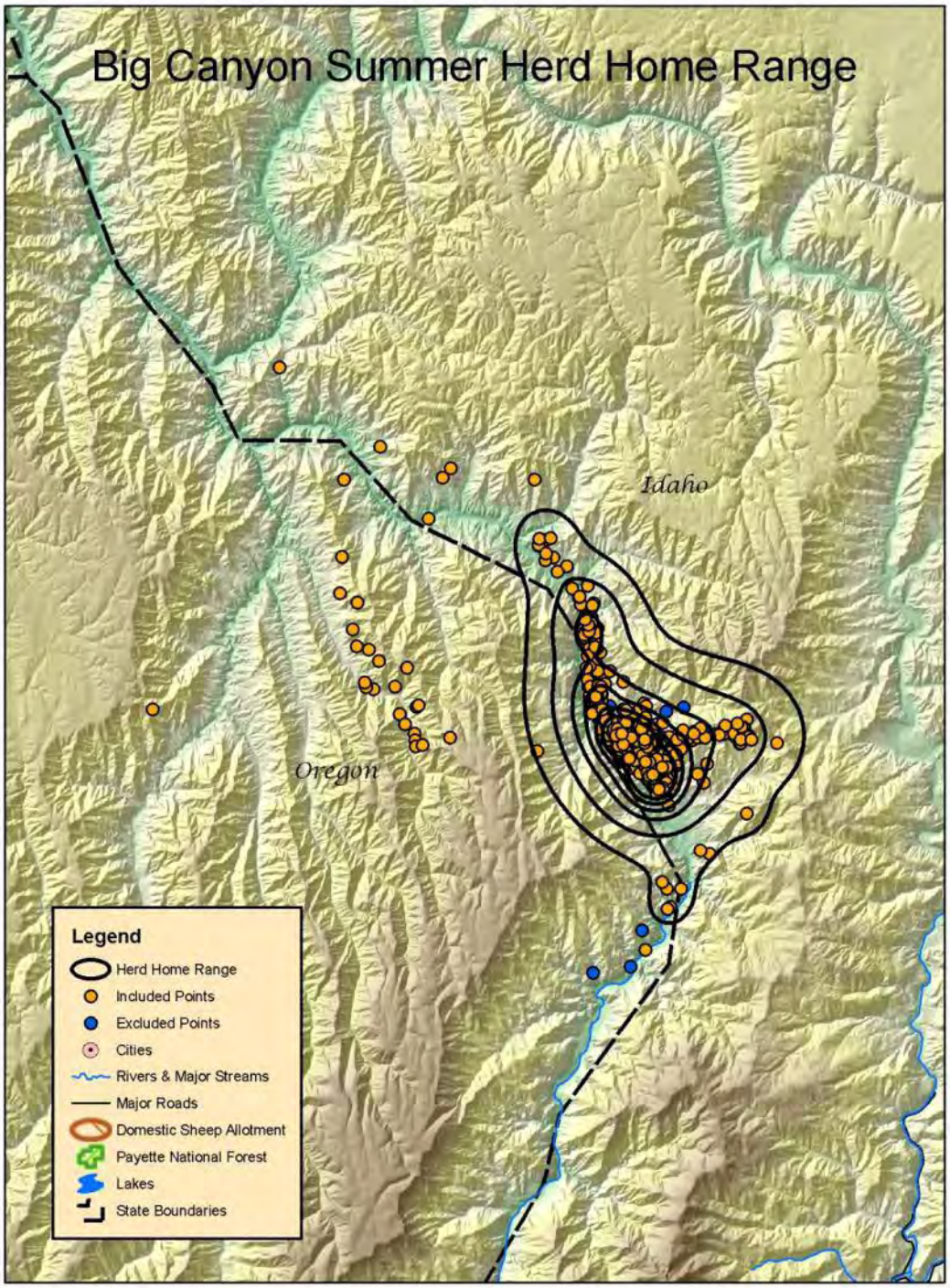



**Figure L-2. Big Canyon core herd home ranges**

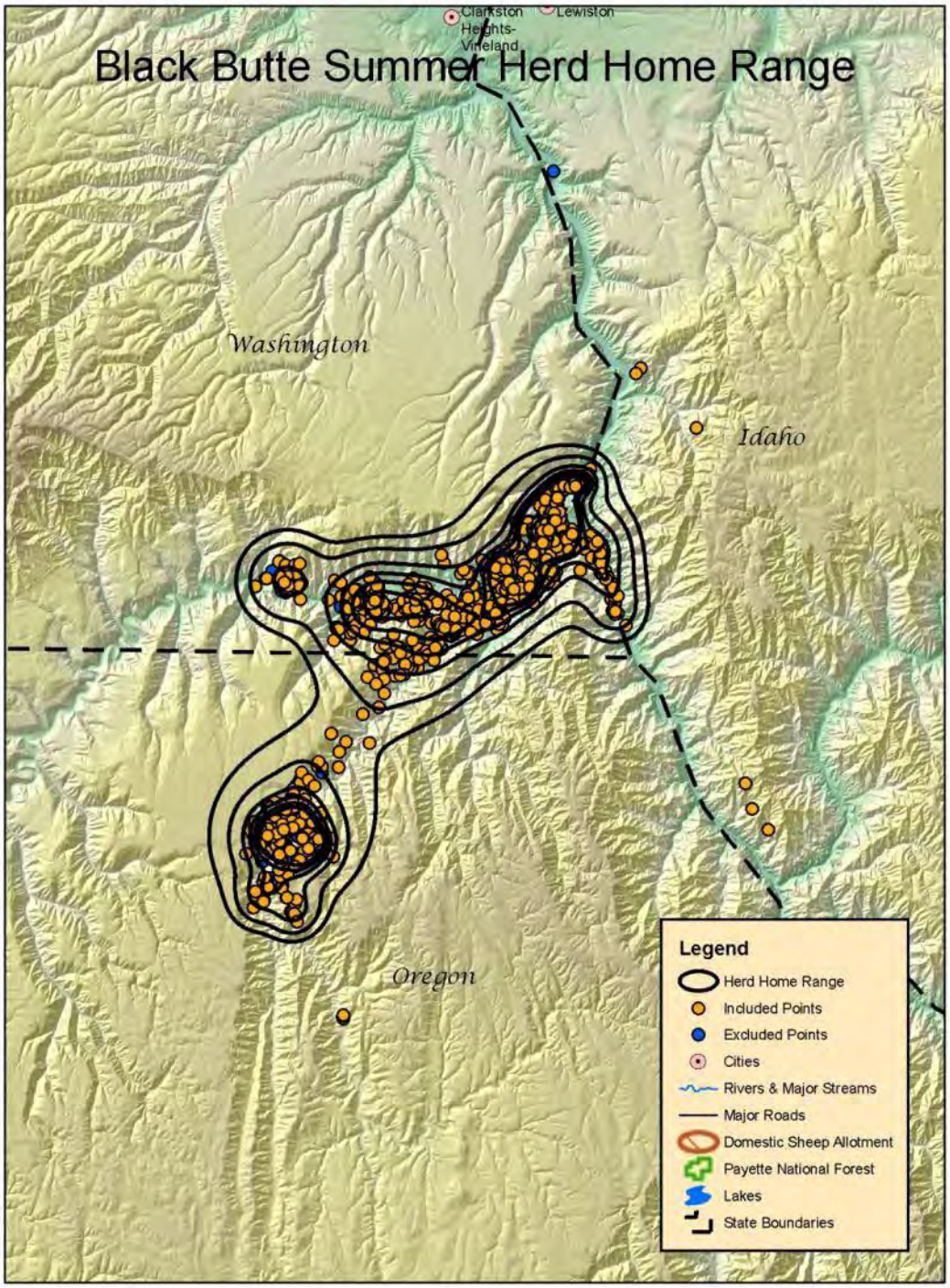



**Figure L-3. Black Butte core herd home range**

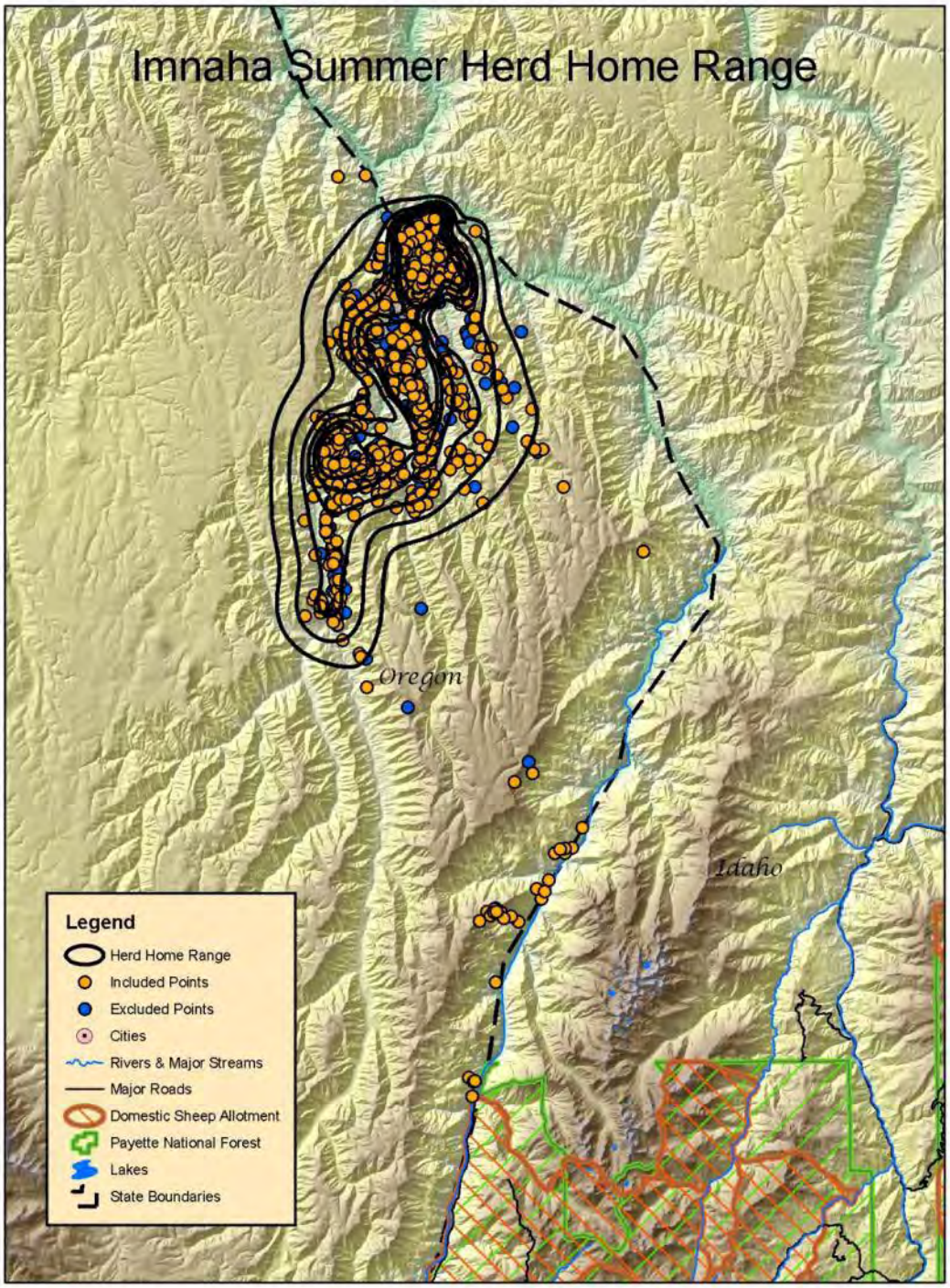



**Figure L-4. Imnaha core herd home range**

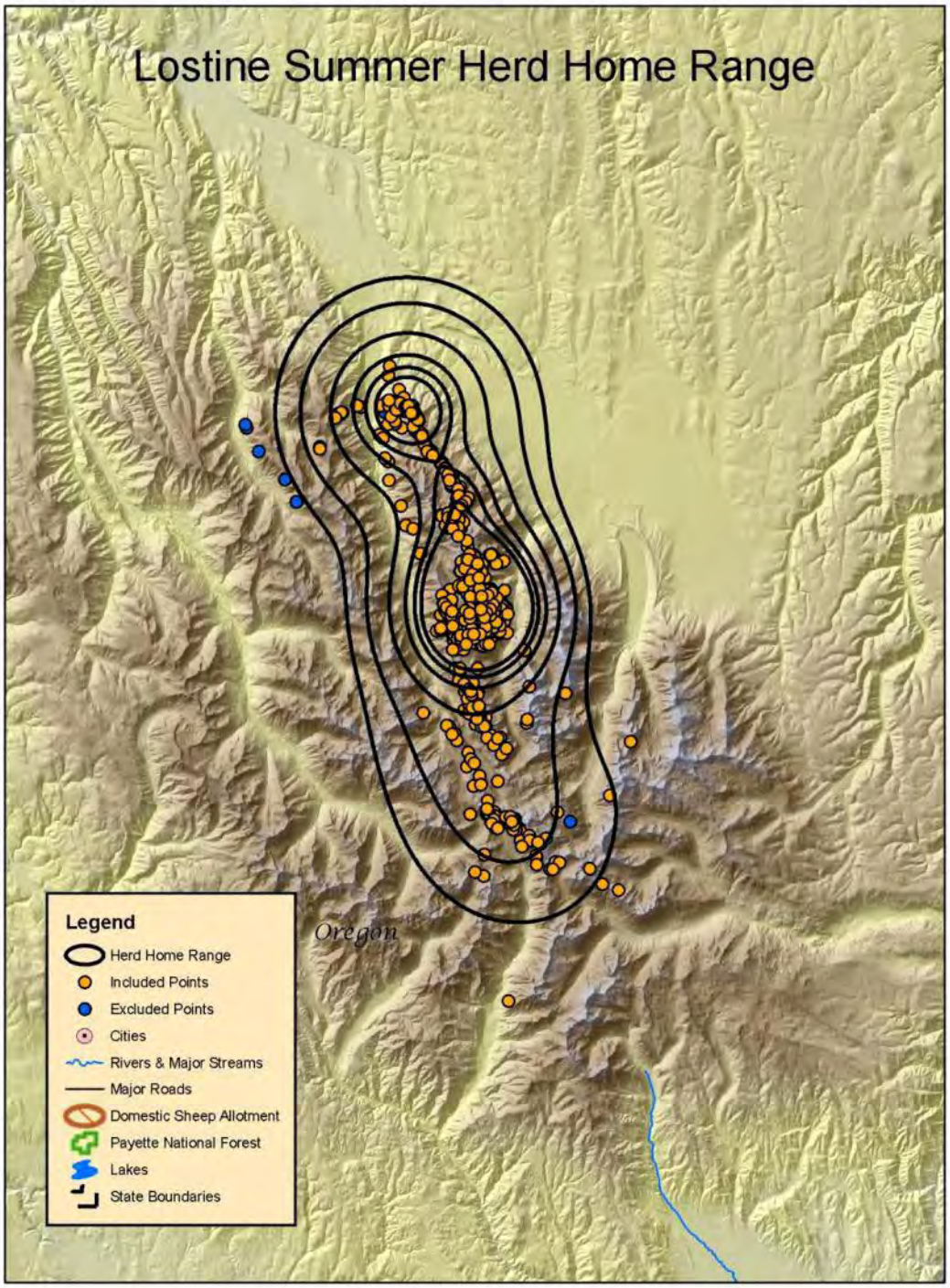



**Figure L-5. Lostine core herd home range**

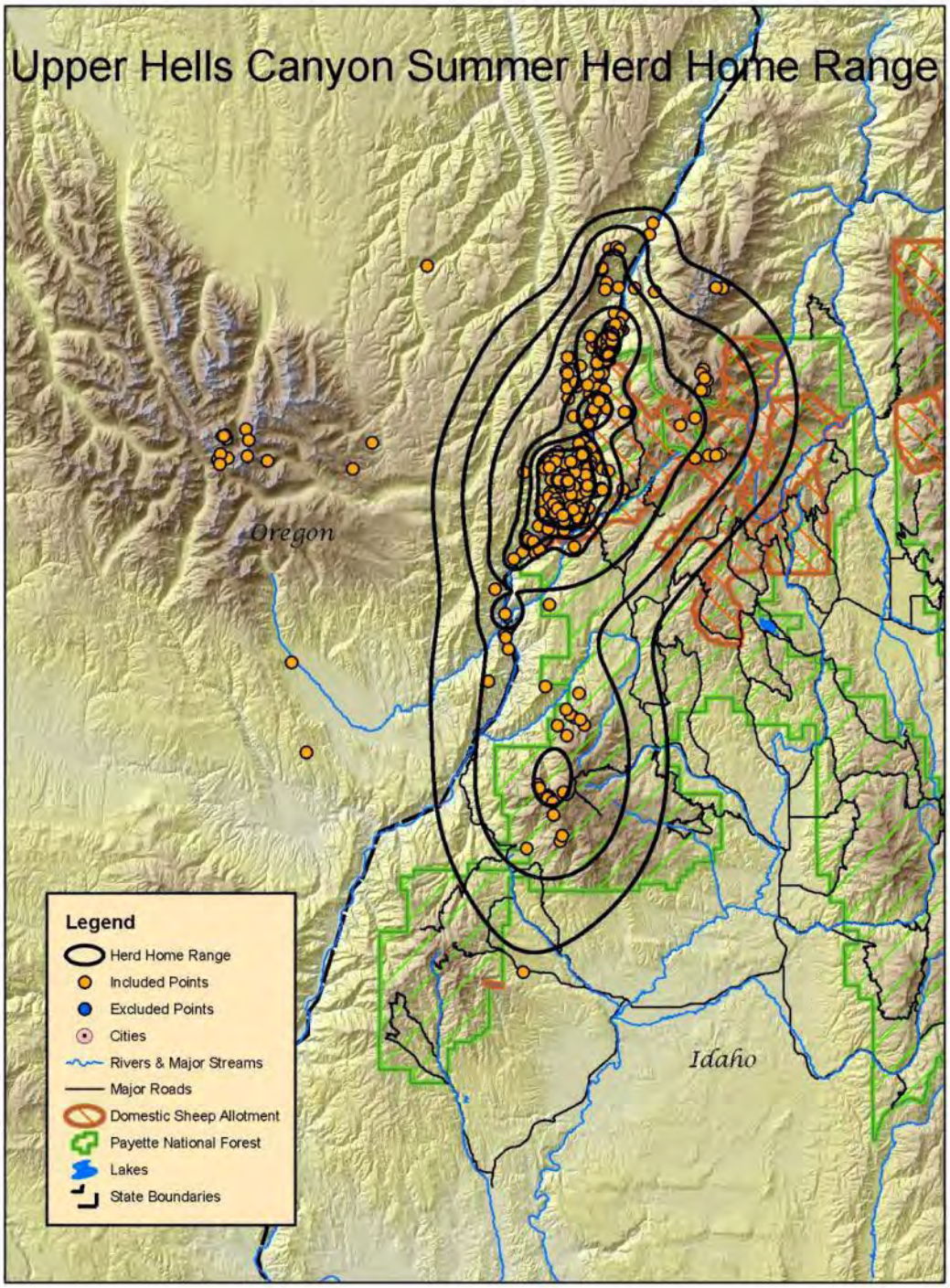



**Figure L-6. Upper Hells Canyon core herd home range**

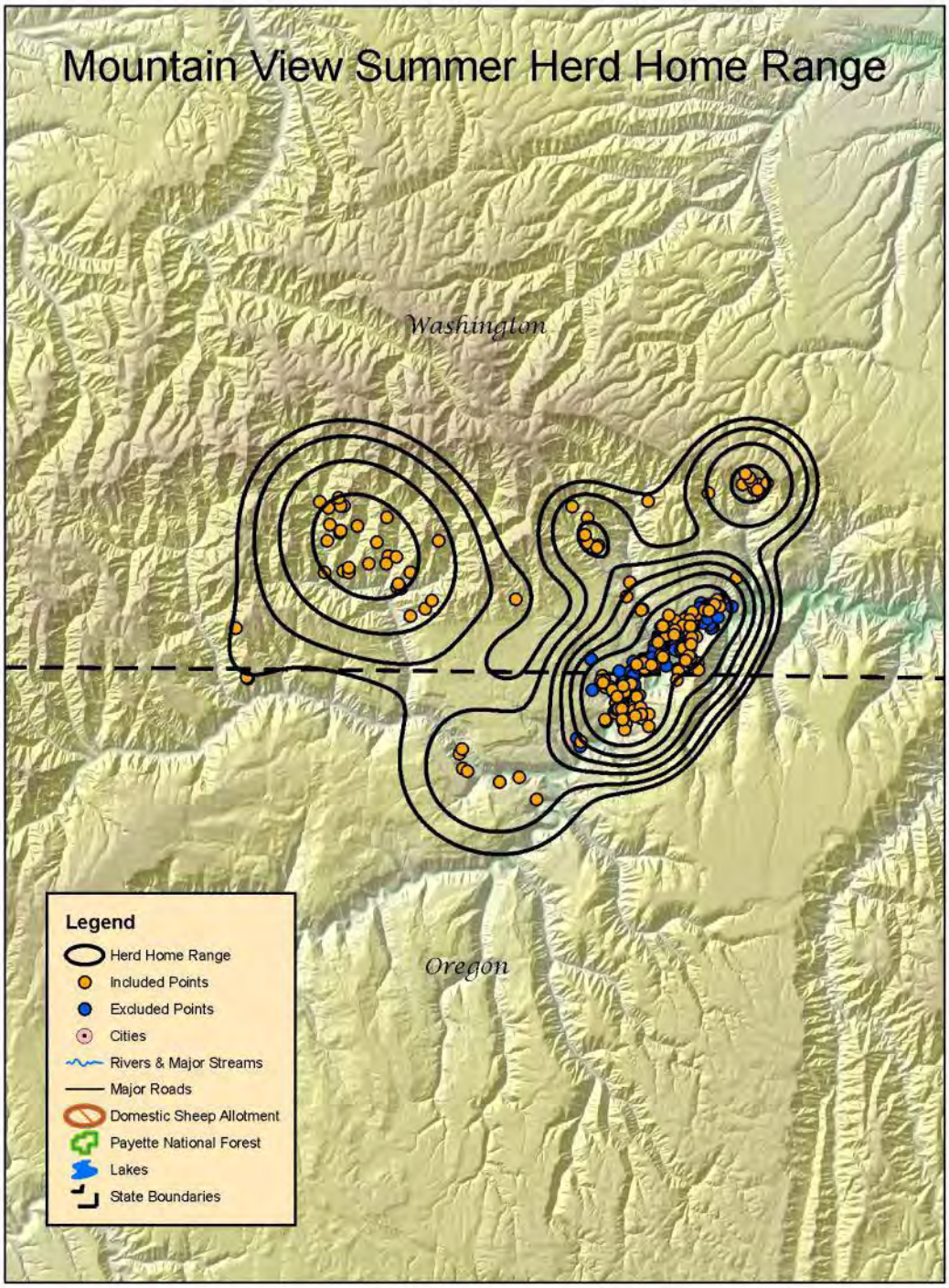



**Figure L-7. Mountain View core herd home range**

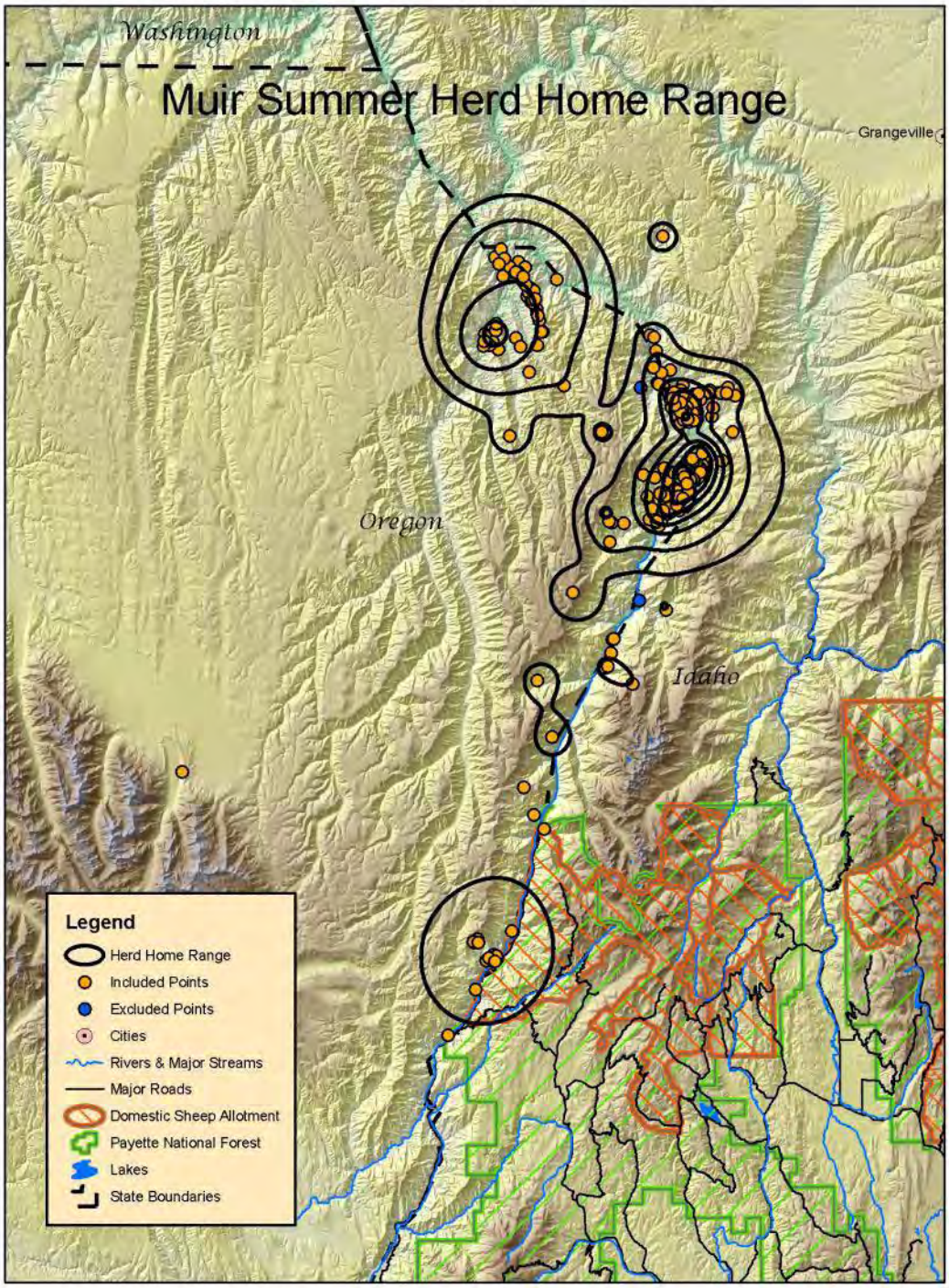



**Figure L-8. Muir Creek core herd home range**

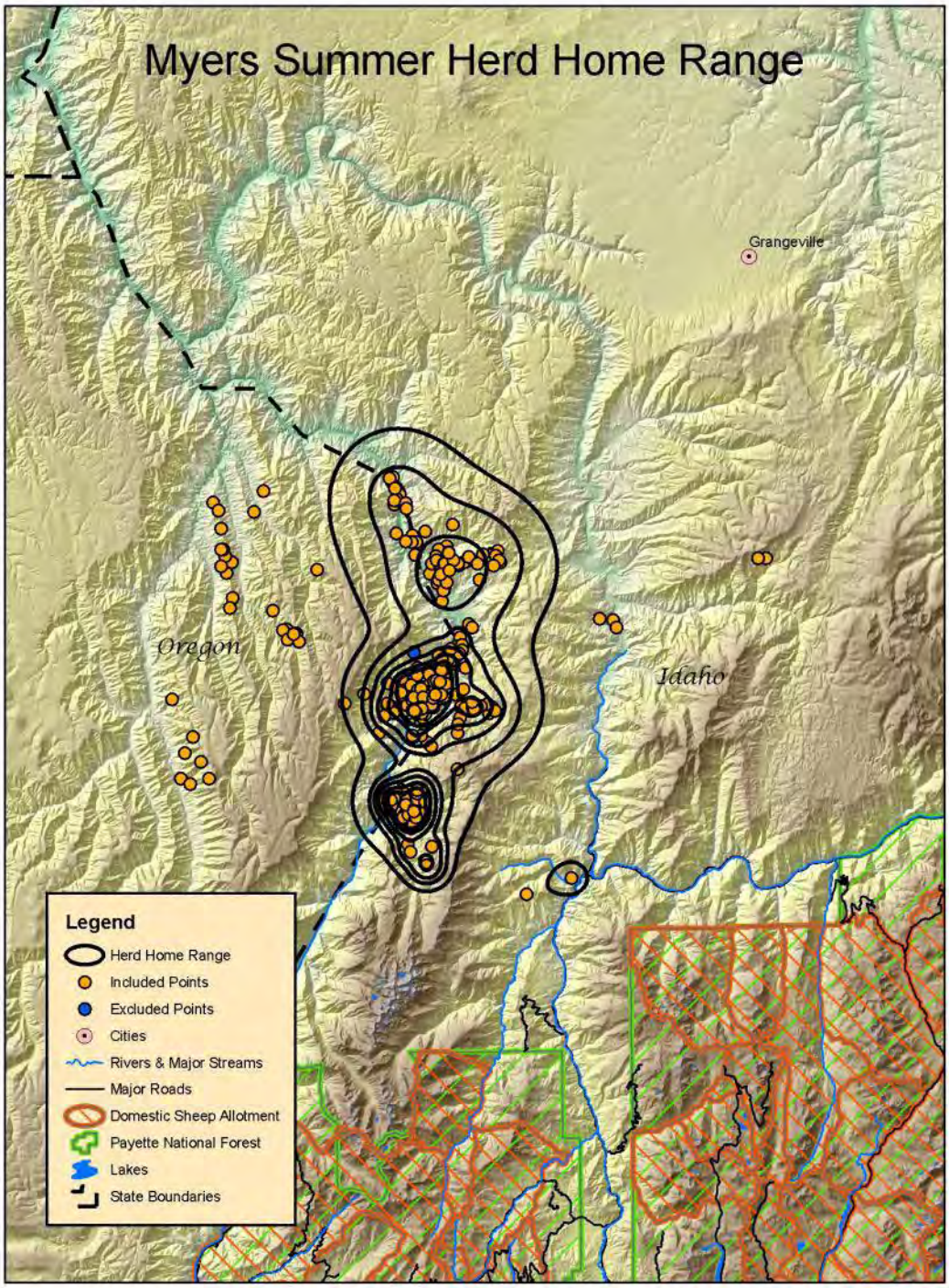



**Figure L-9. Myers Creek core herd home range**

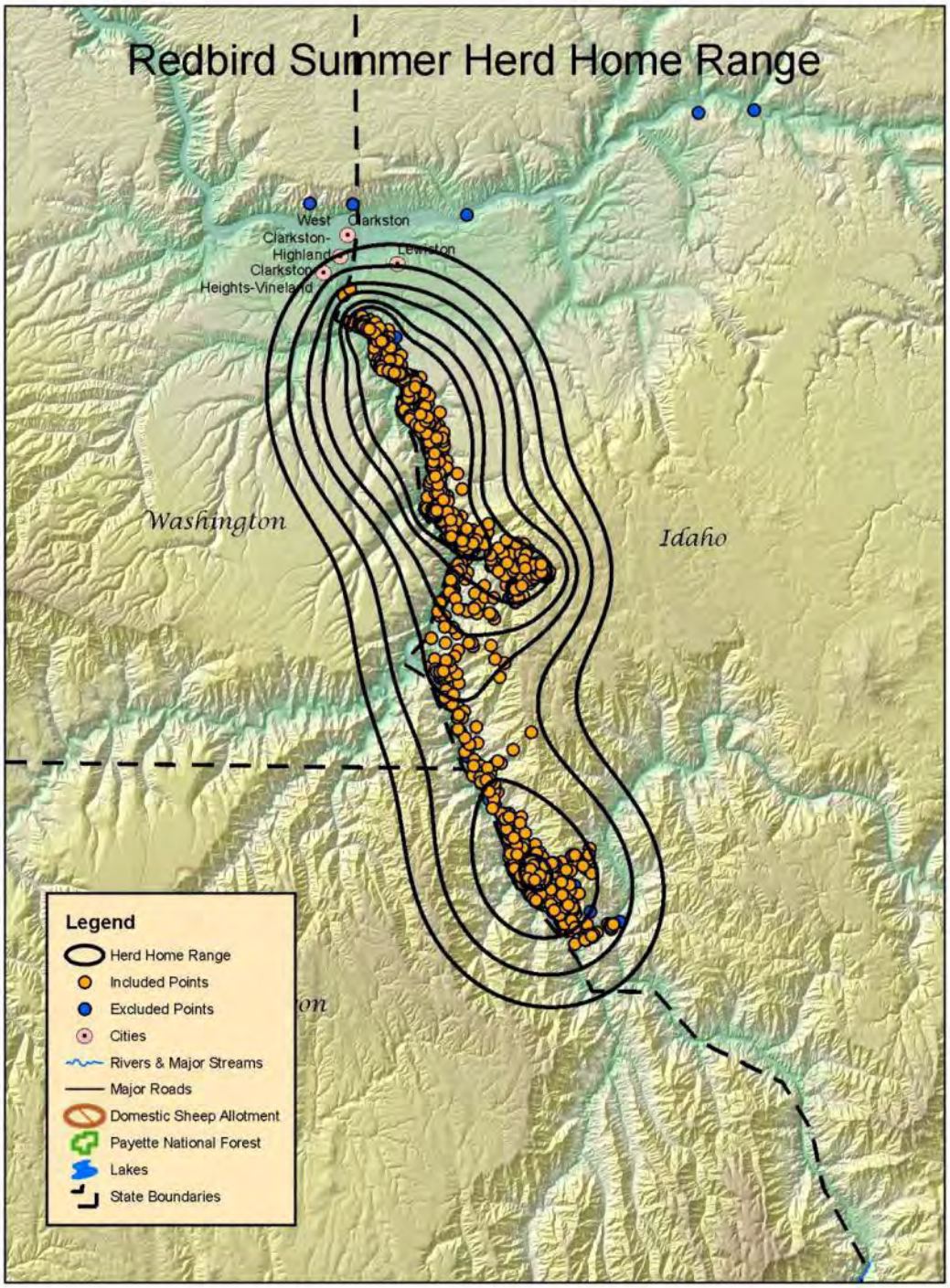



**Figure L-10. Redbird core herd home range**

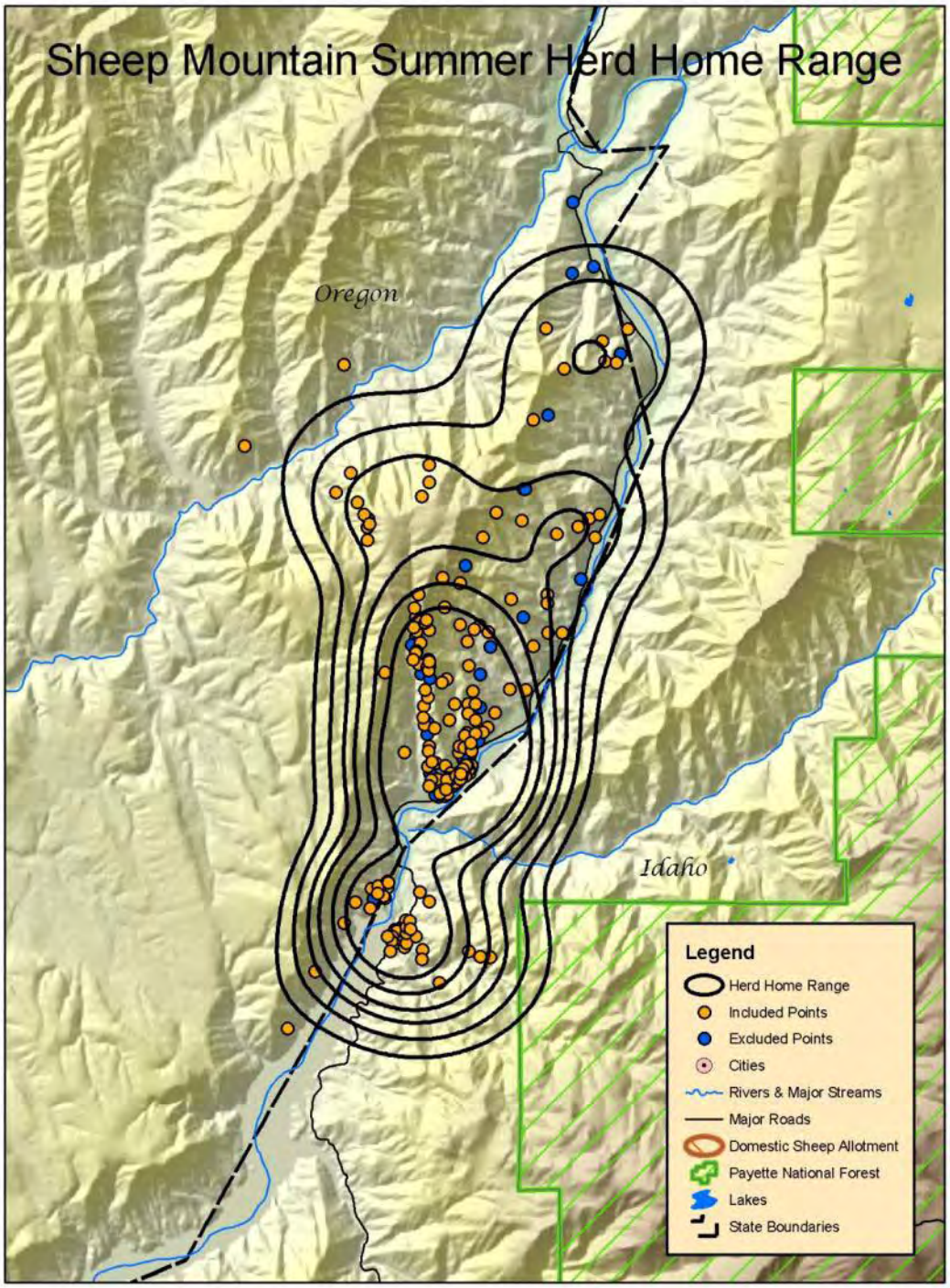



**Figure L-11. Sheep Mountain core herd home range**

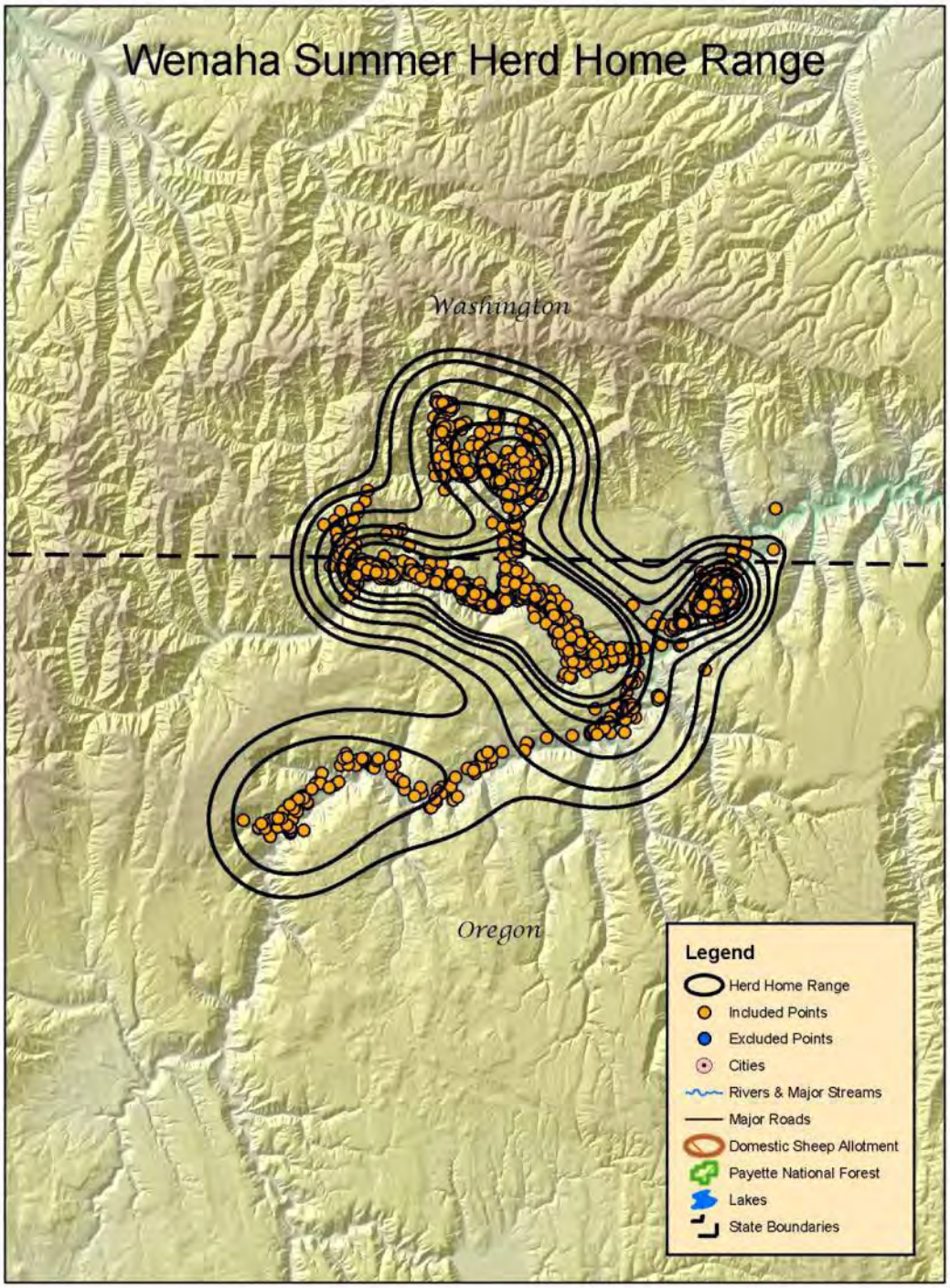



**Figure L-12. Wenaha core herd home range**

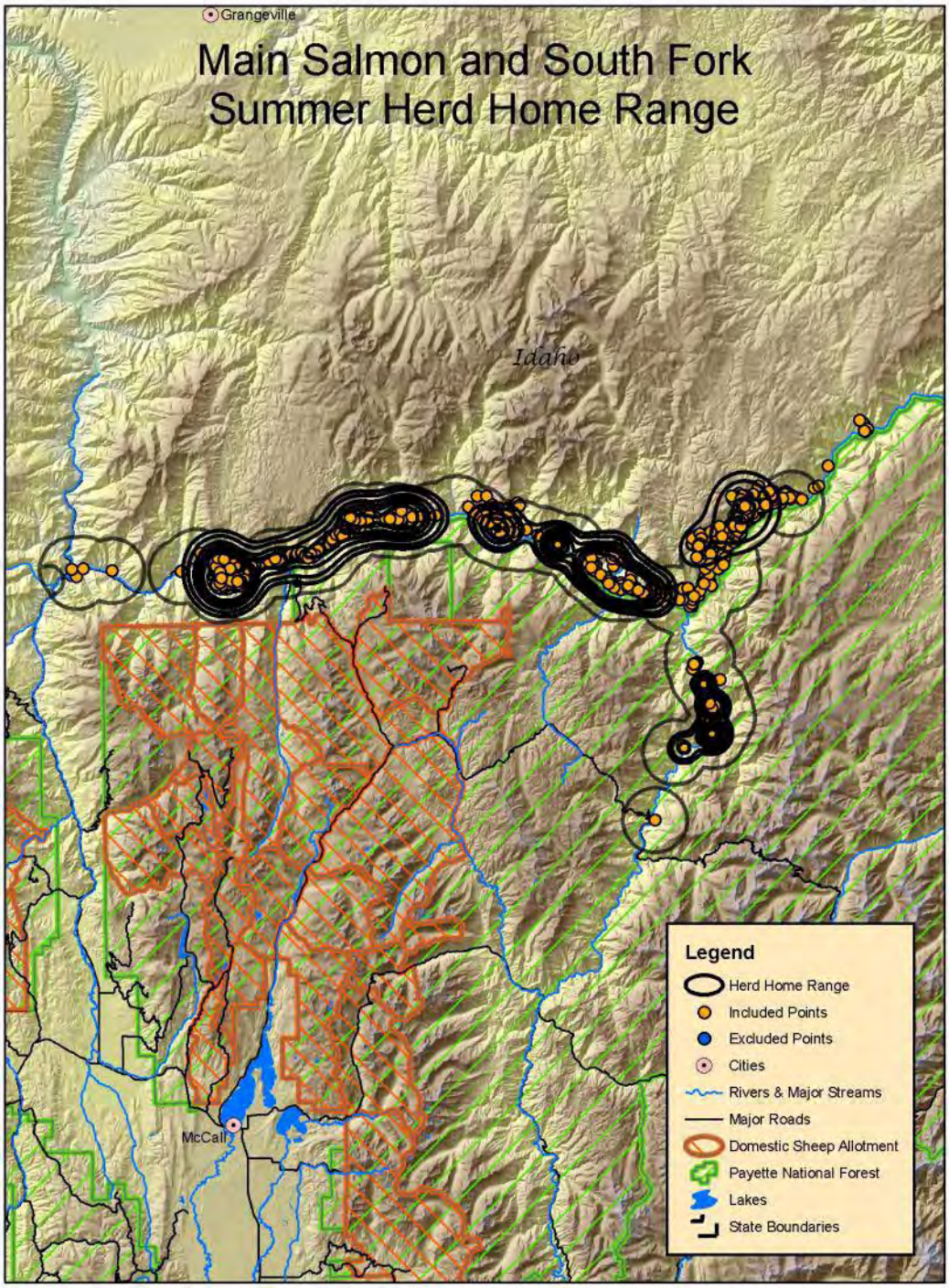



**Figure L-13. Main Salmon/South Fork core herd home range**

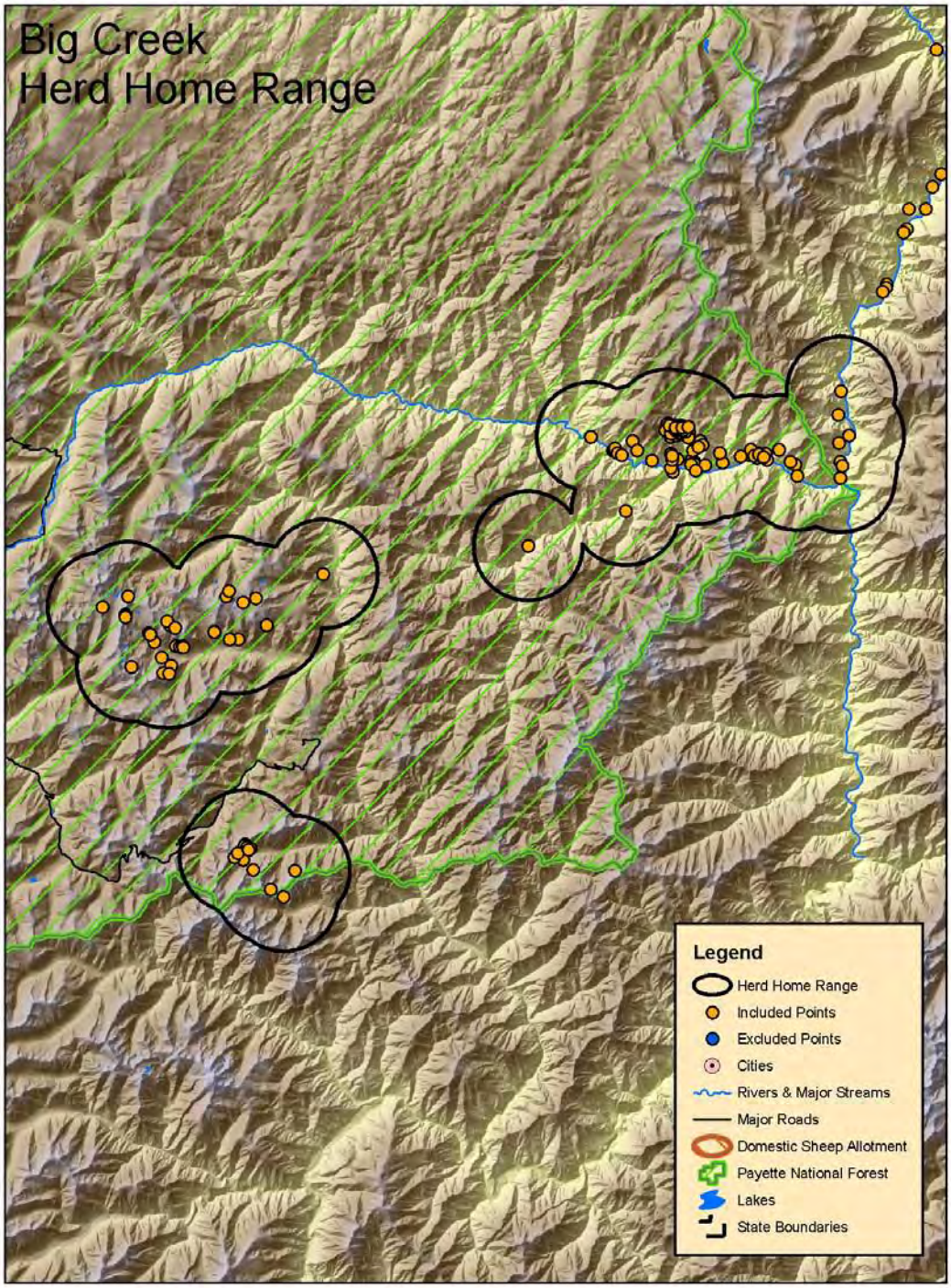



**Figure L-14. Big Creek core herd home range**

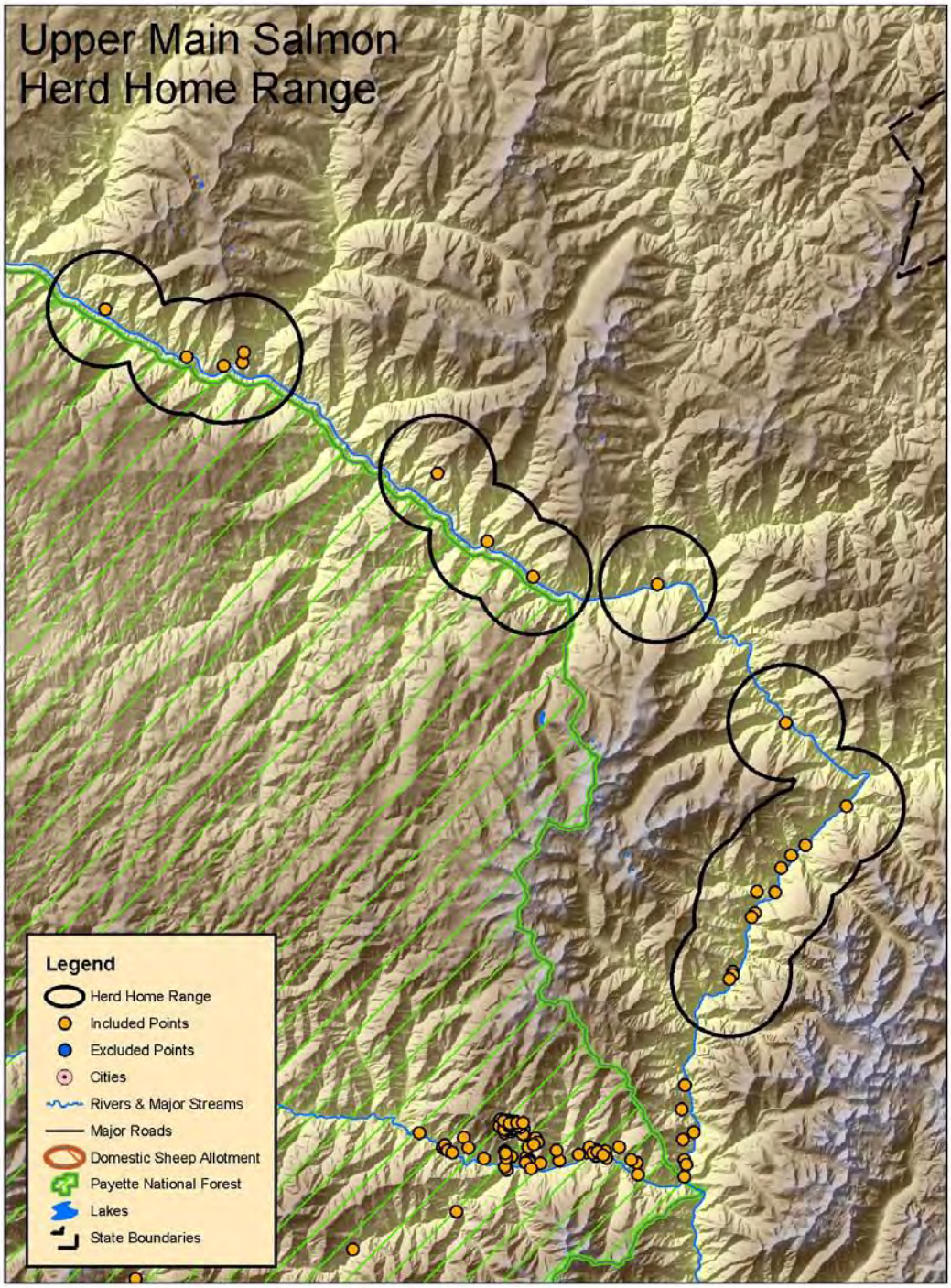



**Figure L-15. Upper Main Salmon core herd home range**

Home range modeling for the Main Salmon/South Fork Herd and for herds in the Hells Canyon metapopulation was completed with Home Range Extension version 1.1 for ArcGIS (Rodgers et al. 2007), a software package designed for just this purpose. The Home Range Extension uses a standard bivariate normal probability density function as the "kernel" employed to estimate the intensity with which animals use each mapped area. A kernel is essentially a small 3-dimensional hill placed over the location of each telemetry observation. Where many observations are clustered together, these hills overlap and pile up, their total height indicates the probability of finding an animal at a given location. The width of the kernels, *href*, is calculated in Equation L-1 as the square root of the mean variance in *x* (var *x*) and *y* (var *y*) co-ordinates divided by the sixth root of the number of points (Worton 1995):

$$href = n^{\frac{-1}{6}}\sqrt{\frac{\text{var}\,x + \text{var}\,y}{2}}$$

**Equation L-1. Calculation for band width of the kernels (href)**

This method of selecting *href* is widely used as a means of extrapolating from the dispersion of observed locations to the likely extent of the full home range

This process of home range analysis was done for each identifiable individual within a herd that had more than 20 telemetry points. All other telemetry and observation points for a herd that did not meet these criteria were excluded from the home range analysis and used to verify the accuracy of the final CHHR volume contours. One of the byproducts of the process is a surface raster from which the volume contours were created.

To create an overall CHHR, the raster surfaces from the individuals were added together. Then, volume contours, known as isopleths, were created from the merged herd surface using Hawth's Analysis Tools version 3.27 Extension for ArcGIS (Beyer 2004). Isopleths are contours meant to enclose a given percentage of the telemetry observations; the 95$^{th}$ isopleth for example, is drawn to enclose an area in which 95% of the telemetry points are found. Volume contours were calculated for the 50$^{th}$, 60$^{th}$, 70$^{th}$, 80$^{th}$, 90$^{th}$, and 95$^{th}$ isopleths, and are shown for each herd in Figures L-1 through L-15. The CHHR is defined as the area contained within the 95$^{th}$ isopleth. Points beyond the 95$^{th}$ isopleth were considered forays and analyzed separately (see Foray Analysis section below). For several reasons, this analysis differs from the procedure used by Clifford et al. (2007) that was referenced (and used as a template) in the DSEIS analysis. The draft analysis used the 100% volume contour calculated by the Home Range Extension (HRE) to estimate the extent of the area used by the whole population. For the Gaussian kernel used by the HRE, however, the actual 100% volume contour is ill defined, extending to infinity in all directions. Accordingly, when a user asks for the 100% contour, the software actually calculates a contour containing close to 100% of the probability density, such as 99.9999%. The actual volume contour calculated when a user requests the 100% contour is undocumented, and has changed between versions of the HRE. The HRE version used in the DSEIS was 0.99, and it had a different internal limit than version 1.1, which was used for the analysis in the FSEIS. A second problem with the approach used in the draft is that home range analyses are not designed to model the distribution of relatively infrequent excursions from the CHHR. With Gaussian kernels in particular, the modeled probability of utilization falls off extremely rapidly with distance from the CHHR, drastically underestimating the probabilities of the occasional long distance forays that are characteristic of bighorn sheep.

Because of these problems, the analysis of bighorn sheep utilization of the landscape was split into two parts. The first part used herd home range analysis to define a core area of habitat usage inside of the 95$^{th}$ volume contour, referred to here as the CHHR. (The analysis for the DSEIS used the 50% to 90% volume contours to define this area of core habitat usage.) The second part was an analysis for the foray behaviors that bighorn sheep exhibit, especially young rams. The probabilities of movements to different distances from the CHHR were empirically derived, rather than being inappropriately extrapolated from the tails of Gaussian kernels used to define the CHHR. The analysis for the DSEIS used the 90–100% volume contour areas to analyze these foray behaviors. The approach used in the current analysis is more appropriate because movements within herd home ranges and foray movements beyond home ranges are two very different types of habitat usage behaviors that need to be handled by two different analyses. While this process differs from the analysis in Clifford et al. (2007), it does allow calculation of the annual rates of contact between bighorn sheep populations and domestic sheep allotments.

While recent telemetry data were available from most Hells Canyon herds and from the Main Salmon/South Fork Herd, telemetry data were not available for the two other herds and the two areas of concern in the Salmon River metapopulation. As a result, modelers used a different method to estimate the extent of CHHRs in the Upper Main Salmon and Big Creek herds, and the Lick Creek and Little Salmon areas of concern.

The CHHR of the Main Salmon/South Fork herd (Figure L-13) shows that most animal movements in the herd are confined to areas near the river at the bottom of the canyon. Because the river canyons of the Salmon River drainage are more similar to one another than to the areas occupied by herds in the Hells Canyon metapopulation, the distribution of the Main Salmon/South Fork Herd's CHHR was taken to be most likely representative of the distribution of the other herds in the Salmon River metapopulation. Accordingly, its average cross-canyon width was measured and determined to be 6.5 km. Next, each observation recorded in those four areas was surrounded by a circular buffer with a diameter of 6.5 km, and the area within these buffers was taken to be the best estimate of the herd's CHHR. Due to a lack of telemetry or other observational data in much of the Salmon River drainage, it is possible that some areas currently occupied by bighorn sheep are not mapped as CHHR by this method.

### 3.1.2 Foray Analysis

Like bighorn sheep elsewhere, Hells Canyon and Salmon River bighorn sheep—particularly rams—make occasional long-distance movements beyond their CHHRs. Singer et al. (2001) called these movements "forays" and defined them as any short-term movement of a radio-collared animal away from and back to its herd's home range. This life history trait can put bighorn sheep at risk of contact with domestic sheep, particularly when suitable habitats are well connected and overlap with domestic sheep use areas (Gross et al. 2000; Singer et al. 2000a), even when domestic sheep use is outside of the CHHR. The risk of contact between dispersing bighorn sheep and domestic sheep is related to the number of bighorn sheep in a herd, the proximity of domestic sheep use areas (allotments) to the bighorn sheep CHHR, the distribution of bighorn sheep source habitats across the landscape, and the frequency and distance of bighorn sheep forays outside of the CHHR.

The foray analysis covers the first three steps in the sequence of events needed for contact with an active allotment and a subsequent disease outbreak to occur, described at the beginning of the Risk of Contact Model section. To reiterate, those steps involved a bighorn sheep (1) leaving the

CHHR, (2) traveling far enough to reach the allotment, and (3) intersecting the allotment (i.e., rather than some other area at the same distance from the CHHR). The foray analysis was used to estimate the per-season (summer or winter) probability that an individual ram or ewe would go on a foray that intersected a given allotment. Separate analyses were carried out for rams and ewes due to the distinct movement patterns exhibited by the two sexes.

All estimates of movement behavior were formed by analyzing the same large telemetry dataset on bighorn sheep movements in Hells Canyon that was used to determine the CHHR of each herd. The dataset consisted of approximately 52,000 point locations from more than 400 animals in 13 herds collected between 1997 and 2008. In the Salmon River system, only 1.5 years of telemetry data for 30 individuals in one herd exist—the Main Salmon/South Fork herd. These data are useful for estimating the herd's CHHR, but are not sufficient to characterize the foray behavior of animals in that herd. As a result, modelers used the much more extensive data collected for the Hells Canyon herds to estimate the likely movement patterns of bighorn sheep in herds throughout the Payette National Forest.

The path taken by a bighorn sheep traveling outside its CHHR might intersect any part of an allotment. Therefore, the analysis began by calculating the probability of intersection in each of 35 "rings" or annuli of 1-km width located between 1 and 35 km from the CHHR boundary. That probability was broken down into three parts, as follows in Equation L-2:

$$\begin{aligned} P(\text{Intersect allotment}_{\text{Ring_k}}) = \; & P(\text{Foray}) \times \\ & P(\text{Animal reaches ring}_{\text{k}} \mid \text{Foray}) \times \\ & P(\text{Intersect allotment} \mid \text{Animal reaches ring}_{\text{k}}) \end{aligned}$$

Where:

ring_k = the ring located k kilometers from the CHHR
P(Foray) = probability of a bighorn sheep leaving the core herd home range
P(Animal reaches ringk | Foray) = probability of a bighorn sheep traveling far enough to reach an allotment
P(Intersect allotment | Animal reaches ringk) = probability of a bighron sheep intersecting an allotment

**Equation L-2. Propability of a bighorn sheep interescting each of the 1-kilometer annuli located between 1 and 35 kilometers from the core herd home range**

The following three sections describe how the probabilities in steps 1–3 were estimated from telemetry data collected from the Hells Canyon herds.

#### 3.1.2.1 Probability of a Foray Movement—P(Foray)

Most bighorn sheep, in most years, never move beyond the CHHR. Table L-5 summarizes the frequency of foray movements by rams and ewes in summer (May–October) and winter (November–April). Modelers calculated the probability of bighorn sheep–domestic sheep contact in summer and winter separately because characteristic movement patterns differ between the seasons (e.g., the rut occurs in November/December and produces relatively frequent and long distance exploratory forays by rams) and the allotments are only permitted to domestic sheep during spring and summer.

For the foray analysis, the key values in Table L-5 are the proportion of animal-years with at least one foray. (Animal-years refer to observations with a unique combination of both animal identification and year: If a single ram was observed in 4 different years and left the CHHR during 1 of those years, it would be said to have made a foray in 1 of 4 animal-years.) In any one summer, 14.1% of rams and 1.5% of ewes typically leave the CHHR at least once. Alternatively, a given ram has a 14.1% probability and a ewe has a 1.5% probability of making a foray. This percentage is the per-season probability of a foray, termed *P*(Foray) and used above in Equation L-2.

**Table L-5. Summary of telemetry observations made outside of the core herd home ranges**

| | Ewes | | Rams | |
|---|---|---|---|---|
| **Summer—May to October** | **Percent of observations (%)** | **Number out of total observations** | **Percent of observations (%)** | **Number out of total observations** |
| Animals located beyond CHHR at least once during period of observation | **6.50** | 14/215 | **28.80** | 30/104 |
| Animal-years with at least one foray | **1.50** | 15/985 | **14.10** | 44/311 |
| Telemetry points outside of CHHR | **0.20** | 29/17,258 | **4.40** | 160/3,674 |
| **Winter—November to April** | | | | |
| Animals located beyond CHHR at least once during period of observation | **12.9** | 28/217 | **34.9** | 38/109 |
| Animal-years with at least one foray | **5.6** | 60/1,062 | **17.8** | 68/380 |
| Telemetry points outside of CHHR | **0.8** | 109/12,941 | **3.7** | 156/4,200 |

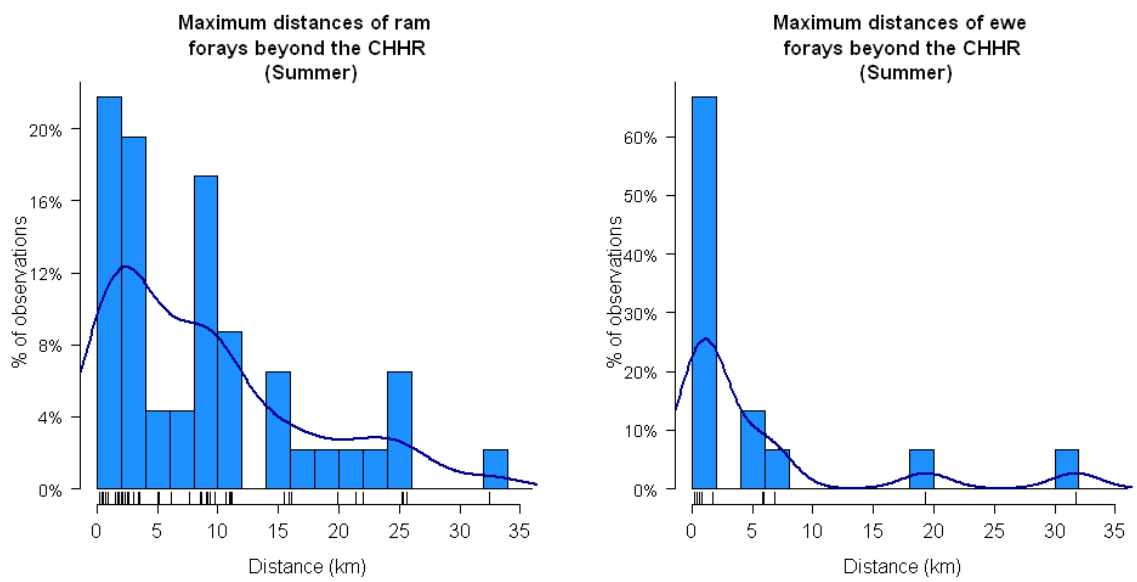
In some of the Hells Canyon herds (Big Canyon, McGraw, Muir, Myers, and Quartz Creek), telemetry data were collected the first year after the initial release. One concern in extrapolating from data collected in Hells Canyon herds to foray behavior in the Salmon River herds is that recently translocated animals may have a higher propensity to move outside of their mapped CHHR. If so, their behavior may be inappropriate as a model for movements made by animals in the endemic populations of the Salmon River metapopulation. Rams from the Big Canyon and McGraw herds did show relatively high numbers of foray movements (with forays occurring in 12 of 24, and 5 of 11 animal years, respectively), while the Myers and Quartz Creek herds had lower rates of foray movements (2 of 14, and 1 of 13 animals). Among "resident herds" (i.e., herds that had been resident in Hells Canyon for a decade or more before telemetry observation began), the rate of forays ranged from 1 out of 46 animal-years (Redbird Herd) to 12 of 49 animal years (Wenaha Herd). Four of the seven resident herds (Imnaha, Mountain View, Sheep Mountain, and Wenaha herds) exhibited a rate of foray movements greater than the value of 14.1% that was used in the foray analysis, which does not appear to be a gross overestimate of the actual value. On balance, a decision was made to include telemetry data from all of the herds.

### 3.1.2.2 Distance from Core Herd Home Range Travelled on Typical Forays—*P*(Animal reaches ring$_k$ | Foray)

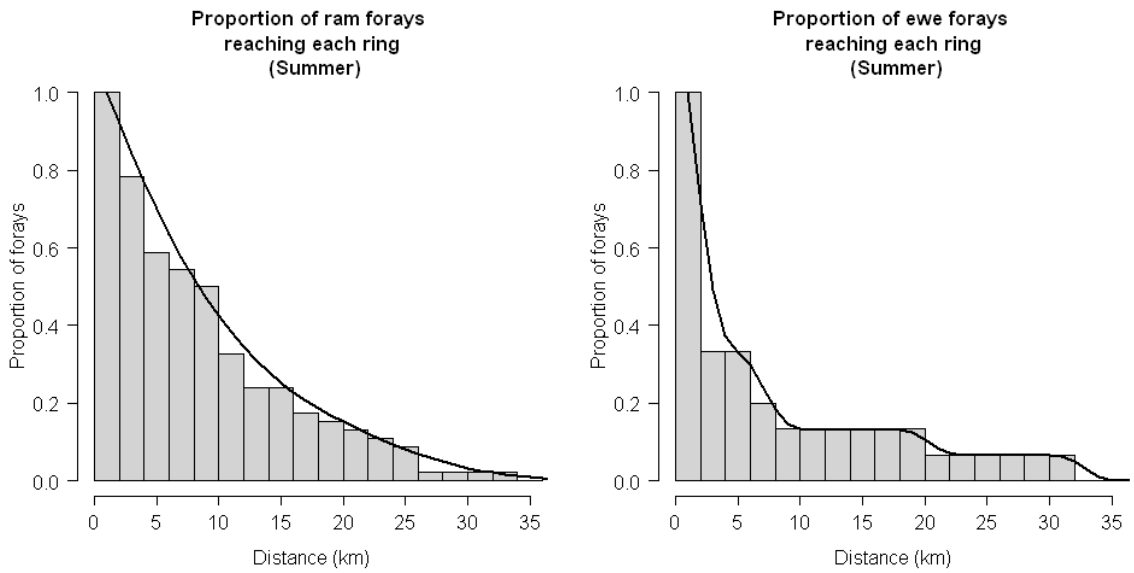
Many animals—particularly ewes—may not travel far, even if they are observed outside of the CHHR. The probability that a bighorn sheep on a foray will reach an allotment decreases as distance increases. To characterize that decreasing probability, modelers first extracted from each foray the maximum distance from the CHHR at which a ram or ewe was observed (Figures L-16a and L-16b). One bighorn sheep (a ram) was observed during the summer nearly 35 km from its CHHR, so the distributions extend out to that distance.

An animal located 25 km from the CHHR has crossed each ring between itself and the CHHR. Likewise, 100% of the animals that make a foray intersect at least the first ring around the CHHR. More generally, the proportion of animals whose forays intersect each ring is equal to the proportion known to have reached it or one of the rings beyond it. That distribution is shown in Figure L-17a, along with a smooth curve fitted to it. The figure shows that fully half of the rams who leave the CHHR travel at least 10 km from it; nearly a quarter get to 16 km, but just one ram has been observed (in summer) more than 26 km away. Modelers used the distributions in Figures L-17a and L-17b to calculate the probability that a ram or ewe on a foray will reach any given ring surrounding its CHHR, *P*(Animal reaches ring$_k$ | Foray) in Equation L-2.

Figures L-16a and L-16b display the observed maximum distances of ram and ewe forays outside of CHHRs (95% isopleth) and Figures L-17a and L-17b display the proportion of rams and ewes with forays reaching each of the rings between 0 and 35 km from CHHR areas.




**Figures L-16a and L-16b. Maximum distances of ram and ewe summer forays beyond the core herd home range.**




**Figures L-17a and L-17b. Proportion of ram and ewe summer forays that reach each ring**

The foray analysis most likely underestimates the true frequency of longer-distance forays because the vast majority of the telemetry data is from standard VHF (very-high frequency) collars rather than from GPS collars, which collect and store or transmit data from everywhere an animal travels. With VHF collars, locations are determined by triangulation from a plane or boat travelling a route every few days or weeks through the areas in which the bighorn sheep of a herd are usually seen. The farther a bighorn sheep has travelled from its CHHR, the farther it is likely to be from the observers, and the less likely it is to be detected. There are in fact several examples of telemetry data where rams last observed on a foray have "disappeared" for a couple of months before reappearing, likely from a journey that carried them beyond the range of detection of the survey.

For bighorn sheep moving through forested areas, detection may also be hampered by line-of-sight and signal bounce issues. Finally, even when an animal on foray is detected in every survey, the large interval between observations means that it is unlikely to be observed at the furthest extent of its foray. The extent to which these forms of sampling bias underestimate the frequency of long-distance movements in the foray analysis is unknown.

Despite these biases, both the observed frequency and distances of foray movements by Hells Canyon bighorn sheep are consistent with other reports in literature. Singer et al. (2001) calculated annual foray rates of bighorn sheep in 10 published studies. In those herds, the annual number of forays per radio-collared animal of either sex ranged from 0 to 0.23 (mean 0.10, standard deviation 0.09), comparable to 14% of rams and 1.5% of ewes making summer forays from herds in the Hells Canyon metapopulation.

In southwestern Alberta, Festa-Bianchet (1986) relocated rams as far as 48 km from the site of their capture. A recent 17-month study of three bighorn herds in Montana, (DeCesare et al. 2006) found relatively long (19- to 33-km) movements by four of five radiocollared males. Finally, Singer et al. (2000b) followed 31 translocated populations of bighorn, and documented numerous colonizations of nearby patches of habitat. In that study, the probability of colonization (75%)

was highest for patches located 12.3 km from a bighorn sheep population, indicating that such movements occur with relatively high frequency. This parallels our finding that nearly 25% of forays by Hells Canyon bighorn sheep reach a distance of at least 15 km from the CHHR.

#### 3.1.2.3 Habitat Selection within a Ring—*P*(Intersect allotment | Animal reaches $ring_k$)

Given that an animal has reached a ring, the probability that an animal will be in an allotment is proportional to the size of the allotment relative to the ring and the quality of the habitat in the allotment relative to that in the ring. Calculating the size of the allotment relative to the ring is simple, but determining the quality of the habitat in the allotment relative to that in the ring requires knowing the habitat preference of bighorn sheep. Modelers represented that preference by calculating a resource selection function, defined as a function that is proportional to the probability of its use by an organism (Manley et al. 1993; Boyce et al. 2002).

Based on the source habitat model, all areas within 35 km of the CHHRs were assigned to one of three habitat classes—source habitat, connectivity area, and non-habitat. Source habitats are areas fitting the criteria described in the Source Habitat Model section above. Connectivity areas do not meet those criteria, but are either located within 350 m of source habitat or between two mapped patches of source habitat that are separated by 1,050 m or less. Areas of non-habitat do not meet those criteria and are located more than 350 m from source habitat. Connectivity areas were distinguished from non-habitat because even when bighorn sheep are found outside of areas mapped as source habitat, they are usually not far from it. Of the 3,177 observations of bighorn sheep located outside of source habitat, all but 80 have been within 350 m of source habitat.

Next, the relative preference of bighorn sheep for these three classes of habitat was calculated using a resource selection function (Manley et al. 1993, Boyce et al. 2002).Modelers constructed the resource selection function using a use/availability approach and expressed the relative preference for connectivity areas and non-habitat relative to the preference for source habitat using Equation L-3:

$$\mathrm{Pref}_h = \frac{\mathrm{Use}_h / \mathrm{Area}_h}{\mathrm{Use}_{source_hab} / \mathrm{Area}_{source_hab}}$$

Where:

$Use_h$ = the number of telemetry points found in habitat type $h$;
$Area_h$ = the area of habitat type $h$ available to the bighorn sheep; and
$h$ = one of source habitat, connective area, or non-habitat.

**Equation L-3. Relative preference for connectivity areas and non-habitat relative to the preference for source habitat**

The resource selection function yields high values for habitat classes with many observations of bighorn sheep relative to their area. If the animals in a herd have equal areas of Habitat A and Habitat B available, but spend 90% of their time in Habitat A, their preference for Habitat A would be 9 times their preference for Habitat B.

To investigate whether habitat preferences differ between animals within the CHHR and those on forays outside of it, modelers calculated habitat preferences exhibited in three different areas:

within the CHHR, in the rings between 1 and 10 km from the CHHR, and in the rings between 11 and 35 km from the CHHR (Figure L-18). The results indicate that while on forays (i.e., in rings 1–35) bighorn sheep are more likely to spend time outside of mapped source habitat than they are while within the CHHR.

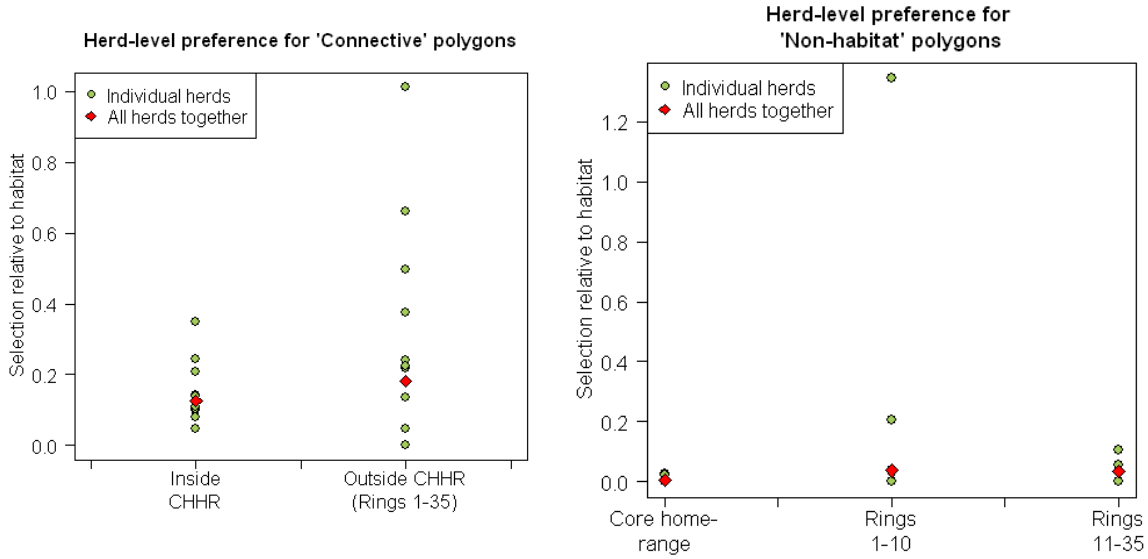



**Figure L-18. Observed herd-level preferences for connectivity area and non-habitat, relative to source habitat.**

Based on the findings, modelers used the habitat selection preferences observed for animals in rings 1–35 to model the behavior of bighorn sheep in the foray analysis. While on forays, bighorn sheep in the Hells Canyon herds prefer source habitat to connectivity areas and prefer both source habitat and connectivity areas to non-habitat. Relative to a preference of 1.00 for source habitat, bighorn sheep showed a preference of 0.177 for connectivity areas and a preference of 0.029 for non-habitat. In other words, within the 35-km-wide ring surrounding a CHHR, bighorn sheep were 5.6 times more likely to be found in a given square-kilometer of source habitat than in a square-kilometer of connectivity area, and 35 times more likely to be found in source habitat than in non-habitat.

Next, modelers used the preferences and distribution of habitat within each ring surrounding a CHHR to calculate the probability that a bighorn sheep that reaches a ring would intersect the ring in an allotment using Equation L-4:

$$P(\text{Intersect allotment}_{\text{Ring_k}} \mid \text{Animal reaches ring k}) = \frac{\sum_{h} (\text{Area}_{h} \text{ in allotments w/in ring k}) \times (\text{Pref}_{h})}{\sum_{h} (\text{Area}_{h} \text{ in ring k}) \times (\text{Pref}_{h})}$$

Where:

$\text{Ring}_k$ = the ring *k* kilometers from the CHHR
$\text{Area}_h$ = the area of habitat $\text{type}_h$ in that ring

**Equation L-4. Probability that a bighorn sheep that reaches a ring will intersect an allotment in that ring.**

Equation L-4 implies that in a ring of homogeneous habitat, the probability of intersecting an allotment is simply proportional to the allotment's size. If, on the other hand, the habitat composition of the allotment is less (or more) favorable to bighorns than the composition of the ring as a whole, bighorns will be correspondingly less (or more) likely to intersect the allotment.

Finally, modelers used Equation L-4 to complete the calculation of Equation L-2 for each of the 35 rings surrounding the CHHR. Equation L-2 expresses the annual probability that a bighorn sheep will go on a foray, reach a ring at a given distance from the CHHR, and intersect that ring within an active allotment.

Going from the probability of intersecting with individual rings to the overall probability of intersection is complicated by the fact that ring-level probabilities are not independent (i.e., a bighorn whose foray intersects a large allotment in ring 17 is also likely to have intersected parts of the allotment lying in rings 16 or 15 on the same foray). As a result, the ring level probabilities cannot simply be added together to determine the overall risk. Although the approach is somewhat conservative (underestimating the probability of intersection), the modelers took the overall probability of intersection with an allotment to be the maximum value found for any one of the rings as shown in Equation L-5:

$$P(\text{Intersect allotment}) = \max_{k} P(\text{Intersect allotment}_{\text{Ring_k}})$$

**Equation L-5. Probability of a bighorn sheep on a foray intersecting an allotment**

A sample foray probability map is shown in Figure L-19.

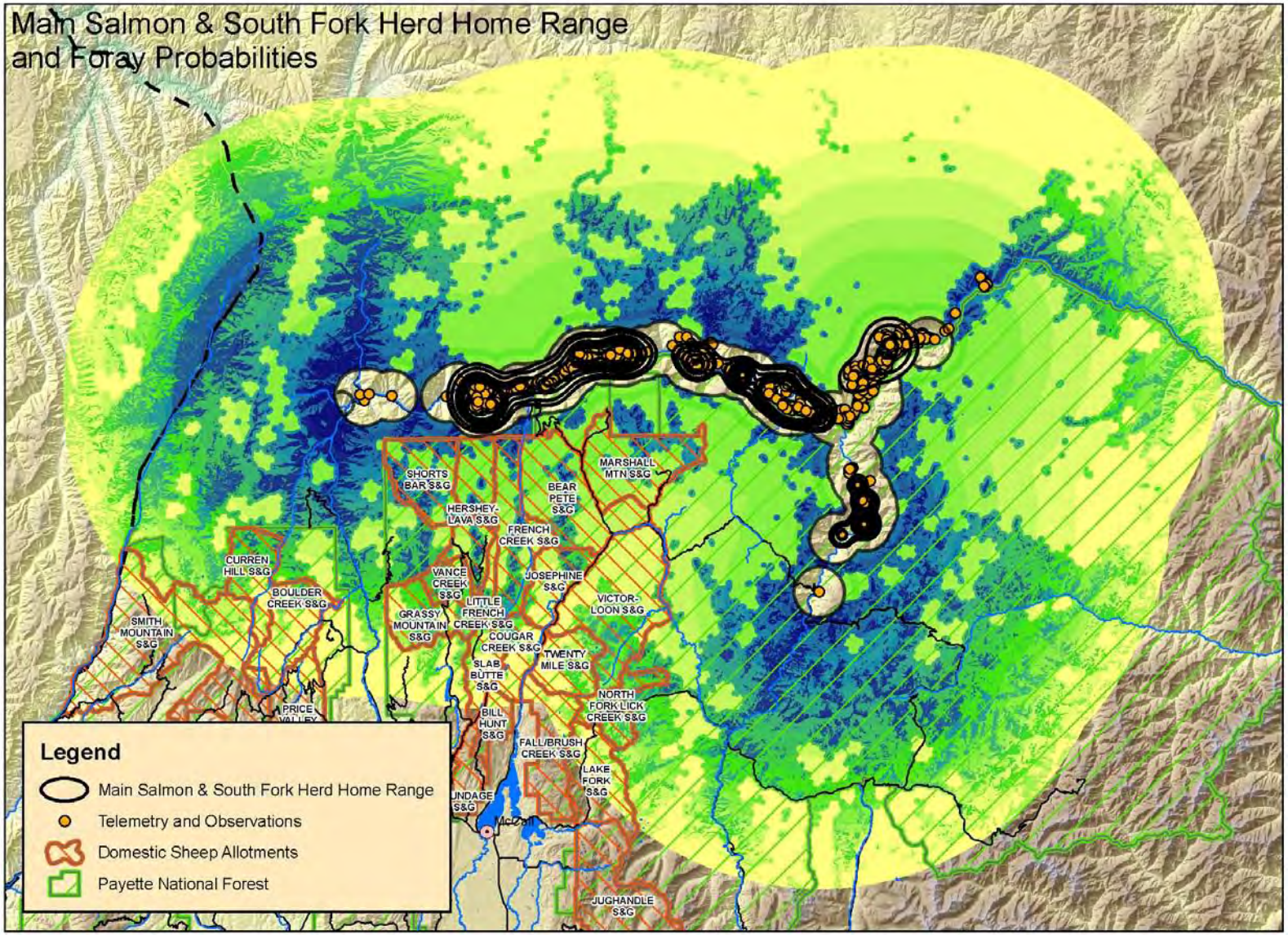



**Figure L-19. Map foray probability for the Main Salmon/South Fork Herd**

### *3.1.3 Probability of Contact with another Bighorn Herd*

Following infection of one herd in a metapopulation of bighorn sheep, respiratory disease has often been observed to spread between herds (Onderka and Wishart 1984; Cassirer et al. 1996; George et al. 2008). In the disease model, the probability of disease transmission from contact with infected bighorn sheep herds was calculated in much the same way as the probability of disease transmission from domestic sheep. For pairs of herds with overlapping home ranges, the probability of cohabitation was set at 100%; for all other herd pairs, the annual probability of cohabitation was given by the probability of a foray occurring from one herd to the other as described above. Given that cohabitation occurred, the probability of disease transmission and a subsequent outbreak of disease was set at 75%.

# 4.0 DISEASE MODEL

Modeling population dynamics of large herbivores at the individual level requires estimating numerous parameters, from adult and juvenile survival rates to age at sexual maturity, fecundity, and lamb survival (Gaillard et al. 2000). In addition, the average values for each of those life-history parameters may be modified by interacting impacts of density dependence, weather, forage availability, and predation. Properly estimating these parameters would require extensive age- and class-specific population data, ideally from the populations being modeled.

Accurate individual-level modeling of the impacts of disease events is even more difficult since the dynamics of respiratory disease in the wild are only partly known. An individual-based model would require understanding many factors, such as the incubation period and active infection durations, probability and rate of recovery from disease, rate of effective contact between individuals within the herd, and possible role of persistently infected individuals in harboring and spreading the disease. Variations in the resistance to disease of individual bighorn sheep and in the virulence of the disease-causing organisms themselves can also affect population dynamics.

Rather than attempting to create a complicated individual-based model that incorporated all of the parameters above, researchers built a population dynamics model using a “top-down” approach in which population size was the primary state variable. A simpler model may appear to have limited accuracy or realism but actually has several advantages for estimating the variables of greatest interest—projections of population size, volatility, and persistence. First, a simpler model requires estimating fewer and more easily estimated parameters. Population size is easier to estimate than individual mortality and fecundity rates that affect it. Likewise, the population-level impacts of respiratory disease outbreaks are better understood than the details of bacterial shedding, within-herd effective contact rates, and individual variation in disease susceptibility that determine the course of individual epidemics. A second important advantage of “top-down” models is that they have fewer moving and interacting parts and so are more interpretable, transparent, and accessible to scrutiny.

## 4.1 Model Organization

Researchers constructed a disease model with three components. The first component modeled the probability that an animal that was determined by the foray analysis to have reached an occupied allotment would subsequently contract respiratory disease and initiate an outbreak in its home herd. The second component modeled population growth in a healthy herd. Annual

population growth in the disease model depends on the current disease status of the herd (disease-free or infected), current population size, and an estimate of the maximum sustainable herd size for each herd. In the absence of disease, herd numbers increase (unless they have fewer than 30 individuals). The third component modeled the magnitude and duration of impacts caused by an outbreak of respiratory disease in a bighorn herd. In the first year of a disease outbreak, herds suffer an all-age die-off, followed by a variable number of years of depressed lamb recruitment. Eventually, herds that survive are considered to be fully recovered from (although still susceptible to further outbreaks of) the disease outbreak.

Figures al-20 and L-21 provide an overview of the disease model structure. Figure L-30 illustrates the first step of the annual cycle in which the disease status of each herd is determined. Figure L-21 illustrates the consequences of current herd size and disease status on next year's population size.

**Figure L-20. Disease transmission and recovery sub-model**

1) Does the herd harbor an ongoing infection?

- **YES →** go to the Population Dynamics Sub-Model
- **NO →** go to the next step

2) Does the herd contract respiratory disease this year? (Use the risk model to determine the probability of disease transmission into the herd from contact with either domestic sheep or infected bighorn sheep.)

- **YES →** determine the number of years that the herd will suffer from depressed recruitment, and go to the Population Dynamics Sub-model
- **NO →** go to the Population Dynamics Sub-model

**Figure L-21. Population dynamics sub-model**

1) Is the population size less than the minimum viable population size (30 animals)?

- **YES →** the population declines by 16 percent
- **NO →** go to the next step

2) Is the population free of respiratory disease?

- **YES →** the population grows by an amount determined by the logistic growth equation
- **NO →** go to the next step

3) Was the population just infected this year?

- **YES →** the population experiences an all-age die-off
- **NO →** the population experiences increased mortality of juvenile bighorns

### 4.1.1 Probability of Effective Contact and Subsequent Herd-level Die-off Given Co-habitation of Bighorn Sheep and Domestic Sheep in an Allotment

Although organisms that cause respiratory disease may be endemic in some bighorn sheep herds (Hobbs and Miller 1992), the current model is designed to assess the impact of disease transmitted from domestic sheep, so all outbreaks ultimately originate from contact with domestic sheep. The foray analysis estimates the probability that a bighorn sheep will reach an allotment occupied by domestic sheep (cohabitation), but it does not address the probability of the additional steps needed for an outbreak to occur. Once a bighorn sheep reaches an occupied allotment, the bighorn sheep must (4) come into contact with domestic sheep in the allotment and (5) contract the disease from the domestic sheep. Finally, for an outbreak to affect the animal's home herd, the infected bighorn sheep must (6) make its way back to the CHHR and (7) transmit the disease to other members of the herd (steps 4 through 7 from the Risk of Contact section).

Assumptions governing the probability that a bighorn sheep that reaches an occupied allotment will contract disease from the domestic sheep are problematic. For a similar model applied to populations of endangered Sierra Nevada bighorn sheep (Clifford et al. 2009), researchers assumed that any cohabitation with domestic sheep was equivalent to contact between the two species, citing the attraction of bighorn sheep (particularly rams) to domestic sheep and past observations of stray domestic sheep associating with bighorn sheep. They estimated that the subsequent probability of disease transmission (effective contact) given such physical contact was between 50% and 100%, based on numerous pen studies that have shown that nearly 100% of bighorn sheep co-housed with apparently healthy domestic sheep develop respiratory disease (e.g., Onderka and Wishart 1988, Foreyt 1989, Foreyt 1990, Lawrence et al. Forthcoming). Less information is available about the probability that a diseased animal will return to its CHHR and initiate an outbreak.

Together, the four steps described above determine the overall probability of an outbreak happening given that an individual bighorn sheep, whose movements were modeled by the foray analysis, reaches an open allotment. Because so much uncertainty surrounding this parameter exists, and essentially no research exists that would allow its estimation, the disease model was run with a range of probabilities of effective contact (a contact resulting in a disease transmission) and a subsequent herd-level outbreak, given cohabitation of a bighorn sheep and domestic sheep in an open allotment. The values used were 5%, 10%, 25%, 50%, 75%, and 100%.

Each individual in a herd has the potential to make a foray that will bring disease back from a contact with domestic sheep. The annual probability that any individual animal will make a foray that results in disease transmission is the product of steps 1–3 (given in Equation L-5) and the probabilities of steps 4–7 (described above). Expressed as an equation (Equation L-6), the composite probability is as follows:

$$P(\text{Outbreak})_{\text{individual}} = P(\text{Outbreak} \mid \text{Intersect allotment}) \bullet P(\text{Intersect allotment})$$

**Equation L-6. Probability that a bighorn sheep on a foray will lead to an outbreak of disease in its herd**

Equation L-6 is used to calculate two individual-level probabilities for each herd—one for ewes ($P(\text{Outbreak})_{\text{ewe}}$) and one for rams ($P(\text{Outbreak})_{\text{ram}}$). The annual probability that a herd will experience a die-off due to contact by one of its members with sheep in an active allotment depends on these two probabilities and also on the number of ewes and rams in the herd. The herd-level probability of contact is given by Equation L-7:

$$P(\text{Outbreak})_{\text{herd}} = 1 - (1 - P(\text{Outbreak})_{\text{ewe}})^{\#\text{ewes}}) \bullet (1 - P(\text{Outbreak})_{\text{ram}})^{\#\text{rams}})$$

**Equation L-7. The annual probability that a herd will experience an outbreak due to contact with and allotment**

### 4.1.2 Population Growth in a Healthy Herd: Density Dependence and the Logistic Growth Model

Bighorn sheep populations, like those of other large herbivores, are subject to density-dependent population growth regulation (Monello et al. 2001; Bonenfant et al. 2009). Even in the absence of disease, a population of bighorn sheep will not grow without bound; as the number of animals in an area increases, the rate of further growth eventually begins to slow. The dynamics by which that slowing occurs can be complicated and are not completely understood. Jorgenson et al. (1997) and Portier et al. (1998) analyzed a long-term mark–recapture study of two populations of Rocky Mountain bighorn sheep in Alberta, Canada, for evidence of density dependence. They found the main demographic response to large population size was a decrease in lamb survivorship. Yearling ewes also suffered some mortality increases when populations were high. Other researchers have also detected a decrease in the rate of recruitment with increasing density (with relatively little response in adult survival) (McCarty and Miller 1998), a pattern that is characteristic of many large ungulates (Gaillard et al. 1998, Bonenfant et al. 2009).

To incorporate density dependence into the disease model, researchers used the logistic equation, a common ecological model of population growth (Gotelli 2008). In the logistic growth model, the maximum per capita growth rate ($r$, with units of new individuals per individual per year) is only achieved when the population size is quite small. As the population increases toward its maximum sustainable size ($K$), the number of surviving offspring per female steadily decreases and the rate of population growth slows. The logistic growth model is defined in Equation L-8:

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right)$$

Where:

$dN/dt$ = yearly change in population size
N = current herd size
r = maximum herd growth rate
K = maximum sustainable population.

**Equation L-8. Logistic growth model for the rate of population increase in a healthy herd**

$K$ is usually known as the "carrying capacity;" in this model it is referred to as the "interim herd level" (IHL) to emphasize that it should not be interpreted as either a goal or a limit to the number of bighorn sheep that might be supported by any given herd.

The following three sections describe how modelers estimated the values of $N$, $r$, and $K$ that were used by the disease model.

#### 4.1.2.1 Estimating *N*—Current Herd Size

Population estimates for the 15 herds (Table L-6) were taken from survey data collected by the IDFG, ODFG, Washington Department of Fish and Wildlife (WDFW), and SRBSP (administered by the Nez Perce Tribe) (Table L-6). For each herd, we used data from the most recent survey available. Estimates of current herd sizes ranged from 10 to 210 and totaled 1,148 for all 15 herds.

One "area of concern," Little Salmon, was not treated as a fully independent population in our model. The Little Salmon has not been regularly surveyed for the presence of bighorn sheep, so a population estimate of four animals in the Little Salmon drainage was made on the basis of incidental observations of bighorn sheep within the last 3 years (Figure L-22 and Table L-6). In the disease model, the Little Salmon area of concern is linked to and effectively treated as a satellite population of the Main Salmon/South Fork Herd. Its CHHR extends 3.25 km around each known observation, and like any other bighorn sheep in the model, each animal in the Little Salmon has a fixed probability of making a foray in any given year. If an outbreak occurs in the Little Salmon, it is spread to the Main Salmon/South Fork Herd, and vice versa. Finally, in the model, the population size of the Little Salmon is tied to that of the Main Salmon/South Fork Herd, with the number in the Little Salmon staying in a constant proportion to the number in the Main Salmon/South Fork Herd. One consequence of this is that when the population of the Main Salmon/South Fork Herd is extirpated in the model, so are the animals in the Little Salmon area of concern.

The proportion of rams and ewes in each herd was determined by analyzing demographic data collected by the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife. In 200 herd-years of data collected from six herds in Oregon (Muir, Sheep Mountain, Wenaha, Fox Creek, Imnaha, and Lostine), an average of 35.4% of adults were rams. In 141 herd-years of data collected from five herds in Washington (Asotin, Black Butte, Mountain View, Tucannon, and Wenaha), an average of 35.2% of adult animals were rams. In both states, the ram-to-ewe ratio varied from year to year, but the average ratios were consistent among herds. The values calculated here are consistent with those reported by in the Hells Canyon Bighorn Sheep Restoration Plan (Hells Canyon Initiative, 1997), which found an average ram:ewe ratio of 52:100 (i.e. 34% rams) in twelve herds. Accordingly, in both the disease and foray models, the percentage of rams among adult animals was set at 35%.

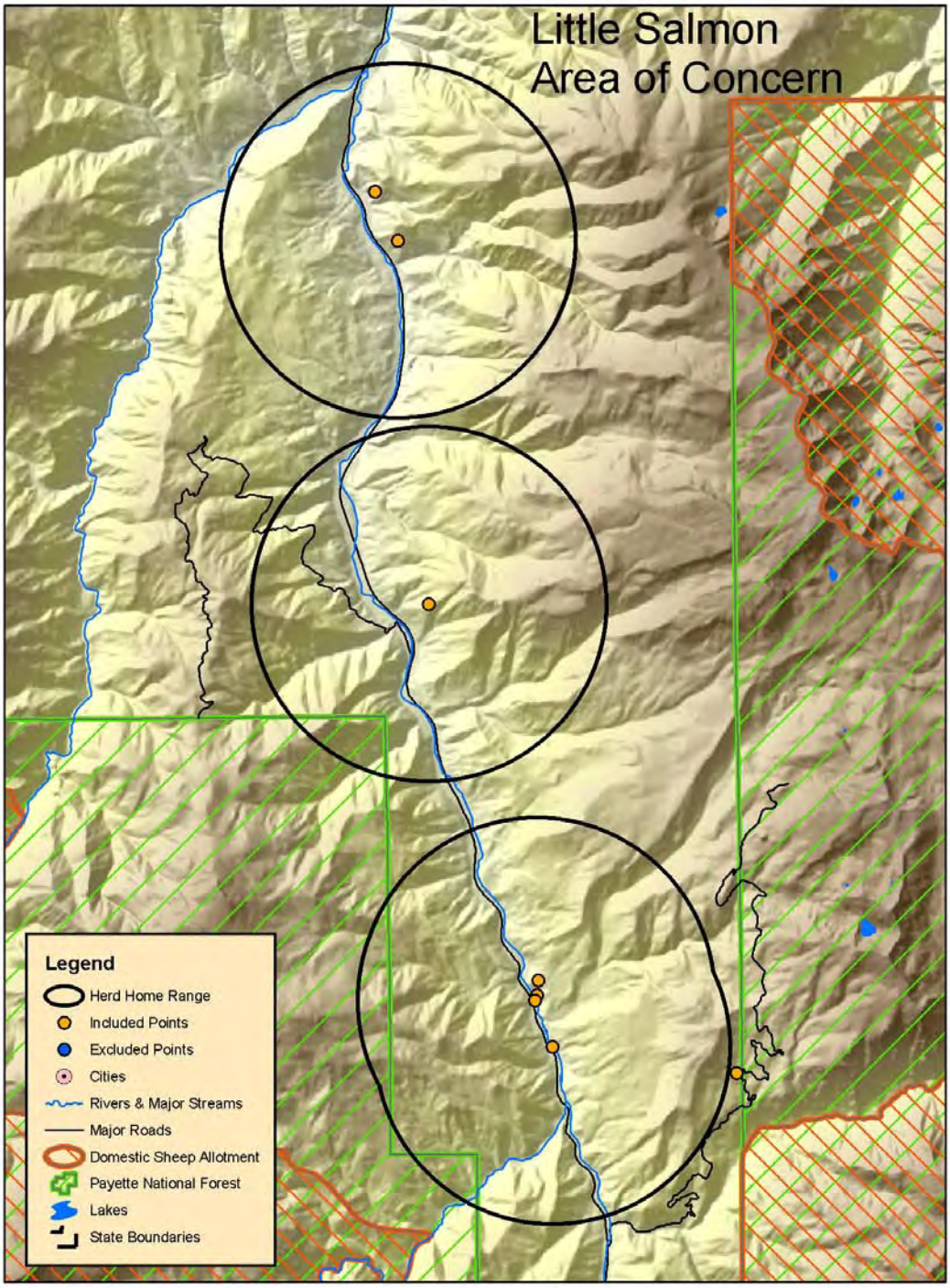



**Figure L-22. Little Salmon Area of Concern**

**Table L-6. Population estimates and interim herd levels (IHLs) for 15 Herds and 1 area of concern from survey data collected by the Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Game (ODFG), Washington Department of Fish and Wildlife (WDFW), and Salmon River Bighorn Sheep Project (SRBSP)**

| Herd | Estimated Population (*N*) | Date of Estimate | Data Source | IHL (*K*) |
|---|---|---|---|---|
| **Hells Canyon** | | | | |
| Asotin | 84 | 2009 | WDFW | 172 |
| Big Canyon | 20 | 2008 | IDFG | 96 |
| Black Butte | 47 | 2009 | WDFW | 461 |
| Imnaha | 135 | 2008 | ODFW | 407 |
| Lostine | 65 | 2008 | ODFW | 110 |
| Mountain View | 13 | 2009 | WDFW | 178 |
| Muir Creek | 30 | 2008 | ODFW | 86 |
| Myers Creek | 10 | 2008 | IDFG | 34 |
| Redbird | 115 | 2008 | IDFG | 322 |
| Sheep Mountain | 11 | 2008 | ODFW | 187 |
| Upper Hells Canyon | 45 | 2009 | IDFG | 279 |
| Wenaha | 90 | 2008 | ODFW | 279 |
| **Salmon River** | | | | |
| Big Creek | 186 | 2006 | IDFG | 479 |
| Main Salmon/South Fork | 210 | 2009 | SRBSP | 413 |
| Upper Salmon | 87 | 2006–07 | IDFG | 975 |
| **Area of Concern** | | | | |
| Little Salmon | 4 | 2007–09 | Various | NA |

#### 4.1.2.2 Estimating *r*—Maximum Herd Growth Rate

Estimates of the maximum growth rate *r* (also known as the intrinsic or exponential growth rate) were taken from published literature. McCarty and Miller (1998) estimated *r* for 16 translocated populations of Rocky Mountain bighorn sheep in Colorado. They based their estimates on herd growth rates observed during the first few years after successful translocations, applying a correction to account for the skewed sex ratio of the translocated animals. Maximum growth rates for the 16 herds ranged between 0.051 and 0.26 (i.e., 5–26% annual increase in population size). In the disease model, a maximum growth rate for each herd was sampled from a normal distribution (mean = 0.136, standard deviation = 0.057) fitted to the estimates of McCarty and Miller (1998).

#### 4.1.2.3 Estimating *K*—Interim Herd Level

Although historical reports indicate that bighorn sheep were once very abundant in Hells Canyon (Bailey 1936), we do not have accurate estimates of the current maximum potential population sizes of the herds found on or near the Payette National Forest. Even when studies are carried out to measure the actual carrying capacity of a population, directly measuring it in the field can be difficult or even impossible (Coulson et al. 2008); in any case, such studies have not been conducted for bighorn sheep in our area.

However, some form of density dependence needs to be introduced to simulate likely future herd dynamics, which means some estimate of *K* needed to be included in the logistic growth model. Modelers named *K* the IHL to emphasize that the number should not be construed as a Forest Service management goal or a strong estimate of actual carrying capacity of the herd home ranges.

In the absence of better information, modelers estimated IHL on the past maximum number of animals observed for each herd. For the Salmon River herds, IHLs were estimated to be 175% of the highest population estimate from the past 30 years. For Hells Canyon herds, IHLs were estimated to be 175% of the highest population estimate from the past 40 years.

#### 4.1.2.4 Nonviable herd numbers

The minimum population size, referred to as the nonviable herd number (NVN), is the threshold below which a population will not continue to grow at a disease-free rate and will, in fact, decline. The model used 30 individuals as the NVN for all herds except Big Canyon, Muir Creek, and Myers Creek—because these herds overlap, they were treated as a single herd with a combined NVN of 30.

Theory and observation have shown that extinction becomes more likely for populations that fall below some threshold of small size (Traill et al. 2010). Small populations become increasingly vulnerable to fluctuations driven by environmental and demographic stochasticity (Melbourne and Hastings 2008), single catastrophic events, and the deleterious effects of inbreeding (O'Grady et al. 2006). In bighorn sheep there is also some evidence that individuals in small groups (less than 10 individuals) need to spend more time on the look-out for predators, and as a consequence may forage less efficiently (Risenhoover and Bailey 1985; Berger and Cunningham 1988) than larger groups.

The existence of clear thresholds or minimum viable population sizes in bighorn sheep has been a matter of contention. Berger (Berger 1990) analyzed 122 bighorn sheep populations in California, Colorado, Nevada, and New Mexico and found that 100% of populations that fell below 50 animals went extinct within 50 years. Subsequently, other biologists (Krausman et al. 1993, Wehausen 1999) analyzed additional populations and noted that extinction of herds dropping below 50 animals, while quite likely, is not inevitable. Berger (Berger 1999) and (McCarty and Miller 1998) argued that, thanks to modern management recommendations and practices (including separation of bighorn and domestic sheep), small populations are now more likely to survive than they were in the past.

Singer et al. (2000a) examined 100 translocations of bighorn sheep and found only one population that fell below 30 animals ever later grew above that number. Based on that finding, Singer et al. (2001) defined quasi-extirpation as a decline of a bighorn sheep population below 30 animals, a size from which they deemed population recovery unlikely.

Other researchers have proposed different minimum sizes necessary for persistence. Based on genetic considerations, Singer and Gudorf (1999) recommended against attempting reintroduction to sites capable of supporting fewer than 100–125 animals, for which they argued that the probability of persistence was low. In their population model, Clifford et al. (2009) defined quasi-extinction as ensuing when the number of ewes in a population dropped below five. They cited the high likelihood that such small populations would be driven to extinction by

a single stochastic event, as well as evidence mentioned above, that small groups forage less efficiently (Berger 1978).

While there is no single threshold below which extinction of a herd is absolutely inevitable, it seems clear that as populations of bighorn sheep decline below 50 animals, they become increasingly vulnerable to extinction. In the present disease model, following Singer et al. (2001), a minimum population size, referred to as the NVN was set at 30 animals. The NVN is the threshold below which a population will not continue to grow at a disease-free rate and will, in fact, decline to eventual extinction. Because, in reality, extinction of herds with fewer than 30 animals is only likely, rather than certain, herds in the model that drop below 30 animals are referred to in this document as having suffered "quasi-extirpation" or "quasi-extinction". The NVN of 30 individuals applied to all herds except Big Canyon, Muir Creek, and Myers Creek—because these herds overlap, they were treated as a single herd with a combined NVN of 30.

#### 4.1.2.5 Population impacts of disease

Disease-caused declines in bighorn sheep populations typically consist of an initial all-age die-off event followed by several years of low lamb survival. Ewes that survive the initial die-off may give birth, but after a period of weeks to months, their lambs develop pneumonia and die. The disease model includes both of these impacts of disease outbreaks; in the first year, infected herds suffer an all-age die-off followed by several years of slower decline due to elevated lamb mortality. The following sections describe how the population impacts of both types of disease-related mortality were modeled.

#### 4.1.2.6 Initial All-age Die-off

Disease outbreak impact was measured as the product of the herd size and proportion of impact. This parameter was estimated using data from documented outbreaks in the Hells Canyon area. In 1983, an outbreak of pneumonia killed 60% of the animals in the Granite–Three Creeks area of Idaho (HCBSRC 1997). An outbreak of pneumonia in the Lostine Herd in 1986–87 killed 66% of the herd (Coggins 1988). A 1995–96 outbreak affected several herds, with herd-level mortality amounting to 33%, 50%, 65%, 69%, and 75% (Cassirer et al. 1996). The lowest mortality rate (33%) occurred in the smallest herd (Upper Joseph Creek, with 30 animals); the highest mortality rate (75%) occurred in the largest herd (Black Butte, with 220 animals). In 1999, a disease outbreak resulted in the death of 59% of the McGraw Herd and 53% of the Sheep Mountain Herd in the first year, followed by subsequent declines in both herds and eventual extirpation of the McGraw Herd. In the model, herd-level mortality during the first year of an outbreak was sampled from the distribution of values observed in the previous Hells Canyon outbreaks described above, with an equal probability of mortality of 33%, 50%, 53%, 55%, 65%, 66%, 69%, and 75%.

#### 4.1.2.7 Chronic Lamb Mortality

The significant impact of the all-age die-off that occurs during the first year of an epidemic is compounded by pneumonia and septicemia in young lambs that frequently suppresses recruitment for several additional years (Cassirer et al. 2001, Miller 2001, George et al. 2008). The duration of this chronic mortality of lambs is variable, but in almost all cases lasts for at

least 2 years[2]. In some cases, poor lamb recruitment has continued for as long as 8 years (Enk et al. 2001) or 9 years (George et al. 2008) post-outbreak. Several Hells Canyon herds have had poor lamb recruitment for 6 or more years (Wenaha, Muir Creek, Upper Hells Canyon, and Sheep Mountain); in the Sheep Mountain Herd, lamb survival has still not recovered 10 years after a 1999 disease outbreak. In the disease model, herds affected by disease suffer poor lamb recruitment for between 2 and 10 years following the all-age die-off with the duration randomly selected.

The adult survival rate for healthy populations of bighorn sheep (i.e., the percentage of adults surviving from one year to the next) is around 90% (Jorgenson et al. 1997). Therefore, in the complete absence of recruitment, populations will decline an average of 10% per year. In herds with depressed recruitment, the percentage of ewes with surviving lambs ranges from 0% to 25%, which translates to an annual population change of between –10% and 2.5%. Therefore, for modeled herds suffering from disease-related lamb mortality, the annual population change was randomly selected from between –10% and 2.5%.

#### 4.1.2.8 Extended Infectious Duration

When a simulated herd becomes infected, animals in the herd remain infectious for a variable length of time, generally more than 1 year. The duration of infectiousness ranges from 1 to 4 years and follows a uniform distribution.

### *4.1.3 Model Implementation*

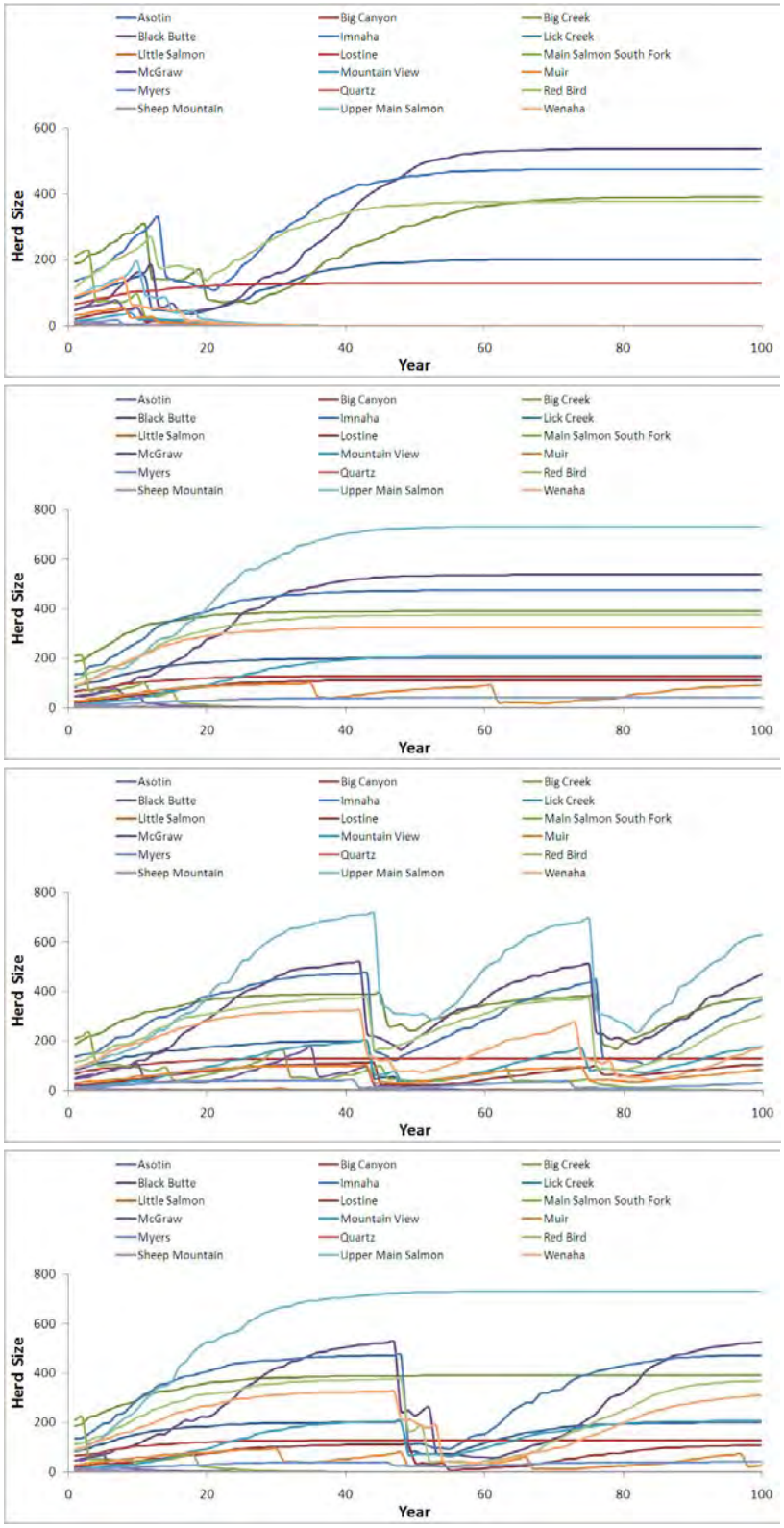
The disease model described above and in Figures L-20 and L-21 was implemented using @RISK, a commercially available Excel spreadsheet add-in (Palisade Corporation 2009). The @RISK add-in permits the model to include components of uncertainty and variability, thereby expanding it from a deterministic model to a stochastic (probabilistic) one. As such, multiple runs, or iterations, may be performed to evaluate the range of outcomes that may arise from selecting various actions.

Examples of the simulated individual herd populations for different outbreak results over 100 years are presented in Figure L-23. Different outbreak results are presented to illustrate the stochastic nature of the model—each time the model is run, the results are different. These outputs were chosen because they show the range of possible outcomes that might result from a single management scenario.

The disease model was used to perform 1,000 simulations of each proposed alternative, with and without cumulative effects. Each simulation began with all bighorn sheep herds uninfected and at their current population size and was run for 100 years. Results, including the number of herds suffering pseudoextirpation in each simulation, were collected and summarized for use in the Environmental Consequences section of the FSEIS (USDA Forest Service 2010).

[2] Many studies reporting post-epidemic lamb mortality have been published in the second or third year after an outbreak, and in such cases, lamb recruitment was almost invariably still low at the time of the last reported observation (Onderka and Wishart 1984; Spraker et al. 1984; Schwantje 1986; Festa-Bianchet 1988; Foreyt 1990; Ryder et al. 1992; Aune et al. 1998).

**Figure L-23. Four Examples of the Outputs Possible from the Disease Model for a Single Management Scenario**



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