“A Process for Finding Management Solutions to the Incompatibility Between Domestic and Bighorn Sheep”

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"A PROCESS FOR FINDING MANAGEMENT SOLUTIONS
TO THE INCOMPATIBILITY BETWEEN DOMESTIC AND BIGHORN SHEEP"

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INTRODUCTION

Scientific research has proven that when bighorn sheep intermingle with domestic sheep, large numbers of bighorn sheep die (Ashmanskas 1995). Major bighorn sheep die-offs have occurred in every western state and have been reported from the mid 1800's to the present (Martin et al. 1996). In recent years, biologists and veterinarians have shown that even casual contact between bighorn and domestic sheep may lead to respiratory disease and fatal pneumonia in bighorns (Onderka and Wishart 1988). The role domestic sheep play in causing pneumonia in bighorn sheep is an important issue in multiple use management (Foreyt et al. 1994).

Presently, about 90 percent of all Rocky Mountain bighorn sheep and 20 percent of desert bighorn sheep in the United States spend all or part of their lives on National Forest System lands. Although domestic sheep allotments on National Forests in the west have greatly declined in number, they are still numerous in some areas. Many bighorn and domestic sheep managers are struggling with this issue because they don't have a good understanding of the incompatibility between the two species, and/or don't know how to address these issues and find potential solutions. Solutions are often difficult to develop and may become politically charged.

The purpose of this document is to describe a process for finding management solutions to the incompatibility between bighorn and domestic sheep. This paper is designed to be used by biologists and range conservationists at the Forest level. The process is divided into 3 parts: (1) disease overview, (2) collaborative approach to identify issues and opportunities, and (3) developing workable solutions. All parts are essential and must be intertwined to become an effective tool for solving domestic/bighorn issues. Overall recommendations are included as well as a question and answer section.

HISTORICAL PERSPECTIVE

Bighorn sheep were once abundant throughout Western North America. Archaeological studies indicate wild sheep were a significant ungulate food item for Native Americans (USDA Forest Service Report 1991). Bighorn populations began to decline dramatically in most areas about 1880. By 1900, many populations were eliminated (Buechner 1960). These historic population declines are attributed to over hunting, parasites, disease, competition with domestic livestock for forage, and competition with humans for space (Buechner 1960, Honess and Frost 1942).

Bighorn populations did not recover following enormous declines in the late 1880's and early 1900's. This is in contrast to the resilience of many other wildlife species such as deer and elk. Bighorns

have demonstrated less tolerance than other native North American ungulates to poor range conditions, interspecific competition, over hunting and stress related to habitat loss (Desert Bighorn Council 1990). Most importantly, they have shown a much greater susceptibility to diseases (Goodson 1982).

In the last century, wild sheep populations have suffered from a wide variety of diseases, some that they have contracted from domestic sheep (Geist 1971). These include scabies, chronic frontal sinusitis, internal nematode parasites, bacterial pneumonia, foot rot, parainfluenza III virus, bluetongue virus, and contagious ecthyma (Desert Bighorn Council 1990).

Bighorn sheep recovery began during the 1960's and 1970's. State wildlife departments in partnership with land management agencies have ongoing efforts that include transplants into unoccupied habitat, augmentation of existing herds, and habitat manipulation. These efforts have had varying success rates; however, success has been consistently poor in areas where contact with domestic sheep occurred. Even with the ongoing recovery effort, current bighorn sheep numbers in the Western United States are estimated to be less than 10 percent of pre-settlement populations.

Historically, bighorn sheep played an ecological and social role. They were part of the prey base for the wolf, cougar, coyote, bear, and golden eagle. Vegetation abundance, evolution, and succession were influenced by herbivores including bighorn sheep. They were widely depicted in rock art indicating their significance to Native American people. Today, bighorn sheep continue to play an ecological role although a smaller one based upon their low numbers. They also continue to be highly prized socially as demonstrated by their extreme recreational value for hunting, wildlife viewing, and photography.

PART I DISEASE OVERVIEW

The following is a brief summary of the current information concerning disease transmission. Viruses, parasites, and bacteria can weaken or kill bighorn sheep. However, bacteria, primarily Pasteurella spp., have led to massive all age die-offs of bighorn sheep in every western state (Martin et al. 1996). Of the numerous pathogens affecting bighorn sheep, Pasteurella haemolytica is by far the most important respiratory pathogen of bighorn sheep leading to pneumonia and death (Foreyt 1993). Pasteurella multocida can also be important in the pneumonia complex.

There are over 70 varieties of P. haemolytica classified in either Biotypes A or T. Each biotype can have many serotypes or strains. Biotype T strains of P. haemolytica are found predominately in bighorns and other wild ruminants, while Biotype A strains are predominately in domestic sheep (Foreyt 1993, Jaworski et al. 1998). Research has shown that P. haemolytica (usually biotype A, serotype 2) is the major pathogen responsible for death in bighorn sheep after contact with domestic sheep. Martin et al. (1996), summarized over 30 published cases where bighorn die-offs are believed to have resulted from contact with domestic sheep. In most cases, between 75 and 100 percent of the bighorn herd died. Domestic sheep always remained healthy.

DNA fingerprinting was recently used to pinpoint the origin of bacteria leading to death in bighorn sheep (Foreyt et al. 1994, Jaworski et al. 1993). Pasteurella DNA isolated from dead bighorns originated in domestic sheep and had not been present in bighorn sheep before they were exposed to domestic sheep. The source of DNA was P. haemolytica (biotype A, serotype 2). Studies at

Washington State University, Edmonton, Canada, and at the Caine Veterinary Center, Boise, Idaho, have shown that specific types of P. haemolytica and P. multocida can be directly transmitted to bighorn sheep from domestic sheep (Onderka and Wishart 1988, Foreyt 1989, Foreyt 1990, Foreyt 1992, Hunter 1995a).

In wild situations, domestic sheep and bighorn sheep association almost always results in deaths of bighorns without affecting the domestic sheep. The finding of a shared P. haemolytica by DNA fingerprinting between domestic sheep and bighorn sheep in a Nevada study indicates this bacteria was transmitted between the two species under field conditions (Hunter 1995b). DNA analysis in the winter of 1995-96 in Hells Canyon during a bighorn die-off revealed that a feral goat and two bighorn sheep shared a genetically identical P. multocida and P. haemolytica (Rudolph et al. 1998). The subsequent die-off resulted in the death of in excess of 260 bighorn sheep in an eight-week period. The disease spread over 30 air miles and affected six bighorn sheep herds.

When bighorn sheep experience a pneumonia episode, all age mortality normally occurs. Lambs born to surviving ewes generally experience low survival rates for three to five years after the initial episode (Foreyt 1990, Coggins and Matthews 1992, Ward et al. 1992, Foreyt 1995, Hunter 1995a). Research indicates that lambs born in bighorn sheep herds that experienced a pneumonia episode usually die before three months of age (Foreyt 1990). It is likely that ewes surviving pneumonia remain carriers of pathogenic P. haemolytica for several years and transfer the bacteria to their lambs through nasal secretions. Lambs are protected by passive colostrum immunity early in life, but when this immunity wanes at six to eight weeks of age, they die from pneumonia. Low lamb survival rates usually continue for three to five years, delaying population recovery for many years.

All ungulates, except llamas, carry some strains of P. haemolytica (Foreyt 1995). However, experimental exposure of bighorn sheep to elk, deer, mountain goat, cattle, llama, and domestic goats has not resulted in pneumonia in bighorn sheep (Foreyt 1992, Foreyt 1993, Foreyt 1994). Bighorn sheep also appear to be attracted to domestic sheep and goats, but not cattle or llamas. Since Pasteurella transmission requires nose-to-nose contact or transfer of mucus through coughing or sneezing, it is most likely to occur between bighorn sheep and domestic sheep or goats. There are isolates of P. haemolytica from domestic sheep that are not lethal in bighorn sheep (Foreyt 1993). In addition, certain kinds of Pasteurella spp. are not toxic to one bighorn, but may be deadly in another.

Bighorn sheep die-offs due to pneumonia have occurred without any known association with domestic sheep (Goodson 1982, Onderka and Wishart 1984**,** Foreyt 1989, and Ryder et al. 1994). These die-offs were typically from P. haemolytica biotype T and serotypes 3, 4 and/or 10. The majority of these T-type die-offs are apparently triggered by some type of stressor, such as severe winter or drought conditions, population in excess of carrying capacity. The major difference between A- and T-type die-offs is the percent of the population lost. T-type incidents usually kill between 15 and 35 percent of the herd whereas 75 to 100 percent of the herd is typically lost in A-type incidents.

No studies report any bighorn sheep herds, fenced or free ranging, that have come into contact with domestic sheep and remained healthy. Several co-pasturing studies revealed that 40 of 42 (95 percent) bighorn sheep died from pneumonia after association with domestic sheep (Foreyt 1995). All domestic sheep remained healthy. Of all animals tested, only domestic sheep and mouflon sheep have been found to be incompatible with bighorn sheep.

No vaccine currently exists that will prevent bighorn sheep from developing pneumonia after contact with deadly strains of P. haemolytica. Attempts have been made to develop such a vaccine for several years and are ongoing.

The incompatibility between domestic and bighorn sheep was tested in the United States District Court (Oregon) in 1995. The following summarizes United States Magistrate Judge Donald C. Ashmanskas' findings. "Scientific research supports a finding that when bighorn sheep intermingle with domestic sheep, large numbers of bighorn sheep die. While the exact reason for this result may be in question, it is clear that the die-offs occur. An incompatibility exists between the two species and there is no way to avoid the incompatibility other than to keep the domestics and the bighorns separate."

Most wildlife biologists and veterinarians have now concluded that bighorn and domestic sheep should not occupy the same ranges or be managed in close proximity to each other (Jessup 1980, Foreyt and Jessup 1982, Goodson 1982, Jessup 1982, Kistner 1982, Wishart 1983, Coggins 1988, Onderka and Wishart 1988, Foreyt 1989, Foreyt 1990, Desert bighorn Council 1990, Callan et al. 1991, Coggins and Matthews 1992, Foreyt 1992, Foreyt et al. 1994, Foreyt 1994, Pybus et al. 1994, Hunter 1995a, Onderka 1986, Hunt 1980, Foreyt 1995, Martin et al. 1996). Consequently, our current recommendation for minimizing pneumonia outbreaks in bighorn sheep is to maintain spatial or temporal separation between bighorn and domestic sheep on native ranges at all times. This is consistent with the following recommendations from leading bighorn sheep disease experts.

Valerius Geist, PhD, University of Alberta: "Domestic sheep are virtually toxic to bighorn sheep. The two species have to be kept apart and cannot be permitted to share any common ground."

William J. Foreyt, PhD, Washington State University: "If the wildlife management objective is to keep bighorn sheep alive, absolutely no physical contact with domestic sheep should be permitted."

Michael W. Miller, DVM, PhD, Colorado Division of Wildlife: "I believe segregating bighorn and domestic sheep on native ranges remains the single most effective management tool for preventing pneumonia epidemics in free-ranging bighorn sheep."

PART II COLLABORATIVE APPROACH

Management of bighorn sheep and domestic sheep in order to avoid physical interactions is often complex and potentially volatile issue. The intent of this paper is to describe a process managers can use in finding solutions benefiting both bighorn sheep and livestock operators. The live-stock industry and the associated ranch families in the western United States are important to America for many reasons. Ranching operations bolster local economies, preserve open spaces, provide critical winter range for big game and habitat for a multitude of wildlife species. They are an important part of Western heritage. The lifestyle that is so important to rural western citizens cannot occur without associated farms and ranches. Likewise, bighorn sheep are an important component of the west as well. They are important to the local residents, wildlife managers, hunters, conservationists, and to the many recreationists that visit or live in the western United States. Bighorn sheep are majestic symbols of the value of National Forests. Healthy bighorn populations are evidence that management for multiple use is working, providing an environment where wildlife can thrive in balance with other uses and values.

Forming a team of key participants that will work together from beginning to end to achieve mutually acceptable solutions is paramount. Although participation is totally voluntary, everyone who should be involved is invited to participate from the outset. Key participants will vary in each situation, but usually involve Forest Service line officers, biologists and range conservationists, livestock permittee(s), and State agency biologists and administrators. Agency managers work shoulder to shoulder with all participants to develop ideas and solutions.

Probably the most essential step in this sheep-specific process is to reach common understanding among all involved that incompatibility between domestic sheep and bighorn sheep exists and mixing the two species will eventually result in a bighorn sheep die-off. Without this fundamental understanding of the problem, collaborative efforts to develop potential solutions will probably not occur. It would be helpful in gaining understanding for all involved to have copies of the pertinent literature well before the initial meeting.

Each participant needs to recognize and respect the positions, needs, and concerns of others. It is the exchange of values and viewpoints to address problems and develop alternative solutions that is essential. Livestock permittee(s) may have been on the allotment for many years and the allotment and the way it is managed often has deep personal meaning. It is often not only life-style but deeply held cultural and social values that are at stake. High values are often associated with the existing ranch, and the allotment may be paramount to that value. Consequently, this issue often poses a significant threat to the permittee.

Biologists and interested publics, such as hunting organizations, have equally strong values associated with bighorn sheep. Die-offs represent many years of costly recovery effort lost. Full population recovery following a die-off requires many years**.** Loss of genetic diversity and herd memory of historical migration routes may be irreplaceable. Economically, the loss of potential hunting and wildlife viewing and photography may represent hundreds of thousands of dollars lost in essential State wildlife agency revenue, as well as lost revenue to local economies associated with these uses. In extreme cases, such as Sierra Nevada bighorn sheep, there is even the potential of federal listing as an endangered species with all that entails.

Discussions need to be open and objective to be productive. The goal is to look for long term solutions, not short term, quick fixes. The objective is to achieve reasonable alternatives keeping woolgrowers economically viable while protecting bighorn sheep. Bighorn sheep range may be on private, state, and federal lands, so solutions may include all of these lands. Decisions made in this process should be by consensus.

Other efforts employed to resolve resource management conflicts, such as outlined in the Coordinated Resource Management Guidelines (Cleary and Phillippi 1993), produced by the Society for Range Management (SRM), have developed rules for successful application of these types of processes. The following "cardinal rules" from that document should be considered:

- **Management by Consensus**. Participation is voluntary and consensus goes hand in hand with volunteerism. If everyone doesn't agree, you go back to the drawing board and listen further to the dissenter's needs.

- **Commitment**. All participants must be committed to the success of the program. Many will come in reserving judgment and keeping their options open to some extent, but at the very

least they must have an open mind to accommodate commitment when the collective behavior of the group warrants it. Undermining the group is not acceptable.

- **Broad Involvement**. All interested parties should participate. To leave some caring interest out is to invite attack. If they too have needs, best to bring them in and hear them out. If their needs are not legitimate, you will eventually flush that out too.

- **Express Needs, Not Positions**. Expressing "positions" generates confrontation. Expressing "needs" generates compassion, trust, and group will to take care of legitimate needs. The group needs to discipline itself by reminding each other to express themselves in terms of needs rather than an expression of positions typical in adversarial posturing.

Techniques for conflict resolution and the basics of consensus development are discussed by Cleary and Phillippi, 1993. Many other sources are available and should be consulted when embarking on the process. Directly connected to the four cardinal rules are operating guidelines for interpersonal relationships that also might prove useful.

- Respect each other in words, tone, and expression.
- Discuss issues forcefully and pointedly, but not personally.
- Maintain a positive outlook, a positive approach.
- Avoid disparaging remarks about colleagues, organizations, agencies, the meeting.
- Be sensitive to other's feelings.
- Take time to affirm what you like, to affirm the good ideas.
- Take time for clarification and understanding.
- Take time to resolve problems and disagreements.
- Disagree without disdain.
- Don't leap to engage an issue – listen and clarify first.
- Avoid side conversations.
- Be open to other's points of view.
- Maintain flexibility.
- Maintain and share your sense of humor.
- Each person is responsible for their own and the group's adherence to these guidelines.

It might be important to consider recruiting an unbiased facilitator or moderator familiar with these types of processes. Skills necessary will include meeting management, communication, role clarification, teambuilding, working with diverse audiences and sometimes difficult people, visioning, goal and objective setting, decision making, and group maintenance. As an additional suggestion, if possible, selection of an unbiased individual that has trust already established with the group that is most fearful entering the process might accelerate teambuilding. Remember that collaboration flourishes in a climate of trust. Because the development of trust takes time, teamwork takes time. Although the collaborative process is time consuming and tedious, the results achieved have a much higher probability of being win-win for all involved. More complete information can be found in the 1993 SRM document.

PART III DEVELOPING WORKABLE SOLUTIONS

This section will be divided into five areas: steps of the process, complexity evaluation, examples, possible solutions, and development of a management strategy.

A. Steps Of The Process

The following steps have been successful in developing workable solutions:

- Step 1. Identify key parameters such as bighorn sheep herd specifics, maps, habitat descriptions, natural barriers, migratory behavior, domestic sheep numbers, and other specifics of the operation.

- Step 2. Identify areas of overlap and potential conflict.

- Step 3. Evaluate management complexity.

- Step 4. Develop site specific solutions for each bighorn sheep herd and domestic sheep allotment.

- Step 5. Develop a management strategy appropriate for the complexity of the management situation.

B. Complexity Evaluation

A complexity evaluation will be based on information supplied by key participants. Each participant will have a critical role in identification of final solution components. The permittee will provide information about his operation in terms of overall allotment management and long-term interest in domestic sheep grazing including interest in converting to cattle, allotment consolidation, allotment location preferences, economic considerations, and any other needs. The State wildlife management agency will need to have maps of occupied and historic sheep range, herd size, home range, migratory behavior, and lambing sites. It will also be important that the State prioritizes existing and potential herds. The Forest Service will supply allotment maps, trailing areas, timing and numbers of livestock on the allotment, details of the allotment management plan, whether bighorn habitat is continuous or isolated and whether any natural barriers to sheep movement exist. This usually will be done cooperatively with the state wildlife agency because sheep movements generally extend beyond the Forest boundary.

This evaluation will identify the complexity of the management situation and the areas of overlap where there is a potential for conflict. Design of a site-specific management strategy will then be based upon these parameters reflecting the level of complexity.

An initial stage of strategy development is to recognize the gradient of risk. As the complexity of the on-the-ground situation increases, the risk of a bighorn sheep die-off also increases as there is greater opportunity for contact between domestic sheep and bighorn sheep.

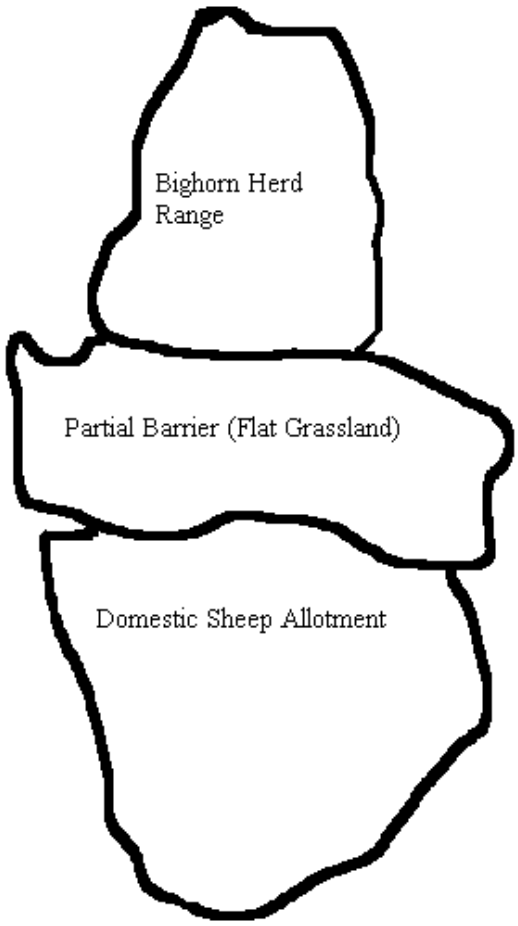
C. Examples

The following are real examples of a simple and complex situation used to illustrate steps 1 through 5 above:

Simple Management Situation:

- Bighorns -- One non-migratory herd with a small home range on isolated habitat.
- Domestics -- One six-month season allotment with no trailing and a cooperative permittee.
- Partial natural barrier available to help maintain separation of wild and domestic sheep.
- Primary conflict is the potential for the two species to mix in the fall when bighorn approach the flat grassland for water. The following illustration shows the situation graphically:

Figure 1. Simple Situation



The solutions identified to solve this potential use conflict were to use the partial barrier in combination with changing the rotation of the domestic sheep on the allotment to effectively increase the distance between species in the fall. The permittee returned to the pasture after livestock were removed to ensure that all stragglers were gathered. Water was developed at a remote site within bighorn habitat to reduce the need to go to water adjacent to domestic sheep. The permittee agreed to notify the State or Forest Service if bighorns were found near the domestic sheep.

Complex Management Situation:

Bighorns:

- Several migratory and non-migratory herds in continuous, large acreage habitat. Significant interchange among herds.
- Large areas of unoccupied historic habitat.
- State agency objectives to restore bighorn sheep to historic habitat using transplants at more than 20 unoccupied sites within the 1.2 million acres.

Domestics:

- Three large allotments trailing livestock up to 50 miles.
- Permittee wants to stay in the area. Area is not suitable for cattle.
- Four small farm flocks on private land.

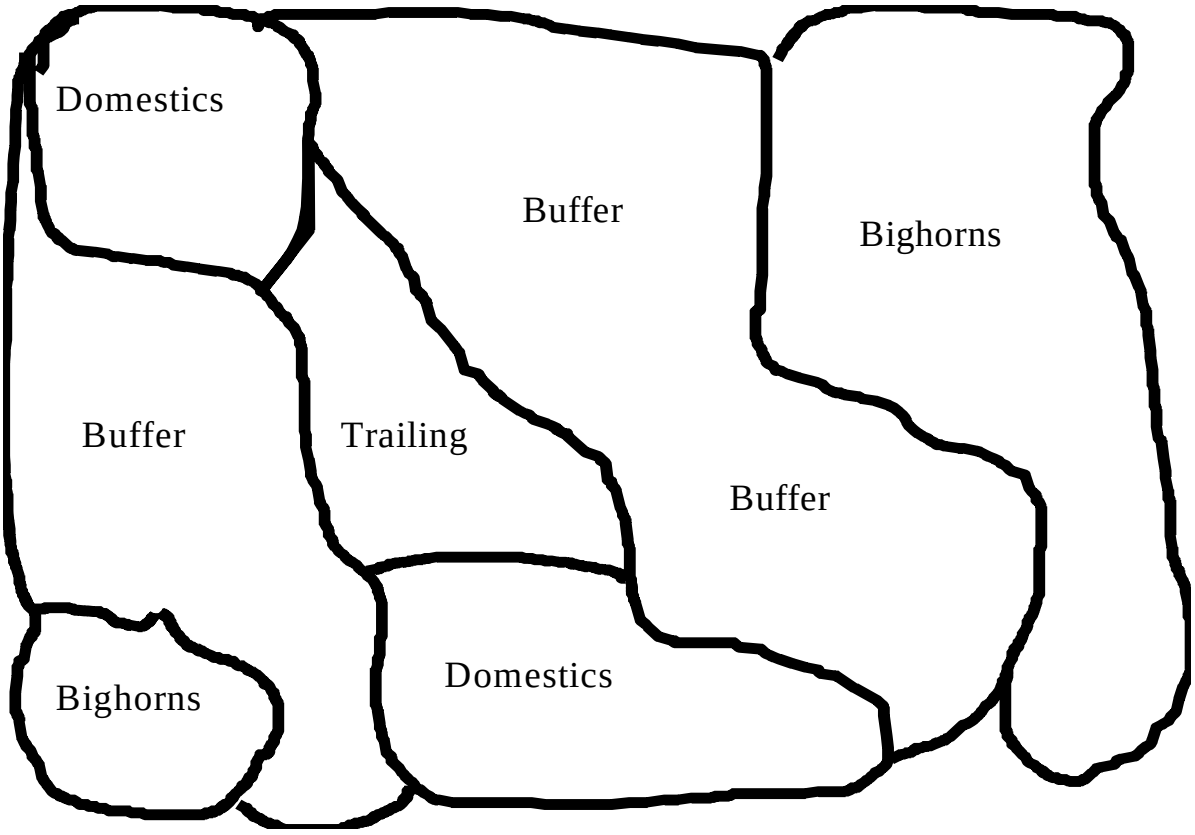
Habitat:

- No natural barriers.
- Previous management separated bighorn sheep and domestic sheep with 25-mile buffers.
- Die-offs continued in spite of buffers.

Repeated exchange between domestic and bighorn sheep has resulted in several minor and major die-offs over a 20-year period.

The following illustration shows the situation graphically.

Figure 2. Complex Situation.



The above example from Hells Canyon is approximately 50 square miles. Solutions included 25 mile buffers and very restrictive domestic management requirements. Both continued to be ineffective in keeping the two species separate. Other options considered were conversion to cattle, finding the permittee a replacement allotment elsewhere, economic incentive packages provided for the permittee to waive the permit back, closing the allotment thereby displacing the permittee, or simply living with continued die-offs. In this very difficult situation, and after 20 years of struggling to balance uses, three allotments were closed, the permittees were relocated to nearby large cattle allotments and/or economic incentives to waive the permit back to the government were supplied by an interested group. This decision was litigated and upheld.

D. Possible Solutions To Consider

The following is designed as a starting point for consideration when developing collaborative solutions. It is not all inclusive.

1. Changing components of the domestic sheep operation
   - Trucking vs. trailing sheep
   - Changing rotations
   - Intensive effort to gather strays
   - Timing and/or duration of use
   - Herding or improving the current herding situation
2. Moving domestic sheep to another allotment or dropping pastures
3. Conversion to cattle
4. Consider using natural barriers if topography allows for them
5. Habitat improvements
   - Burning
     - forage improvement
     - reduce conifer encroachment
     - reestablish migration corridors
   - Water developments
   - Salting

E. Development Of A Management Strategy

A "management strategy" is intended as a broad Forest approach to guide site specific bighorn and domestic sheep management. It is recommended in all situations, but is absolutely necessary in complex situations. It is in addition to developing site specific herd solutions. In most cases, the management strategy will result in a Forest Plan amendment. Many Forests are approaching the Forest Plan revision period. In these cases, revision provides a perfect opportunity to begin solving these types of conflicts through a suitability analysis. Regardless of the status of the Forest Plan, consider the following components for the strategy.

- Allotment management guidelines for domestic sheep that reduce the potential for interaction with bighorn sheep.
- Identify "domestic sheep emphasis" areas.
- Identify "bighorn sheep emphasis" areas.
- Identify a process for allotment review.

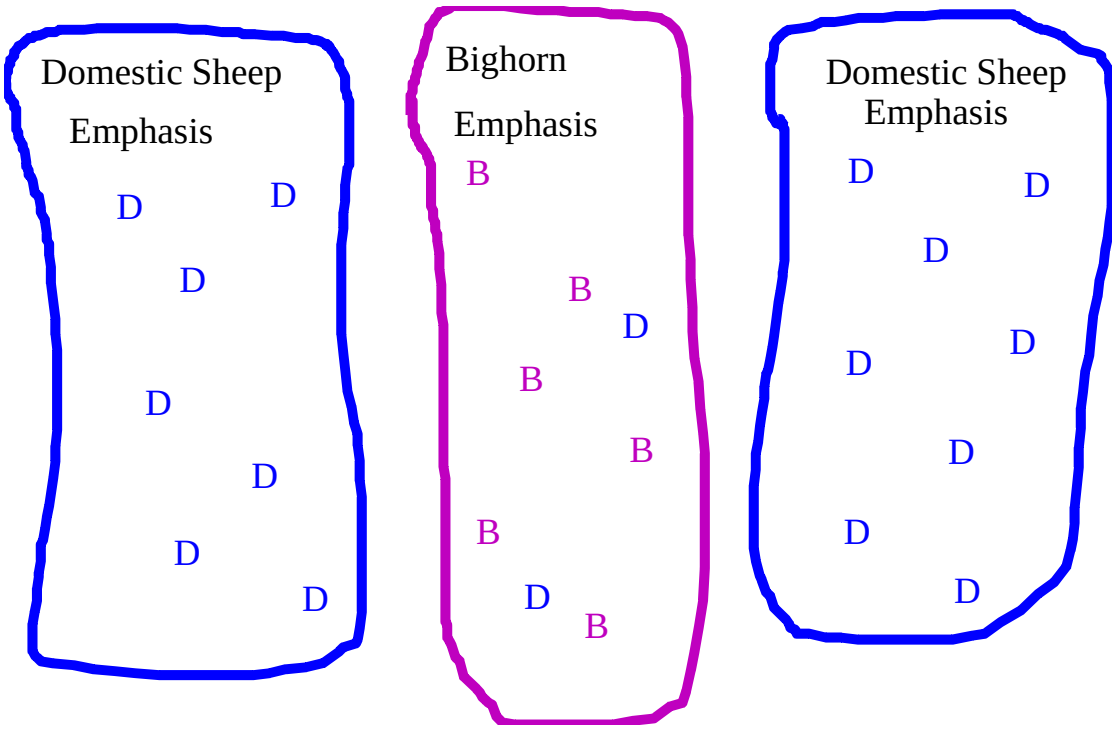
- Identify Forest Plan standards and guidelines to reduce conflicts between domestic and bighorn sheep.

Four key factors are important to identify primary emphasis areas for bighorn sheep and domestic sheep:

- Bighorn home ranges and movements.
- Domestic sheep locations, trailing areas, and grazing rotations.
- Natural barriers to bighorn movements, such as lakes, reservoirs, large continuous forests, or desert.
- Suitable or historically occupied habitat.

Figure 3 below illustrates the emphasis area concept graphically. In this example, each of the 3 areas represent a large mountain range. The symbols D and B show the current locations of domestic sheep allotments (D) or bighorn sheep herds (B). Through a collaborative process, emphasis areas were completed and agreed upon. The two outside mountain ranges will continue to be managed for domestic sheep. No bighorn sheep will be introduced. In the center mountain range, alternatives were explored for reducing the contact between bighorn and domestic sheep. These alternatives took a few years to implement and included: incentives, converting to cattle, and moving to vacant allotments in the other two mountain ranges. Now completed, the center mountain range only contains bighorn sheep. A detailed example of how to develop emphasis areas and a management strategy is contained in Appendix A "Bighorn/Domestic Management Strategy for the Wallowa-Whitman National Forest."

Figure 3. Example of Emphasis Areas
D = Domestic Sheep Allotment B = Bighorn Herd



PART IV SUMMARY OF RECOMMENDATIONS

- Reach a common understanding with all key players concerning the incompatibility of domestic and bighorn sheep.

- Use a collaborative approach to develop solutions.

- Develop strategies to keep the species separate at all times.

- No matter how complex the management situation is, develop site specific solutions for each bighorn sheep herd.

- Develop management strategies when the situation is complex.

- Maintain management flexibility and opportunities for the livestock industry by leaving vacant sheep allotments open when they are not in conflict with other resource uses.

PART V QUESTIONS AND ANSWERS

1. Is the potential for bighorn die-offs higher when bighorn sheep population densities are high?

   Yes, especially when bighorn sheep populations are above carrying capacity. We encourage State agencies to keep population densities below carrying capacity for several reasons. High ram ratios can lead to more pioneering by young rams, especially in unhunted herds. This behavior can increase the risk of nose-to-nose contact with domestic sheep. In addition, bighorn die-offs have also occurred without association with domestic sheep when bighorn sheep densities were above carrying capacity. This appears to be a density related phenomenon.

2. How should small farm flocks be handled?

   Small farm flocks may or may not be a potential conflict. In most cases, gaining support is best done through educating owners of the risks and consequences of physical contact between the species. Personal contact and dialog is the best approach. A brochure titled "The Compatibility between Bighorn and Domestic Sheep" is available to use when making these contacts. It is available from the Foundation for North American Wild Sheep (FNAWS).

3. Should State agencies assume the risks of die-offs when reintroducing bighorn sheep where any potential for mixing with domestic sheep occurs?

   Yes. Several states have established a policy where they will assume this risk. Bighorns coming in contact with domestic stock are removed or destroyed. This is to prevent spreading disease to healthy bighorns. Encourage your cooperating State agency to adopt this policy.

4. Can different migratory behaviors of bighorns be used strategically in transplants to reduce the chance of mixing with domestic sheep?

Yes. Sheep obtained from non-migratory herds can provide more effective separation between the two species. However, remember that just because sheep came from non-migratory stock does not mean that they will not move. Young rams in particular will wander. That wandering may be extensive.

5. How can the Forest Service planning process be used to help eliminate bighorn and domestic sheep conflicts?

   Forest Plan Revisions provide the perfect opportunity to begin solving bighorn and domestic sheep conflicts. Planning regulations (36 CFR 219.20, 1982 planning regulation) require the Forest Service to conduct a "suitability analysis" for both livestock and wildlife. A suitability analysis identifies uses on the Forest that are not compatible. Since bighorns and domestics cannot co-exist in close proximity, Forest Plans should identify areas where conflicts are currently occurring, allocate those areas to either bighorns or domestic sheep, and develop strategies to eliminate the interactions in future years. (Note: Ongoing changes in the NFMA planning regulations may result in a change in this current requirement.)

   If a Forest Plan Revision is not in the foreseeable future, the Forest can decide to conduct a separate National Environmental Policy Act (NEPA) analysis to determine where conflicts exist and amend the existing Forest Plan to adopt strategies that will remedy the conflicts. Whether the analysis is completed through a Forest Plan Revision or through a Forest Plan Amendment, the key to success is looking at the problem at a large enough scale to have some management flexibility. In many situations the analysis might be more effective at a state level or on a multi-forest level.

6. What are some of the management strategies that can be effective in resolving bighorn and domestic sheep interactions?

   There are many options that can be used including:

   - Conversion of livestock kind from sheep to cattle. This must only be done after a completed range analysis indicates the allotment is capable of supporting cattle use. CAUTION: Many good domestic sheep allotments will never be good cattle allotments.

   - Relocating domestic sheep from a conflict allotment to a vacant allotment without bighorn/domestic conflicts. Many National Forests have sheep allotments that are now vacant. These vacant allotments might be used to shift domestic grazing away from conflict areas. CAUTION: Some allotments are vacant due to conflicts with other resources such as wilderness, T & E species, recreation, etc. Do not create or foster other resource problems by putting domestic sheep on a vacant allotment to solve a domestic/bighorn conflict.

   - Where the opportunity exists and can be done in an environmentally sound manner, permittees on conflict allotments can be prompted to move to non-conflict vacant allotments by offering them additional numbers or allotments.

   - There are several organizations that offer grants to the Forest Service to cover costs of solving bighorn/domestic conflicts. Costs that might be covered include NEPA analysis, publications and maps, etc.

- Many conflicts can be solved by modifying the allotment annual operating instructions changing rotation, trailing to trucking or improving herding.

7. When a bighorn die-off begins, is there anything that can be done?

   Maybe. A protocol has been developed by the Hells Canyon Restoration Committee for application of antibiotics and release of the animals on site. It has helped to reduce the losses of bighorn sheep in the wild. The key to its effectiveness is treatment of bighorns before they get into the later stages of pneumonia. It is an emergency measure that is expensive, but can be used as a last resort in an effort to save some of the herd. It may not be applicable in wilderness due to restrictions on use of helicopters. Additional information is available through Vic Coggins (Key Contact List attached).

8. Are there non-local interests that should be involved in conflict resolution with domestic and wild sheep management.

   Yes. FNAWS has been an active partner in bighorn sheep programs. They will be a very useful component as you work through these challenges. Further discussion concerning the value of their involvement is available through Melanie Woolever (Key Contact List attached).

9. Why hasn't the Forest Service adopted the Bureau of Land Management (BLM) Guidelines?

   The Forest Service believes that these issues can be best addressed on a site-specific basis using the Forest Planning process. The needs of bighorn sheep and of the domestic sheep operator can be meshed and balanced in a more effective manner locally. Also, situations vary in size and continuity of sheep habitat, topography, water availability, operator effectiveness, etc. These variations can be better accounted for using site-specific solutions.

10. Why not recommend a minimum buffer distance?

    A minimum buffer is not applicable across all National Forest situations and bighorn sheep habitats. For instance, the minimum buffer in Hells Canyon was 25 miles and yet was not effective in separating the species. Both species tend to wander and this area is a large block of continuous habitat which provides for wandering. On the other hand, the Lostine herd is separated from domestic farm flocks by a distance of about three miles. In this situation where farm flocks are separated by dense forest and topography, three miles is adequate. These examples illustrate why it is so important to develop site-specific solutions to these management challenges.

11. Is trailing of domestic sheep in occupied bighorn sheep habitat a problem? If so, can it be mitigated?

    Yes, it is a problem. Trailing in or near occupied bighorn sheep habitat needs to be prohibited if trailing timing coincides with the presence of wild sheep. The problem arises when trailing through densely vegetated areas. Even close herding is not completely effective in preventing stragglers and pioneers. Close herding can mitigate the impact when the trailing area is in the open and when bighorn sheep are utilizing a different portion of the range at the time.

12. Are there any examples of Forest Plan Standards and Guidelines addressing bighorn/ domestic sheep management?

    Yes. Examples from the Wallowa-Whitman and White River National Forests are provided in Appendices A and B, respectively.

13. Is there a viability issue with small, isolated populations of bighorn sheep?

    It is possible that this could be of concern. The Craig Wildlife Wildlands Institute began work addressing this issue related to the number of rams in the herd and those that actually breed. The risk to small populations increases as they become more isolated without genetic exchange. State agencies may want to supplement smaller herds to provide for genetic diversity. When addressing viability, remember it is most effectively addressed at large scales such as the Forest Planning level, consistent with the definition of viability in the NFMA planning regulation (36 CFR 219.19 of the 1982 planning regulations).

14. Can domestic goats transmit deadly bacteria to bighorn sheep?

    The current information on this issue is not definitive. Co-pasturing trials done by Dr. Foreyt with domestic goats and bighorn resulted in all bighorns remaining healthy. However, the most recent die-off in Hells Canyon was traced by DNA fingerprinting to a domestic goat that had been recently released in the wild. It is important to note that prior to release, the goat had recently been exposed to domestic sheep at a County Fair.

15. What should I do if there is pack goat use on my district?

    First determine if there is a potential for interaction with bighorn sheep. If there is, we recommend the following:

    - Animals should be tended and kept in sight at all times, especially when packing in areas where bighorn sheep are present.
    - Animals should be tethered or penned at night and not allowed to roam freely.
    - When bighorn sheep are in close proximity, pack goats should be moved quickly through the area and the wildlife gently hazed if necessary.
    - If it is determined that the pack goats are or have been in contact with domestic sheep, more stringent restrictions should be considered to ensure the goats do not make contact with the bighorn sheep.
    - Informational signing at trailheads should be used to explain the potential risks.

16. Is there a problem with llamas and disease transmission to bighorn sheep?

    There is not a problem with Pasteurella spp. transmission from llamas. There has been ongoing concern about Johnes disease transmission from llamas to bighorn sheep. However, there is no evidence to support the concern. Only 4 confirmed cases on Johnes disease have been documented in the United States in a population of approximately 100,000 llamas. Transmission requires repeated and prolonged nasal contact to high concentrations of bacteria (10-8 per gram). Animals shedding this number of bacteria are in the terminal stages of the

disease. They are emaciated and weak which is incompatible with a viable pack animal. In short, this is not a problem for our bighorn sheep herds. For additional information, refer to the Johnes Disease Workshop Proceedings March 1996 available from Melanie Woolever.

17. What information can the State wildlife management agency provide that would be helpful in finding solutions?

    The State Agency will be a key player in developing solutions. An example from Wyoming Game and Fish is attached.

18. Are there any models available to help determine bighorn habitat suitability?

    Yes. There are five different Rocky Mountain bighorn sheep habitat models. They are discussed in Gudorf and Sweanor 1996, Shirokauer 1996, Smith et al.1991, Dunn 1993 and Johnson and Ringo 1995.

19. Is there anyone I can contact for help if I have more questions or need additional support?

    Yes. A Key Contact List is attached. Tim Schommer and Melanie Woolever work nationally in the Forest Service FULL CURL program. They are available to help you. Others on the Key List would also be willing to provide necessary support to help you work through this process.

20. Does Pasteurella or any other bacterial or fungal pathogen remain in the environment after domestic sheep leave the area?

    No. These pathogens die quickly outside of the host animal. Nose to nose contact is required for disease transmission to occur.

PART VI KEY CONTACT LIST

- Tim Schommer, Wallowa-Whitman NF, PO Box 907, Baker City, OR 97814, 541-523-1383
- Melanie Woolever, US Forest Service, R-2, PO Box 25127, Lakewood, CO 80225, 303-275-5007
- Vic Coggins, Oregon Dept. Fish & Wildlife, 65495 Alder Slope Rd., Enterprise, OR 97828, 541-426-3279
- Kevin Hurley, Wyoming Game & Fish, 356 Nostrum Rd., Thermopolis, WY 82443, 307-864-9375
- Bill Foreyt, Washington State University, Pullman, WA 99164, 509-335-6066
- Mike Miller, Colorado Division of Wildlife, 317 W. Prospect, Fort Collins, CO 80526-2097, 970-472-4348
- Karen Rudolph, University of Idaho/Caine Veterinary Training Center, 1020 E. Homedale Rd., Caldwell, ID 83605, 208-454-8657
- FNAWS Headquarters, 720 Allen Ave, Cody, WY 82414, 307-527-6261
- Jim deVos (desert bighorn sheep) Arizona Department of Game and Fish, 2221 W. Greenway Road, Phoenix, AZ 85023, 602-789-3247.
- Cal McCluskey, BLM, 1387 S. Vinnell Way, Boise, ID 83702, 208-373-4042
- Forest Service Regional Wildlife and Range Program Managers

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PART VIII APPENDICES

- **A**. Wallowa-Whitman N. F. Bighorn/Domestic Sheep Management Strategy
- **B**. White River NF Forest Plan Standards and Guidelines for Bighorn Sheep Habitat
- **C**. Wyoming Game and Fish Herd Unit Review pages
- **D**. Literature Review Regarding the Compatibility between Bighorn and Domestic Sheep

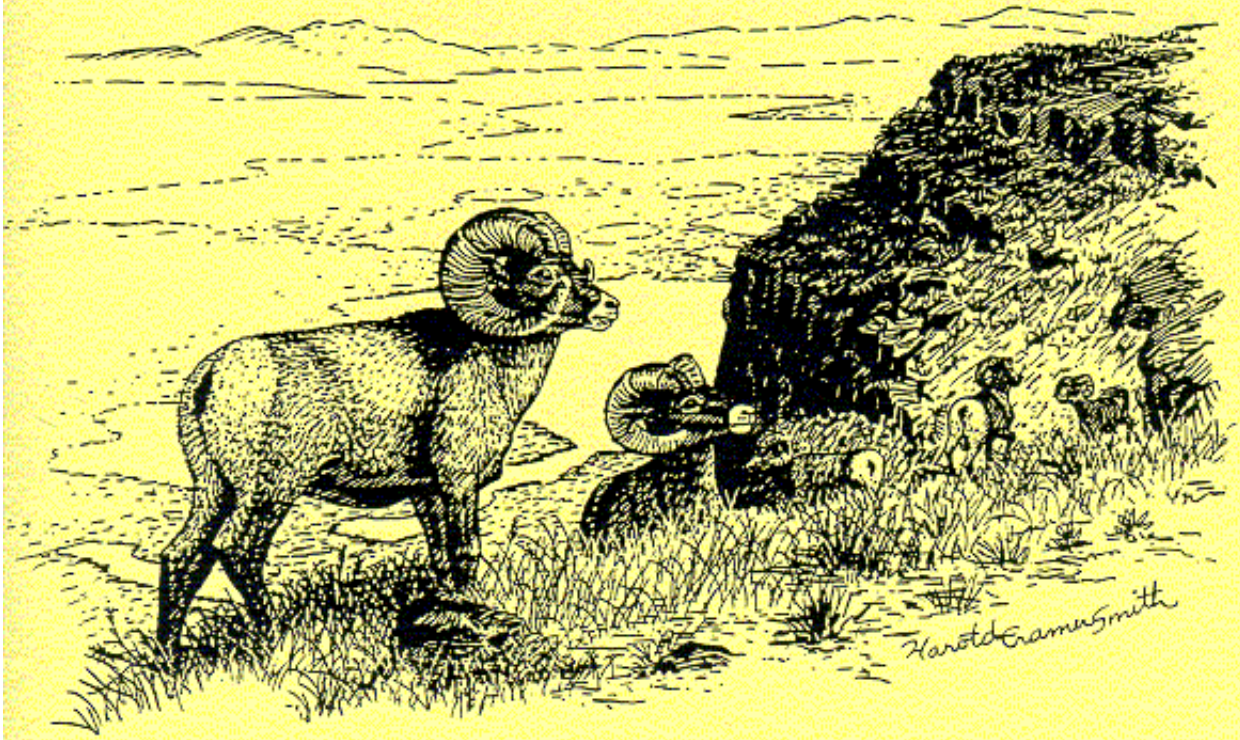
We sincerely appreciate the review and input provided to us by many domestic and bighorn sheep managers working together to solve this difficult management challenge.

APPENDIX A

BIGHORN/DOMESTIC SHEEP MANAGEMENT STRATEGY

FOR THE WALLOWA-WHITMAN NATIONAL FOREST

SEPTEMBER 1991



BIGHORN/DOMESTIC SHEEP MANAGEMENT STRATEGY FOR THE WALLOWA-WHITMAN NATIONAL FOREST 1991

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Adopted by:

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/s/Jim Lauman Date 10/17/91

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/s/Jerry Thiessen Date 12/10/91

Bob Richmond — Forest Supervisor — WWNF

/s/Bob Richmond Date 10/3/91

I. INTRODUCTION

The following "Management Strategy" is intended as a broad Forest approach to guide site specific bighorn and domestic sheep management. This is not an Environmental Assessment document. It is only intended to replace the 1981 Bighorn/Domestic Sheep Guidelines currently in effect. After a 30 day public review process, we incorporated several of their suggested changes.

The document has the following objectives:

1. Develop a Forest Plan amendment which will move bighorn/domestic sheep management forward.

2. Decrease the potential for contact between bighorn and domestic sheep.

3. Allow bighorn reintroduction to proceed on specific areas, with restoration as the goal. Reintroduction would follow site specific analysis of these areas.

4. Identify a process for domestic sheep allotment review which will address bighorn/domestic sheep interaction within the context of NEPA.

5. Establish Forest-wide recognition of all existing bighorn sheep populations.

6. Incorporate this management strategy into the 1991 update of the State of Oregon Bighorn Sheep Management Plan.

A number of events have occurred over the last 20 years which have had an effect on the management of bighorn sheep on the Wallowa-Whitman National Forest (WWNF). In order to provide a basis for development of this management strategy, a brief overview of the history of bighorn sheep and their management is warranted.

Rocky Mountain bighorn sheep (Ovis canadensis canadensis) were native to much of the mountain and canyon country which currently comprises a large proportion of the Wallowa-Whitman National Forest in northeast Oregon and western Idaho. Specifically, historical accounts indicate that bighorns were numerous in the drainages in and around the Wallowa Mountains, the lower Imnaha River, Snake River, Grande Ronde River, Elkhorn Mountains, Powder River, and Joseph Canyon. Archaeological studies indicate wild sheep were the most important ungulate food item for Native Americans.

The California bighorn sheep (O. c. californiana) was found in the Burnt River canyon and on isolated mountains in the southern portion of the Wallowa-Whitman National Forest.

As European people settled the west, many of the activities either directly or indirectly had a negative impact on native bighorn sheep populations. Unregulated hunting, competition for forage with domestic livestock, and parasites and diseases introduced by domestic livestock were all factors which helped eliminate the bighorn from the state. The last native Rocky Mountain bighorn was seen in the Wallowa Mountains in the 1940's.

In Idaho, the Idaho Department of Fish and Game (IDFG) reintroduced 26 Rocky Mountain bighorn sheep into Granite Creek during 1975 and 1976. Seven bighorn ewes were released into nearby Bernard Creek in 1979. Both transplants flourished and reached an estimated herd size of 120 by 1983. In 1984, about 60% of the herd died of pneumonia. This was found to be caused by a disease called Pasteurella hemolytica. The bighorn population did not rebound from die-off. Thus, in 1990, the IDFG supplemented the herd with 31 more bighorns. The current status of the herd has not been evaluated, but IDFG believes it has continued to decline.

In 1971, the Oregon Game Commission reintroduced Rocky Mountain bighorns into the state when transplants were released on the Lostine River and on the Snake River at Battle Creek. The Battle Creek transplant failed within 2 to 3 years. A sizable herd, about 30 bighorns, developed and ranged along the Snake River from Wild Sheep Creek to Sand Creek until one winter in the early 1980's they suddenly disappeared. These sheep were thought to have migrated from Battle Creek. The Lostine River transplant flourished and grew to a herd size of 120 head. Limited hunting of rams was initiated in 1978 and trapping and transplanting to other release sites was initiated in 1977. This was accomplished in order to stabilize bighorn numbers in the Lostine herd while at the same time reintroduce bighorn sheep to additional historic habitats within their former range in Oregon. Some transplanting involved exchanging of Lostine stock for stock from the Salmon River drainage in Idaho so that sheep better suited to a release site and increased genetic diversity could be attained. This activity resulted in additional populations becoming established on the lower Imnaha River, Bear Creek, lower Minim River and the lower Grande Ronde River at Troy.

In 1981, concern for management of bighorn sheep in and around domestic sheep grazing allotments stimulated development of a document called the "White Paper" (Appendix D, #4) which outlined management guidelines designed to reduce potential conflicts between the 2 species.

In 1986, the Oregon Department of Fish and Wildlife (ODFW) developed a Bighorn Sheep Management Plan to provide management direction for reintroductions of bighorn sheep in Oregon and to provide public land management agencies a timeline on which to analyze proposed release sites. This document identifies proposed release sites and provides management direction for bighorn sheep in the future. The plan will be revised every 5 years with the first revision occurring in 1991.

Fifteen California bighorn sheep were reintroduced in 1987 on Bureau of Land Management lands along the Burnt River. The herd is slowly increasing and is now estimated to total about 35. They currently are adjacent to Forest Service lands, but are not known to drift onto the Forest.

An all age die-off of bighorn sheep on the Lostine River occurred in the winter of 1986. The disease agent was identified as Pasteurella hemolytica, which caused Pneumonia, and reduced the herd from 120 to 32 animals. Since Pasteurella hemolytica has remained in the surviving sheep for several years, it has been the primary factor preventing herd recovery to date.

Concern for the health and future of other existing bighorn herds caused ODFW and WWNF to decide to revise the 1981 "White Paper." The overall intent was to bring all concerned parties together in development of a series of management guidelines where all interests could participate equally. The primary area of concern was how to manage bighorn sheep and domestic sheep so contact between the two species could be minimized. The Bighorn/Domestic Sheep Task Force met three times and failed to reach consensus on the white paper revision. At that point, the document was turned over to the WWNF Supervisor and the ODFW NE Region Supervisor for their review and final decision. Immediately upon being jointly approved, implementation of the decision was contested by conservationist groups on the basis that the decision did not afford adequate protection to existing herds of bighorn sheep on the Forest. At that point, the WWNF issued a decision which suspended use of the guidelines, stopped all bighorn sheep transplanting efforts, and restocking vacant domestic sheep allotments, pending a broad Forest approach to the situation.

II. PROPOSED MANAGEMENT DIRECTION

1. Bighorn/Domestic Sheep Management Zones

The Bighorn/Domestic Sheep Task Force developed a "management zone" concept by dividing the lands administered by WWNF into nine Bighorn/Domestic Sheep management zones (see Appendix E). The zones were located to identify areas of higher and lower conflict between bighorn and domestic sheep. Areas of high conflict currently contain active domestic sheep allotments, areas of moderate conflict contain vacant domestic sheep allotments, and areas of low conflict do not contain domestic sheep allotments. A high conflict area would be one having a high probability that sometime during the grazing season domestic and wild sheep will come into close contact.

The use of management zones was developed to facilitate the objectives of restoring bighorn sheep populations and maintaining domestic sheep grazing as outlined in the Forest Plan. In areas where the potential for conflict is 1ow, NEPA analysis could be easily accomplished and bighorn populations restored. In areas where the risk is higher, the analysis process would become more complex. Entire allotments or groups of allotments would be analyzed and decisions would be made on how best to manage the existing and potential resources.

2. Locations of Potential Release Sites

The Task Force identified 20 potential release sites (see Appendix A and F). This list is not exclusive; other sites may be later identified. Not all of these sites are feasible under current management conditions, but are shown here to display potential. Eight of these twenty sites would be supplementing existing populations and 12 would be reintroduction of animals into unoccupied suitable habitats.

3. State Bighorn Sheep Management Plans

The emphasis of the States of Idaho and Oregon is to reintroduce bighorn sheep into all available and suitable habitats. Reintroduction will proceed according to the State Bighorn Sheep Management Plans.

Bighorn sheep will not be reintroduced into locations where it is probable they may come into contact with domestic sheep. Occasionally, bighorn may migrate outside of their designated range. If they come in contact with domestic sheep, bighorns will be considered "at risk" for disease transmission and potential loss of bighorn sheep. There is also the potential for a disease infected bighorn to leave the area and spread the disease to other bighorns. The State agency will assume the responsibility for bighorn losses and further disease transmission. If these situations occur, the State will take whatever action with infected bighorns that it feels necessary to reduce further losses.

Habitat improvement work, such as water developments and controlled burning, will be accomplished as needed, identified in an Environmental Assessment, and will be cooperatively funded when possible.

4. Management of Domestic Sheep Allotments - "Analysis Process"

Introduction: The Forest Plan for the WWNF allocates thirteen allotments as domestic sheep and two allotments for dual use (sheep and cattle). This means that a portion of the forage resources within those allotments are allocated for harvest by domestic sheep under the authority of a proper grazing permit and within constraints imposed by both the Forest Plan and the terms and conditions of the permit. Of the 15 allotments designated in the Forest Plan, five sheep allotments and two dual use allotments are currently stocked by domestic sheep under a permit. In addition, there are eight designated sheep allotments that are in a vacant status.

Analysis of domestic sheep allotments falls into one of two categories: Allotments are either active, indicating that there is a Term Grazing Permit issued that provides for stocking of the allotment by a prescribed-number of domestic sheep for a given season (or a preferred applicant has a priority for issuance of a permit), or the allotment is vacant. An allotment is considered to be vacant when either no Term Grazing Permit is in effect for that allotment or no priority applicant exists. The process for making decisions regarding each of these situations will be discussed separately.

Active allotments

Currently, Sheep Creek, Temperance-Snake, Mud Duck, McCarty, and Spring Creek are active sheep allotments (Appendix B and G). In addition, Mud and Davis Creek are designated for dual use (e.g., stocking is permitted by both domestic sheep and cattle).

Management of active allotments is conducted under the provisions of a Term Grazing Permit. This permit prescribes certain management activities under the Terms and Conditions of the Permit. The Allotment Management Plan is incorporated as a part of the Term Grazing Permit. This Plan sets the stage for prescribing management of the allotment, including the management of the permitted livestock.

The development of an Allotment Management Plan follows a combination of law, policy and direction, including that provided by the Forest Plan and National Environmental Policy Act (NEPA). Specifically, the initial step in the planning process is a public scoping to identify the issues and concerns associated with management of the allotment. From this scoping, a set of data needs is developed and a process for collecting the data is derived. Once the data is collected and analyzed, additional scoping and public involvement leads to development of alternative systems of management that address the issues and concerns. This step includes development of objectives for management and criteria to measure the effectiveness of each alternative against the issues and concerns.

The final part of the planning process involves selection of the preferred alternative by the Line Officer (usually the Forest Supervisor). This is done through completion of the Environmental Analysis and documentation of the decision in a public decision document.

This preferred alternative is then written in the form of an Allotment Management Plan. This plan will contain the objectives for the management of the allotment, prescribed management requirements (grazing systems, constraints, improvement developments, etc.), coordination requirements (such as for wildlife, recreation, etc.), livestock management requirements, etc. The plan will also contain monitoring plans based on short term implementation of standards and guidelines from the Forest Plan (ex: utilization standards), and long term monitoring of the effectiveness of the management practices in meeting the objectives of the plan.

In general, the Allotment Management Plan is expected to cover a ten to twenty year period. However, it is also expected the plan will be updated as needed. This can occur as a minor modification or may require a complete revision.

On the WWNF, all allotments are currently planned for new Allotment Management Plans within a ten year period. This schedule is based on a prioritization process that considers resource problems and conflicts. The more significant the problems or conflicts, the higher the priority assigned to the allotment. This schedule changes slightly from year to year based on accomplishments and budgets. The most up-to-date schedule can be found in the latest amendment to the Forest Plan.

In general, the Temperance-Snake and Mud Duck allotments are scheduled to be analyzed together within the next few years. Sheep Creek Allotment is not currently scheduled within the current five year period but would be scheduled within the second five years. McCarty and Spring Creek have recently completed plan updates and would not normally be re-visited for about ten years. Mud and Davis Creek Allotments are both planned for re-analysis and planning within the next five years.

Vacant Allotments

Currently, the Canyon, Big Canyon, Sheep Rock, Minam River, Standley-Huckleberry, Huckleberry, Indian Crane, and Chicken Hill allotments are designated as sheep allotments in the Forest Plan but are currently in a vacant status.

The process for making decisions on vacant allotments is determined by various laws and policies including NEPA, the Forest Plan, and manual direction on the permit grant process.

For a vacant domestic sheep allotment, there are a number of potential decisions that can be made. First, a Forest Plan decision exists that the allotment is suitable and available for stocking by domestic sheep. Therefore, the Forest Plan recognizes the area as an established domestic sheep allotment.

However, in some cases, there could be reasons for re-considering the kind of livestock to be permitted. This may include economics, potential changes to alleviate other resource problems or conflicts on either the vacant allotment or on other allotments, etc. This determination would be made following an analysis as to the potential suitability of the vacant allotment for other kinds of livestock. This information would be presented and a decision made through the NEPA process which would include public scoping and involvement in the decision making process.

If the preferred alternative, and the subsequent decision is made to change the kind of livestock from domestic sheep to cattle, the allotment would cease to be available for stocking by domestic sheep. Stocking of the allotment would then be conducted under the grant process (explained below) and management would be detailed through the development of an Allotment Management Plan (as described above).

Where there is no decision made to convert the kind of livestock to other than domestic sheep, a process called the grant process must be followed to stock the allotment. This process is basically a priority screening that provides for using the capacity available on the allotment to meet certain obligations including restoring past resource improvement reductions (including on other allotments), correcting overstocking on other National Forest allotments and, meeting the proportionate needs of other resources and values. In order to issue a permit under the grant process, there must be an Allotment Management Plan that meets current Forest Plan Direction and NEPA sufficiency.

This grant process is only a priority screening process that selects a preferred applicant for an allotment area that is already established through the Forest Plan. The decisions regarding stocking levels, seasons of use, management intensities, etc., are made through the NEPA process and are documented in the form of a public decision document and an Allotment Management Plan.

If the capacity, or a portion thereof, is granted under a Term Grazing Permit, the new permittee becomes responsible for compliance with the Terms and Conditions of the Term Grazing Permit and Allotment Management Plan.

Until such time as a NEPA decision is made regarding the allocation of the forage resources, the allotment remains as a designated domestic sheep allotment.

In general, these vacant allotments are considered to be a low priority for analysis and planning on the Forest. This is because certain other active allotments are considered to be in more need of planning to either correct current resource problems or to prevent resource problems and conflicts from occurring. This would generally mean that these vacant allotments would not be scheduled for analysis and planning until the last years of the planning cycle.

Finally, a decision can be made to close specific allotments if analysis shows that the allotment no longer provides suitable range, the allotment is not economically feasible to be stocked under current or projected management systems, the area within the allotment is to be designated for emphasis on a resource or resources where significant conflicts would exist with livestock grazing, or various other reasons. This closure of an allotment would need to occur through the NEPA evaluation process and would result in amendment of the Forest Plan.

III. BIGHORN/DOMESTIC SHEEP MANAGEMENT ZONES

Zone One -

Zone One is located north and northeast of Enterprise and covers approximately 225,000 acres (see Appendix E). Currently there are about 30 bighorns in upper Joseph Creek, 10-15 in lower Joseph, and about 30 adjacent to Cherry Creek (Appendix C and H). All populations are slowly increasing in size. There are no domestic sheep allotments within the zone, only cattle and horse allotments.

The Department considers this zone to have several areas of unoccupied suitable habitat. The task group feels zone one has a low risk for conflict between bighorn and domestic sheep. Consequently, this zone has the highest priority for reintroduction/supplementation. Four sites have been identified as shown in Appendix A.

This zone will be considered available for reintroduction/supplementation subject to a case-by-case Environmental Assessment. All future decisions will address at least the following:

a. Intended and mapped boundary of bighorn year round range and maximum bighorn population objective.

b. Identification and recognition of nearest domestic sheep population of other possible activities that could be a potential resource conflict.

c. An evaluation of range vegetation conditions and year-round forage supplies for the bighorn population size objective.

d. List of habitat improvement opportunities with corresponding map.

If bighorns are reintroduced and migrate outside of zone one, these animals will be considered "at risk." The Department can mitigate some of this potential by selecting non-migrating stock, if available. However, some sheep in any population will "pioneer," and look for new areas. In these cases, the Department will address these potential migrations when they occur.

Zone Two –

Zone Two is located east of Enterprise and continues to the Idaho border, covering about 300,000 acres. There are about 100 bighorns along the lower Imnaha River. This population is increasing slowly. Four of the seven Rocky Mountain bighorn sheep hunting permits allowed in Oregon are permitted in this zone. There is currently one vacant sheep allotment, Canyon, which was last grazed by sheep in 1977. Forty to fifty Forest Service horses currently winter graze a portion of this allotment.

Since this zone contains a vacant sheep allotment, no bighorn or domestic sheep would be reintroduced into the Canyon allotment until the "Analysis Process" is followed. Bighorns could be reintroduced outside of the Canyon allotment in zone two, if the conditions outlined in zone one management were met. If a decision is made to not restock the allotment with domestic sheep, zone one management would prevail. If restocking the allotment with domestic sheep is decided, zone four management would apply.

This zone has five potential reintroduction/supplements. Two of these, H and I, are far enough away from Canyon Allotment that ODF&W feels reintroductions would have a low risk. All five sites are considered high priority by the Department.

Zone Three -

Zone Three is located directly south of Enterprise and covers the entire west side of the Wallowa Mountains, about 400,000 acres. About 45 bighorns are located along the Lostine River (which once numbered 110 head), and about 40 head represent the Bear/Minam herd. Both populations are slowly increasing. This zone has two potential reintroduction sites.

The zone contains several cattle allotments and four vacant domestic sheep allotments (Minam River, Standley-Huckleberry, Huckleberry, and Sheep Rock). Since this zone contains vacant sheep allotments, no bighorn or domestic sheep would be reintroduced until the "Analysis Process" is followed. Bighorns could be reintroduced outside of these vacant allotments within zone 3, if the conditions outlined in zone one were met. If it was decided to not stock any of the 4 vacant allotments with domestics, zone one would apply. Zone four would apply if any of the vacant allotments would be restocked with domestics.

Zone Four -

Zone Four contains about 350,000 acres and lies just southeast of Enterprise. There are only 5 to 10 bighorns remaining in the Upper Hells Canyon herd. Once numbering about 40, there have been a couple of major die-offs since 1983. The Department has identified two areas for possible reintroduction, both of which are considered low priority because of an active domestic sheep operation.

Temperance/Snake and Mud Duck sheep allotments have been active for many years. The sheep winter along the Snake River and move to the upper Imnaha drainage in summer. As long as these allotments remain active, the Department has no plans for reintroducing bighorns. If these allotments ever became vacant, the "Analysis Process" would be followed prior to any restocking of bighorn or domestic sheep.

The existing bighorns or others that move into active sheep allotments in zone four are considered at risk. If bighorns are found in active sheep allotments, the agency that makes the initial finding will immediately notify the WWNF. State agency action in these situations will be to remove or eliminate the bighorns if they consider them a possible source of disease transmission to any established bighorn herd.

The following management guidelines will be used on active domestic sheep allotments to help resolve potential conflicts between domestic and bighorn sheep:

a. Culling of domestic sheep - all obviously sick or lame sheep will be removed from the band prior to entering the National Forest allotment.

b. Upon entering or leaving an allotment or when moving between major grazing areas, the permittee will make every effort to ensure that no domestic sheep are left behind. If strays are found, they will be removed from the allotment, returned to the band, or disposed of by the permittee after the permittee discovers the problem or within 3 days after being notified by the Forest Officer.

c. While on the allotment, domestic sheep will be routed according to the approved annual operating plan and will not be allowed to graze outside the area planned for use. If unforeseen circumstances cause a need to change, the change must be approved in advance by the Forest Service. If domestic sheep are grazed outside the scheduled area without written approval, this will be cause for adverse action against the term grazing permit. In addition, the permittee will be required to move the livestock back into the scheduled area as soon as the problem is discovered or within 3 days following notification by the Forest Officer. The Forest Service will not tolerate non-compliance with the annual operating plan, and appropriate timely corrective actions will be implemented.

d. The domestic sheep permittee will comply with all applicable state laws dealing with interstate transport of livestock. In addition, for situations where the domestic sheep will be grazing in areas near bighorn range, the Forest Service may require tests and veterinarian certification for certain other diseases prior to placement of the sheep on the allotment.

e. All domestic sheep herders will be required to promptly report sightings of any bighorn to the permittee, who will then pass on the information to ODF&W and the Forest Service for appropriate action. The period of time between initial bighorn sighting and reporting to ODF&W will rarely exceed ten days. If bighorn sheep are seen approaching the domestic sheep, the herder will take all precautions to keep the bighorns separate from the herd. These steps may include moving the domestic sheep, chasing off the bighorns, creating noises, or other means of harassment to discourage the approach of the bighorns.

Zone Five –

Zone five is located about 12 miles north of Wallowa and covers only about 38,000 acres. This area currently has no bighorns. Only one site (Mud Creek) has the potential for reintroduction. ODF&W considers this a very low priority for reintroduction because it is an active sheep allotment.

Two dual use sheep and cattle allotments, Mud and Davis Creeks, have been active for many years. As long as these allotments remain stocked with domestic sheep, the Department has no plans for reintroducing bighorns. Animal management for domestic sheep and bighorn strays will be the same as zone four.

Zone Six -

This area is the small fringe Forest land adjacent to the Grande Ronde River. There are currently no bighorn sheep, but there is one low priority location that ODF&W feels could support a small herd. Only one cattle allotment is within the area, and presents no conflicts with any potential bighorn reintroduction. The zone borders the N. end Transitory sheep allotment which could present potential conflicts in the future between wild and domestic sheep. Presently, however, there is a buffer between the two species.

Since most of bighorn habitat lies on the adjacent Umatilla National Forest, this document will defer any bighorn management within this zone to that Forest.

Zone Seven -

Zone seven is the Idaho portion of the HCNRA and covers about 120,000 acres. About 40 to 50 bighorns occupy two locations. Both populations are declining, and their current status is undetermined. The cause of the current die-off is undetermined at this time.

The Idaho Department of Fish and Game (IDFG) has identified three sites: Granite, Bernard, and Sheep Creeks for potential supplementation. Priority for all three sites is considered only moderate, due to Sheep Creek, a currently active sheep allotment. If the allotment no longer had domestic sheep grazing, the sites would have a high priority. Management of this allotment would be similar to zone four.

There is another sheep allotment on the Idaho side, Big Canyon, which has been vacant since 1982. The "Analysis Process" would be followed prior to restocking of either bighorn or domestic sheep.

Zone Eight -

The very southern edge of the Forest, near Dooley Mountain, comprises zone 8. In 1987, about 15 California bighorn sheep were introduced on Bureau of Land Management lands at the base of Hooker Gulch. The herd has grown to about 35 and is staying very close to where they were released. ODF&W does not feel, at this time, the zone has any other potential bighorn release sites.

Currently, there are no domestic sheep allotments in this zone. The 6 cattle and horse allotments should pose no conflicts with bighorns. If ODF&W identifies a potential release site, management of this zone would follow zone one.

Zone Nine -

The rest of the Forest is in this zone. There are no Rocky Mountain bighorn sheep populations. However, historical records show that bighorns occupied the Elkhorn Mountains. ODF&W has identified one moderate priority site in the Elkhorns that has potential to reintroduce bighorns. This is considered a low risk site, because there are no domestic sheep allotments nearby. For this site, zone one management would apply.

The north part of this zone has 2 active sheep allotments (Spring Creek and McCarty), and 2 vacant sheep allotments (Chicken Hill and Indian Crane). Currently, the north part of this zone has very little potential for bighorn reintroductions and ODF&W has no plans to do so.

Management for All Zones

There are a number of private farm and range flocks surrounding the Forest. If bighorns move down into these domestic sheep, it is important that ODF&W biologists are contacted as quickly as possible. ODF&W will take the lead in organizing a public education process that will make the public more aware of the potential for bighorn/domestic sheep disease transmission.

The proximity of private farm flocks to potential bighorn transplant sites on the WWNF will be considered by both agencies in the decision process for future bighorn transplants. If there's a high probability of physical contact between domestic and wild sheep, it may be the best decision to not transplant bighorns in that area.

APPENDIX A

Locations of Potential Reintroductions/Supplements

Map Letter	Zone	Location		State	Priority
A	1	Bear Ridge	Reintro	ODFW	High
B	1	Table Mountain	Supp	ODFW	High
C	1	Cache Creek	Reintro	ODFW	High
D	1	Deadhorse Ridge	Supp	ODFW	High
E	2	Deep Creek	Reintro	ODFW	High
F	2	Tryon Creek	Reintro	ODFW	High
G	2	Pumpkin Creek	Reintro	ODFW	High
H	2	Sheep Divide	Reintro	ODFW	High
I	2	Devils Gulch	Reintro	ODFW	Moderate
J	3	Minam	Supp	ODFW	High
K	3	Cornucopia	Reintro	ODFW	Low
L	4	Sand Creek	Reintro	ODFW	Low
M	4	Battle Creek	Supp	ODFW	Low
N	4	Spring Creek	Reintro	ODFW	Low
O	5	Mud Creek	Reintro	ODFW	Low
P	6	Grande Ronde	Supp	ODFW	Low
Q	7	Granite Creek	Supp	IDFG	Moderate
R	7	Bernard Creek	Supp	IDFG	Moderate
S	7	Sheep Creek	Supp	IDFG	Moderate
T	8	Rock Creek	Reintro	ODFW	Moderate

ODFW - Oregon Department of Fish and Wildlife
IDFG - Idaho Department of Fish and Game
Reintro - Reintroduction of new herds
Supp - Supplement existing herds

APPENDIX B

STATUS OF DOMESTIC SHEEP ALLOTMENTS

Active Domestic Sheep Allotments

Sheep Creek - HCNRA (Idaho portion)

Temperance-Snake - HCNRA

Mud Duck - HCNRA and Eagle Cap RD's

Spring Creek – La Grande RD

McCarty – La Grande RD

Mud Creek (dual use) - Wallowa Valley RD

Davis Creek (dual use) - Wallowa Valley RD

Vacant Domestic Sheep Allotments

Big Canyon - HCNRA (Idaho)

Canyon - HCNRA

Minam River - Eagle Cap RD

Standley-Huckleberry - Eagle Cap RD

Huckleberry - Eagle Cap RD

Sheep Rock - Pine RD

Chicken Hill – La Grande RD

Indian Crane - Baker RD

APPENDIX C

Status of Bighorn Sheep Herds
on or Near the WWNF
September 1991

Herd Name	Management Unit	Population #'s	Population Trends	
Lostine	Minam	45	Slowly increasing	App
Lower Imnaha	Snake River	100	Increasing	App
Upper Hells Canyon	Snake River	5-10	Static	App
Cherry Creek	Chesnimnus	30	Slowly Increasing	Non
Bear/Minam	Minam	40	Increasing	App
Upper Joseph Creek	Sled Sps/Ches	30	Increasing	Non
Lower Joseph Creek	Sled Springs	10-15	Summer range for Wash	XXX
Granite/Three Crks	18	40-50	Declining	App
Sheep Mountain	Pine Creek	30	Slowly Increasing	XXX
Hooker Gulch	Sumpter	35	Slowly Increasing	XXX

App - Release was approved through the environmental assessment process
Non - Not approved through the process.
XXX - On private, state, and/or BLM land

APPENDIX D

LIST OF PERTINENT BIGHORN SHEEP DOCUMENTS

1. Cooperative Management Agreement - Supplemental Release of Bighorn Sheep Snake River 12/14/89.

2. Guidelines for Bighorn/Domestic Sheep Management on the WWNF. 1988.

3. Bighorn Sheep Management Plan written by ODFW. 1986

4. Environmental Assessment for Lower Minam Area Bighorn Sheep Reintroduction 9/10/85.

5. "Whitepaper" - Guidelines for bighorn sheep/domestic sheep management on the Wallowa-Whitman National Forest. 1981

6. Environmental Assessment and Memorandum of Understanding for Reintroduction of Bighorn Sheep in the Imnaha River Drainage 1/2/79.

7. Memorandum of Understanding for Transplant of 20 Bighorns to Black Mountains 1/10/78.

8. Addendum to Environmental Assessment for Reintroduction of Bighorns into Bear Creek 12/28/83.

9. Memorandum of Understanding for Transplant of 25 Bighorns from Lostine River to Bear Creek 12/23/76.

10. Memorandum of Understanding for Reintroduction of 20 Bighorns to Sheep Creek Divide 7/10/86.

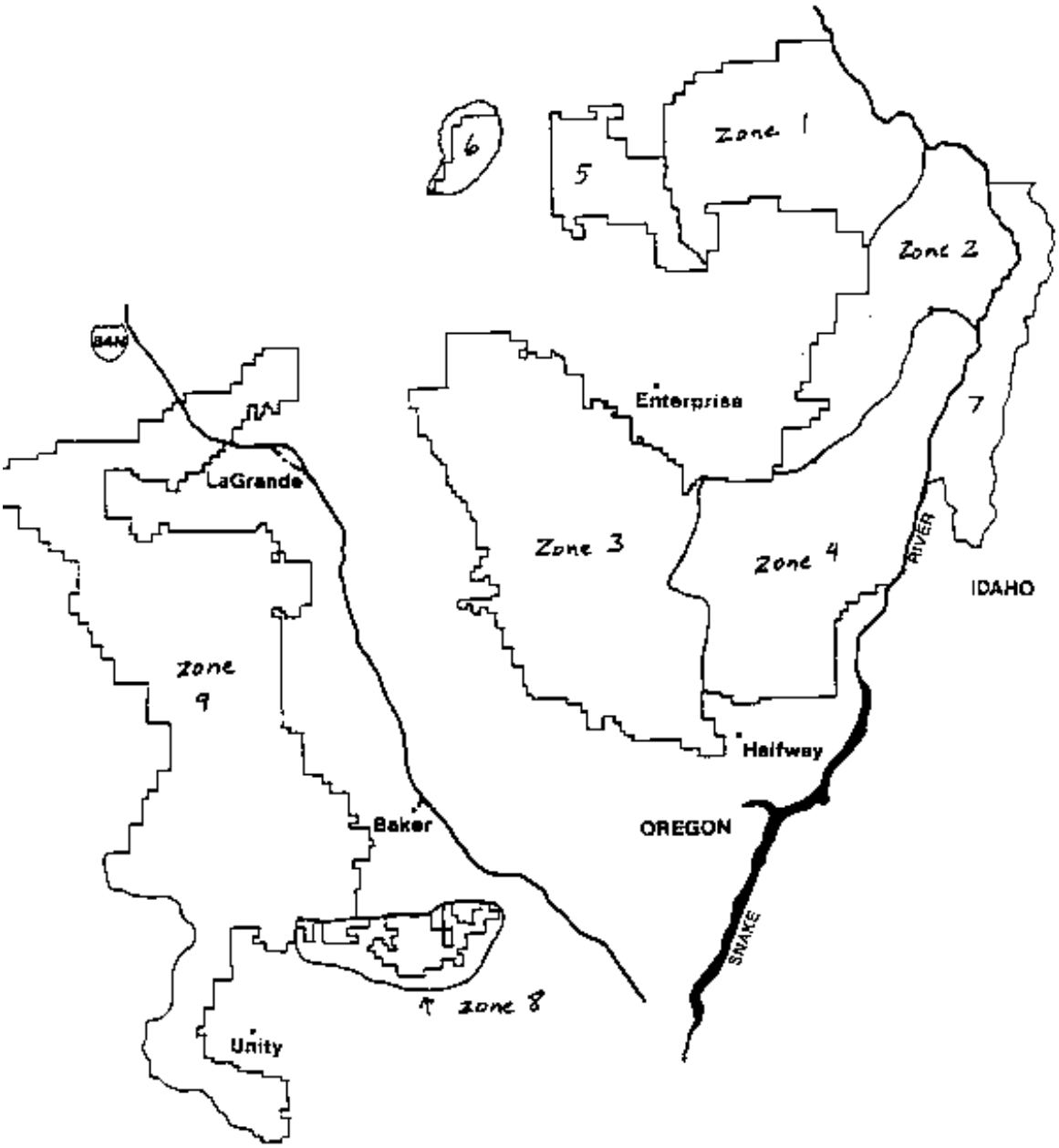
11. Environmental Assessment for Bighorn Reintroduction on Snake River 1/20/76.

12. Multiple Use Survey Report for Bighorn Sheep Transplants 1/70.

13. Lostine River Biological Unit Management Plan 11/10/71.

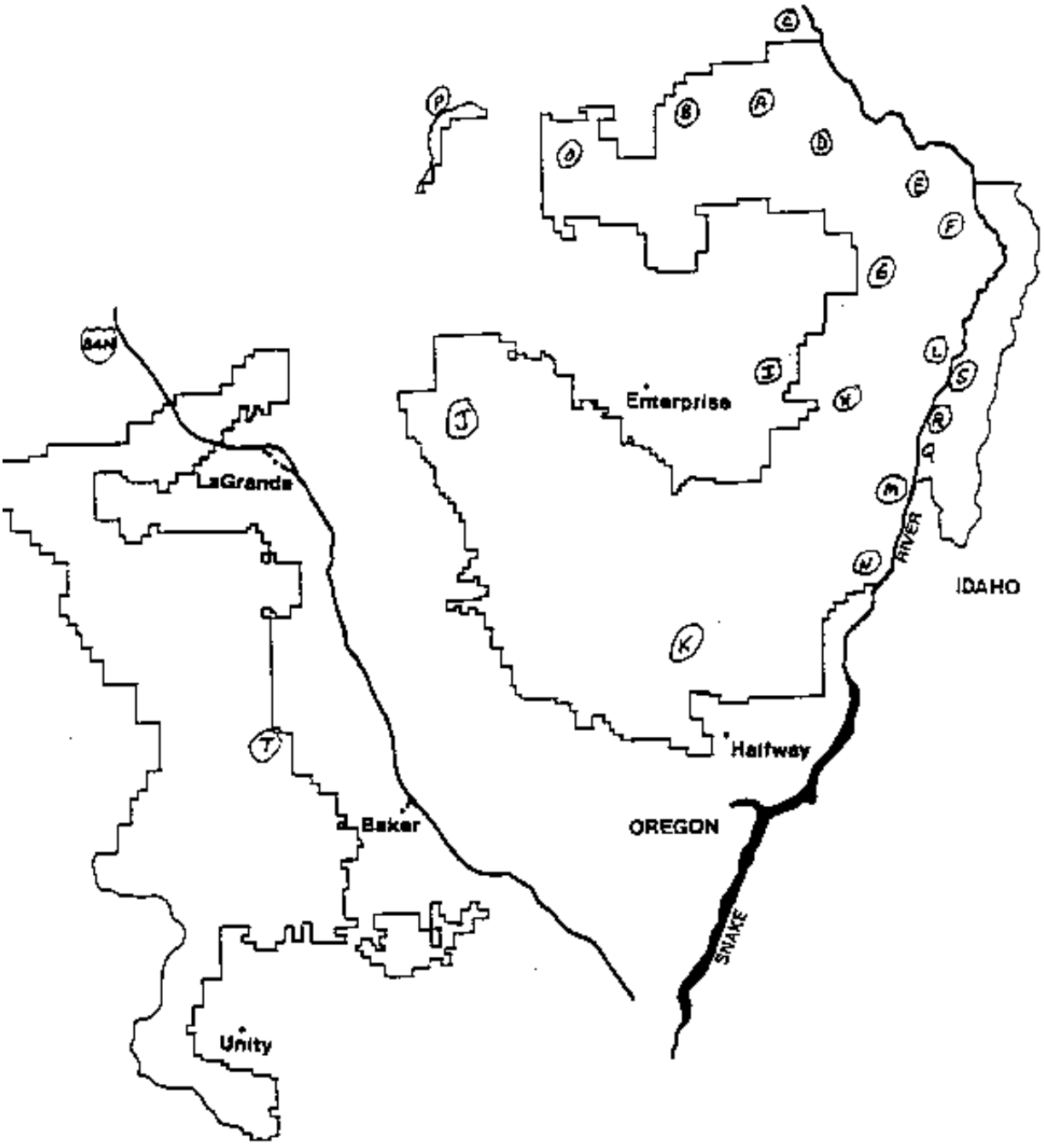
APPENDIX E

BIGHORN/DOMESTIC SHEEP MANAGEMENT ZONES



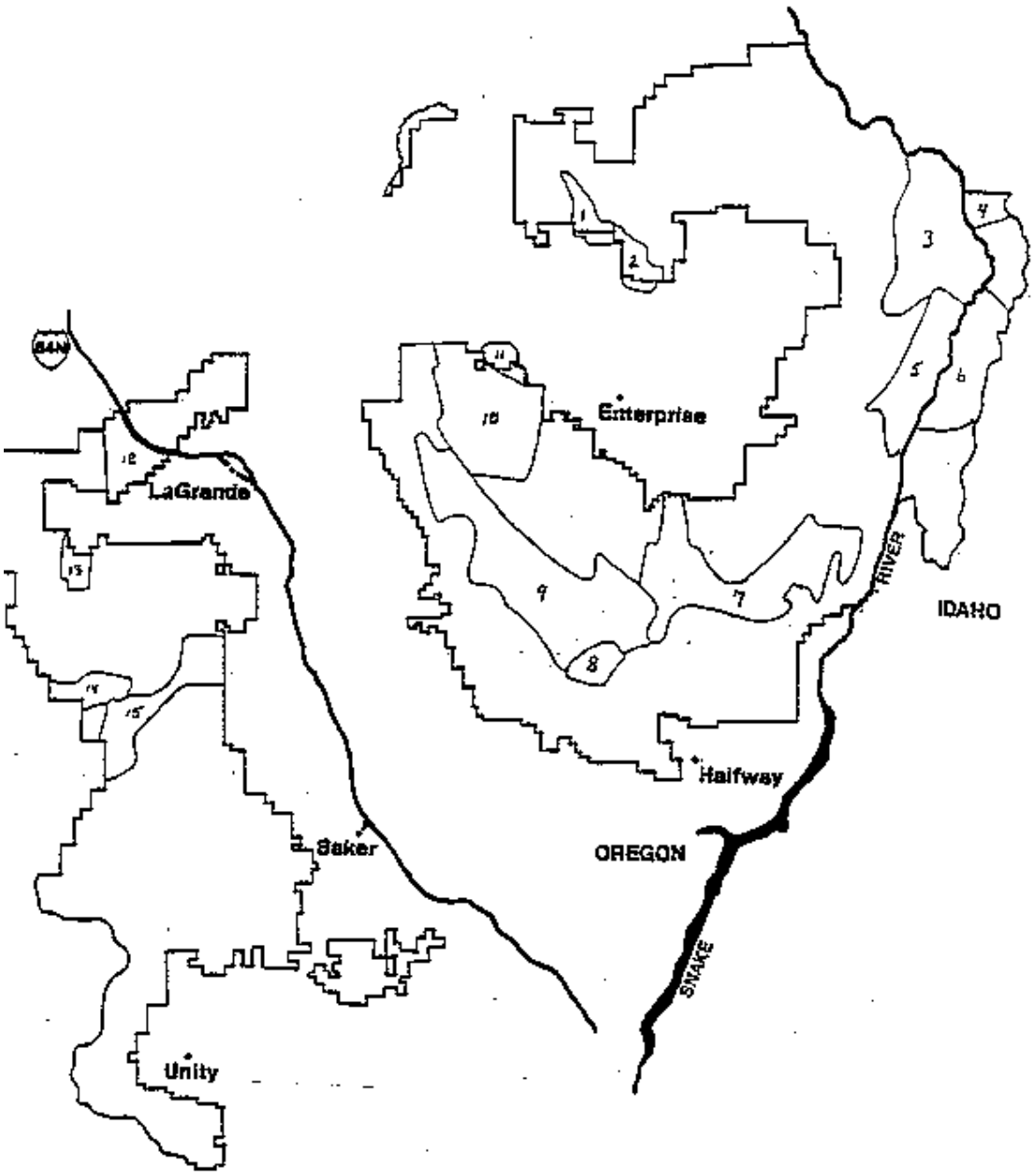
APPENDIX F

POTENTIAL REINTRODUCTION



APPENDIX G

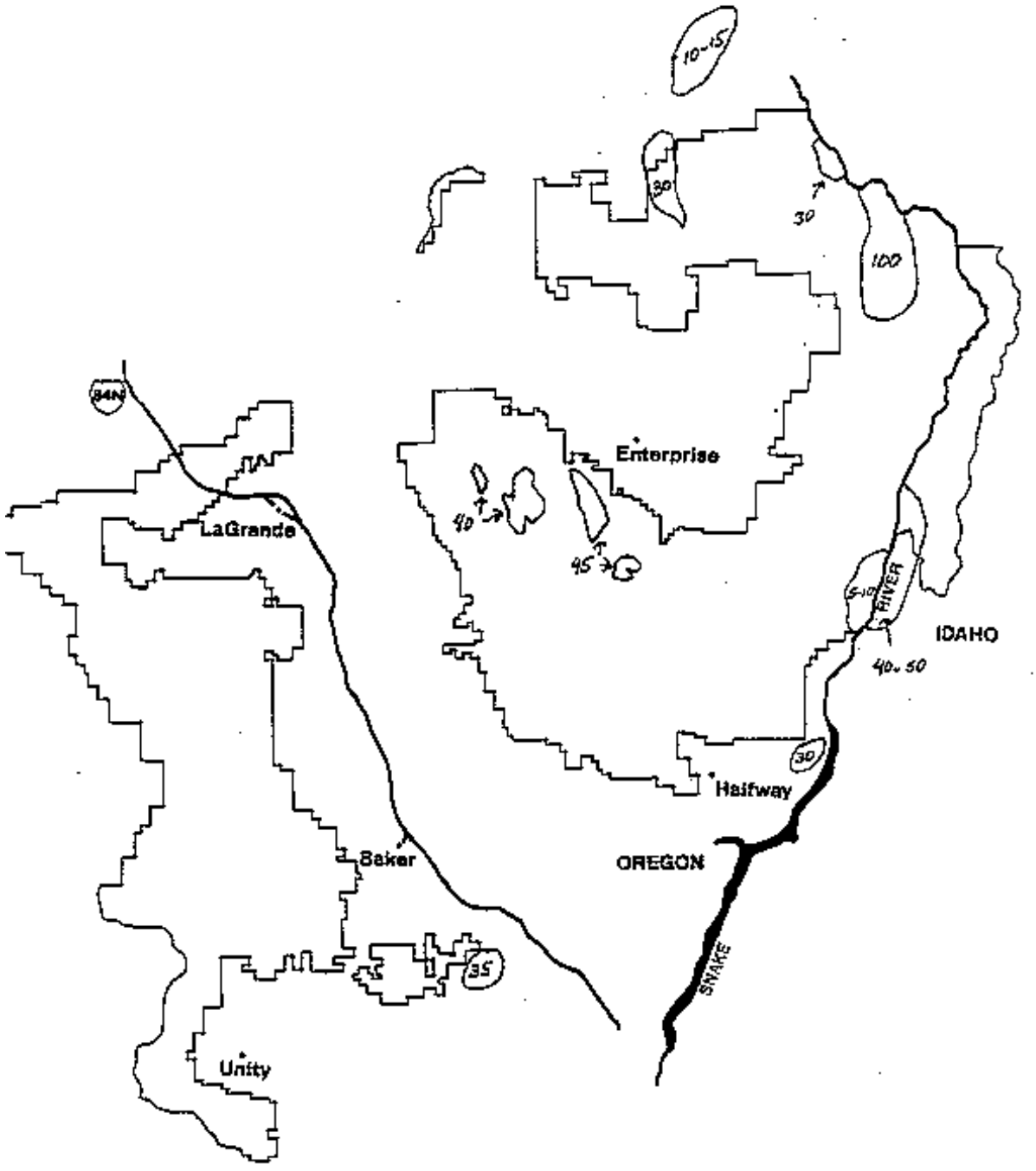
DOMESTIC SHEEP ALLOTMENTS



DOMESTIC SHEEP ALLOTMENTS	
1. MUD CREEK	8. SHEEP ROCK (V)
2. DAVIS CREEK	9. MINAM RIVER (V)
3. CANYON (V)	10. STANDLEY
4. BIG CANYON (V)	11. HUCKLEBERRY (V)
5. TEMPERANCE-SNAKE	12. SPRING CREEK
6. SHEEP CREEK	13. MCCARTY
7. MUD DUCK	14. CHICKEN HILL (V)
	15. INDIAN CRANE (V)

APPENDIX H

BIGHORN HERD LOCATIONS AND SIZES



LIST OF THOSE RESPONDING TO BIGHORN/DOMESTIC SHEEP MANAGEMENT STRATEGY

August 1991

1. Jon Vanderheyden
2. Ed Watters
3. BLM Baker Office
4. Hells Canyon Preservation Council
5. Idaho Department of Fish and Game
6. Umatilla National Forest
7. Art Seamans
8. Paul Morehead
9. Skye Krebs

APPENDIX B

5.42 Bighorn Sheep Habitat

Theme

Management emphasis is to provide adequate amounts of quality forage, cover, escape terrain, and solitude for bighorn sheep and other species, while allowing vegetative manipulation that provides other multiple-use resources.

Management area description

These areas provide habitat for established bighorn sheep herds on the Forest. To ensure bighorn sheep viability, maintaining and improving the habitat upon which bighorn sheep depend is emphasized. Much of the area contains cliffs, rocky points, and benches intermixed with grass, forb, and shrub communities. Forested stands may also be present.

Desired condition

Herd objectives are established in cooperation with the Colorado Division of Wildlife. Interpretive opportunities are provided in established viewing areas.

Vegetation is managed to provide healthy plant communities with a variety of species present for food and cover. Natural and created openings or meadows of various sizes and shapes occur. Prescribed natural fire and management-ignited fire plans are developed in support of habitat improvement.

The recreation opportunity spectrum (ROS) for this management area is primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, or rural year-round. For the ROS designation of a particular area, see the ROS maps in Appendix XX. Scenery is managed to provide a range of scenic integrity objectives from moderate to high as shown on the Scenic Integrity Objective maps in Appendix XX.

Standards and guidelines

INFRASTRUCTURE

Standard **1.** Over-the-snow vehicle use is restricted to designated routes.

MINERAL AND ENERGY RESOURCES

Guideline **1.** These areas are available for oil and gas leasing with controlled surface use or timing restrictions.

RANGE

Standards

1. Grazing strategies will be implemented to meet bighorn sheep habitat objectives.

2. Grazing by domestic sheep is prohibited unless adequate temporal or spatial separation can be demonstrated.

RECREATION

Guidelines

1. Recreation activities that disturb bighorn sheep should be restricted.

2. Provide interpretive opportunities in established viewing areas.

VEGETATION MANAGEMENT

Standards

1. These areas are not part of the suitable timber land base.

2. Vegetation management practices will be used to maintain or improve bighorn sheep habitat.

APPENDIX C

BIGHORN SHEEP
HERD UNIT REVIEW

Targhee (Area 6) (BHS106) **Revision Date: 4/17/98**

Estimated Population: 100 (post season 1997)

Population Objective: 125

Most Recent Hunting Regulations: 4 licenses, 3/4 curl ram

Current WGFD Managers: Doug Brimeyer, Steve Kilpatrick, Doug Crawford

JCR Responsibility: Doug Brimeyer

Other Contacts: Mary Oshner (USFS), Garvice Roby (WGFD-Ret.), Steve Cain (NPS)

Previous Studies: Steve Cain (NPS Reports)
N. Fitzsimmons & S. Buskirk (1992)
Mike Whitfield (1984)

Problems:

Habitat - Limited winter range, lack of fire
Domestic Sheep - Buffer zone only 3 miles (enough?)
Predation -
Genetics - Isolated population
Disease -
Migration -
Herbivore Competition -
Recreation/Development Encroachment -
Poor/Inconsistent Classification Data -
Hunting Related - Variable harvest due to land status (Grand Teton National Park)
Other - High natural mortalities (GTNP)

Jackson (Area 7) (BHS107) Revision Date: 4/17/98

Population Estimate: 530 (post season 1997)

Population Objective: 500

Most Recent Hunting Regulations: 20 licenses any sheep

Current WGFD Managers: Doug Brimeyer, Gary Fralick, Doug Crawford, Dallas Jenkins

JCR Responsibility: Doug Brimeyer

Other Contacts: Adrian Villaruz (USFS), Garvice Roby (WGFD-Ret.)

Previous Studies:

Honess and Frost (1942)
Les McCann (1956)
Buechner (1960)

Transplant History:

1934 Transplant - 20 sheep trapped in Flat Creek, released in Bighorn Mountains - Hurley (1996)
1980 Transplant - 14 sheep released at Stinking Springs - Roby (1980)
these sheep were destined for Darby Mtn., but weather conditions precluded their release there, so they were turned out at Stinking Springs
- 11 sheep were released on Flat Creek

Total - 25 sheep released into herd unit

Problems:

Habitat - Habitat conditions (Willow Creek), lack of fire
Domestic Sheep - Yes, potential for contact on south end of herd unit
Predation -
Genetics - Scattered, isolated populations
Disease - Scabies at Camp Creek
Migration -
Herbivore Competition - Elk competition
Recreation/Development Encroachment - Snow machine disturbance
Encroachment on winter range - Stinking Springs
Poor/Inconsistent Classification Data -
Hunting Related -
Other - Recent overwinter mortality

Wapiti Ridge (Area 3) (BHS203) Revision Date: 4/17/98

Population Estimate: 925 (post season 1997)

Population Objective: 1000

Most Recent Hunting Regulations: 44 licenses, 3/4 curl ram

Current WGFD Managers: Larry Roop, Craig Sax, Tim Fagan

JCR Responsibility: Larry Roop

Other Contacts: Dave Henry, Bernie Spanogle (USFS), Kevin Hurley, Scott Smith, Doug McWhirter (WGFD)

Previous Studies: Hurley (1985)
Smith (1988)
McWhirter (1993)

Problems:

Habitat - Private land issues - winter range - reliance on improved meadows, valley, ranch
Fenced in holdings in USFS - Land exchange
CRM - Upper South Fork - USFS initiated
Weed problems on winter range - "toadflax"
Tremendous habitat opportunities - limber pine/juniper, S. Fork side - some on N. Fork, but limited.
Conifer encroachment

Domestic Sheep - Potential for domestic sheep on private lands - easement potential?

Predation - Predation - wolves - Upper South Fork

Genetics –

Disease - Disease – scabies

Migration –

Herbivore Competition - Elk numbers?? South Fork
Livestock issues - Ishawooa Hills

Recreation/Development Encroachment - Winter range encroachment - Recreation (ice climbing, photographers, wildlife viewers)
Worth The Watching - Lots of interest- High profile

Poor/Inconsistent Classification Data –

Hunting Related –

Other - Prospects for trapping - up to 80 sheep

Francs Peak (Area 5, 22) (BHS205) Revision Date: 4/17/98

Population Estimate: 1430 (post season 1997)
Three components: Area 5, Badlands (Area 22), Owl Creek Mountains/ Wind River Indian Reservation (OCM/WRIR)

Population Objective: 1360

Most Recent Hunting Regulations: Area 5-60 licenses any ram, Area 22-4 licenses 3/4 curl ram, OCM/WRIR-8 licenses any ram

Current WGFD Managers: ColeThompson, Pat Hnilicka, Tim Fuchs, Jerry Longobardi, Kevin Hurley, Tim Fagan

JCR Responsibility: Kevin Hurley

Other Contacts: USFWS - Dave Skates, Jeff Kimber, USFS - Joe Hicks, Mark Hinschberger, Dave Henry
BLM - Sue Oberlie, Tim Stephens, Marian Atkins, Kathy Firchow (formerly USFWS)

Previous Studies: Hurley/Firchow (1994)
Smith (1981)

Transplant History:

1970 Transplant - 23 sheep released at Castle Creek -WGFD (1976), Oudin (1996), Hurley (1996)
1973 Transplant - 17 sheep released at the Dennison Place - WGFD (1976), Hurley (1996)
1995 Transplant - 43 sheep released in Wind River Canyon - USFWS (1996), Hurley (1996)

Total - 83 sheep released into herd unit

Problems: Hunt Area 5

Habitat - Habitat opportunity - on and off USFS - on Inberg-Roy WHMA
Domestic Sheep - Livestock - 6 "vacant" domestic sheep allotment - USFS looking to fill these?
Predation - Predation -future? - wolves/ no escape cover (Dennison) Little escape cover on Black Mountain, better escape cover higher
Genetics –
Disease - Disease - minor, scabies
Migration - Reservation - Unoccupied habitat - 40 mile migration lost - from Wind River Canyon to Owl Creek Mtns.
Herbivore Competition - Wild horses on sheep winter range (WRIR)
Recreation/Development Encroachment –
Poor/Inconsistent Classification Data –
Hunting Related –
Other - Unoccupied habitat - 50's-60's - thousands of domestic sheep, slowly coming back in these areas, Reintroduction potential

Problems: Hunt Area 22 (Badlands)

Habitat - Habitat improvement potential high - Wiggins Fork to Badlands
Private meadows
Domestic Sheep -
Predation -
Genetics -

Whiskey Mountain (Area 8, 9, 10, 23) (BHS609) Revision Date: 4/17/98

Population Estimate: 950 (post season 1997)

Population Objective: 1350

Most Recent Hunting Regulations: Area 8-4 licenses any ram, Area 9-8 licenses 3/4 curl ram, Area 10-16 licenses 3/4 curl ram, Area 23-8 licenses any ram

Current WGFD Managers: Pat Hnilicka, Cole Thompson, Bob Yates, Doug McWhirter, Duke Early, Dan Stroud

JCR Responsibility: Pat Hnilicka

Other Contacts: Mark Hinschberger, Barb Franklin (USFS), Sue Oberlie (BLM)

Previous Studies: Thorne et al. (1976)
Thorne et al. (1984)
Ryder et al. (1992)
Ryder et al. (1994)
Corruthers GIS Study (date?)
Hnilicka et al. (1997)

Transplant History:

1,894 sheep have been trapped on Whiskey Mountain winter ranges for relocation elsewhere (1949-1995)
1,878 sheep were released at their respective destinations
99.2% survival for all sheep relocation efforts spanning a 46-year period

1,489 were released in Wyoming, 389 were released in other states - Hurley (1996)

Problems:

Habitat - Forage quality?
Mineral quality?
Heavy forage use on portions of winter range (90%+ on some preferred sites)
Very limited winter range in Upper Green River
Some resident (year-round) use by sheep on Torrey Rim and Torrey Creek

Domestic Sheep - Domestics on Pinedale side, particularly Baldy Lake & North Fork Allotments

Predation -

Genetics -

Disease - Chronic Disease? Pasturella trehelosi present as of 3/97 in 5 of 9 ewes tested

Migration -

Herbivore Competition - Elk Competition

Recreation/Development Encroachment - Recreation - dogs/people

Poor/Inconsistent Classification Data -

Hunting Related -

Other - Poor lamb production (6th year), resulting in declining population
Tenuous access across Wind River Indian Reservation to portions of winter range (Red Creek)

Temple Peak (Area 11) (BHS610) Revision Date: 4/17/98

Population Estimate: 35 (excluding WRIR) (post season 1997)

Population Objective: 250

Most Recent Hunting Regulations: CLOSED

Current WGFD Managers: Tom Ryder, Bob Trebelcock, Chuck Clarke, Doug McWhirter, Tom Christiansen,
Allan Round, Dan Stroud, Dennis Almquist

JCR Responsibility: Tom Ryder

Other Contacts: Bob Lanka, John Emmerich (WGFD), Ken Persson (WGFD-ret.), Jack Welch (BLM-ret.),
Barb Franklin (USFS)

Previous Studies: Smith (1981)
Deibert (1994)
Firchow (1995)
Ryder and Lanka (1997)

Transplant History:

1964 Transplant - 21 sheep released in Sinks Canyon - Ryder & Lanka (1996)
1965 Transplant - 20 sheep released in Sinks Canyon - Ryder & Lanka (1996)
1966 Transplant - 18 sheep released in Sinks Canyon - Ryder & Lanka (1996)
1971 Transplant - 13 sheep released in Cherry Creek - Ryder & Lanka (1996)
1973 Transplant - 39 sheep released in Cherry Creek - Ryder & Lanka (1996)
1987 Transplant - 77 sheep released in Sinks Canyon & N. Fk. Popo Agie - Ryder & Lanka (1996)
1988 Transplant - 47 sheep released in S. Fk. Little Wind River - Firchow (1995)
1993 Transplant - 42 sheep released in S. Fk. Little Wind River - Firchow (1995)

Total - 277 sheep released into herd unit (including WRIR) - summarized in Hurley (1996)

Problems:

Habitat - Lack of Fire

Domestic Sheep - Past exposure to domestics on winter range
Real potential of co-mingling on summer range west of Continental Divide

Predation -

Genetics -

Disease -

Migration - Interrupted migration corridors - conifers

Herbivore Competition -

Recreation/Development Encroachment - Recreation - (Sinks Canyon/N. Fork/Cherry

Crk)

Poor/Inconsistent Classification Data - Data difficult to obtain - inconsistent
Hunting Related -
Other -

APPENDIX D

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LITERATURE REVIEW REGARDING THE COMPATIBILITY BETWEEN BIGHORN AND DOMESTIC SHEEP

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Abstract: A literature review was conducted regarding the compatibility of bighorn sheep and domestic sheep. In both fenced studies and free ranging herds, most contact between bighorn sheep and domestic sheep has resulted in pneumonia in bighorns and the deaths of all or most bighorns while domestic sheep remained healthy. Published research has shown that *Pasteurella haemolytica* (usually biotype A, serotype 2) is the major pathogen responsible for the death of bighorn sheep after contact with domestic sheep. DNA fingerprinting has proven the transfer of *Pasteurella* spp. between bighorn and domestic sheep under both controlled "experimental" and range conditions. No studies reported any bighorn herds, fenced or free ranging, that have come into contact with domestic sheep and remained healthy. No vaccine currently exists that will prevent bighorn sheep from developing pneumonia after contact with virulent strains of *Pasteurella.* With the current information, almost all wildlife professionals, wildlife veterinarians and researchers have concluded that bighorn sheep and domestic sheep should not occupy the same ranges or be managed in close proximity to each other, because of the potential adverse effect from disease on bighorn sheep.

BACKGROUND

This is an updated report and literature review of information pertaining to the compatibility of bighorn and domestic sheep. The original review was requested by Regional Forester, John Lowe in 1993, with the content to be used as the basis for future decisions for the management of bighorn sheep and domestic sheep within the boundaries of Hells Canyon National Recreation Area, on the Wallowa-Whitman National Forest.

Current bighorn sheep numbers in the western United States have been estimated to be less than 1% of what they were prior to presettlement (Goodson 1982). Rocky mountain bighorn sheep (*Ovis canadensis canadensis)* were native to much of the mountain and canyon country which currently comprises a large proportion of the Wallowa-Whitman National Forest in Northeast Oregon and western Idaho. Specifically, historical accounts indicate that bighorns were numerous in the drainages in and around the Wallowa Mountains (Bailey 1936), the lower Imnaha River, Snake River, Grande Ronde River, Elkhorn Mountains, Powder River, and Joseph Canyon. The last Rocky Mountain bighorn sheep were gone from northeastern Oregon by 1945 (Oregon's Bighorn Sheep Management Plan 1992). Current numbers of Rocky Mountain bighorn sheep in the Hells Canyon National Recreation Area are also a fraction of what they were historically. Archaeological studies indicate wild sheep were a significant ungulate food item for Native Americans (USDA Forest Service Report 1991).

Following enormous population declines in the United States in the late 1800s and early 1900s, bighorn populations did not recover, in contrast to many other wildlife species. Bighorns have demonstrated less tolerance than other native North American ungulates to poor range conditions, interspecific competition, over hunting, and stress caused by loss of habitat (Desert Bighorn Council 1990). Most important, they have shown a much greater susceptibility to diseases (Goodson 1982).

In the last century wild sheep numbers have declined, their populations suffering from a wide variety of diseases, some that they have contracted from domestic sheep (Geist 1971). Some of these include scabies, chronic frontal sinusitis, internal nematode parasites, pneumophilic bacteria, footrot, parainfluenza III virus, bluetongue virus, and contagious ecthyma (Desert Bighorn Council 1990). Documented bighorn die-offs were recorded as early as the mid-1800s and have continued up to the present (Table 1) (Goodson 1982, Foreyt and Jessup 1982, Coggins 1988, Onderka

et al. 1988, Foreyt 1989, Desert Bighorn Council 1990, Foreyt 1990, Callan et al. 1991, Hunter 1993, Foreyt 1993, Foreyt et al. 1994). Bighorn sheep die-offs have occurred in every state in the western United States. In recent years biologists and researchers have suspected that even casual contact between bighorn sheep and domestic sheep may lead to respiratory disease and fatal pneumonia in the bighorns (Onderka and Wishart 1988). The role of domestic sheep in the epizootiology of bighorn sheep pneumonia is an important issue in multiple use management (Foreyt et al. 1994).

FINDINGS

There is strong evidence (Table 1) that the presence of domestic sheep with bighorn sheep caused the loss of part or all of the affected bighorn sheep population. The lack of compatibility between domestic sheep and bighorn sheep is evidenced by the fact that no bighorn populations exist anywhere in the state of Nevada where domestic sheep are currently being grazed (McQuivey 1978). Goodson (1982) reported that no bighorn sheep herds, that occurred with domestic sheep on their ranges were increasing except those on ranges where use by domestic sheep has been significantly reduced. With the information currently available, most wildlife professionals, wildlife veterinarians and researchers have concluded that bighorn sheep and domestic sheep should not occupy the same ranges or be managed in close proximity to each other, because of the potential adverse effect on the bighorn sheep (Jessup 1980, Foreyt and Jessup 1982, Goodson 1982, Jessup 1982, Kistner 1982, Wishart 1983, Coggins 1988, Jessup 1988, Onderka et al. 1988, Foreyt 1989, Foreyt 1990, Desert Bighorn Council 1990, Callan et al. 1991, Coggins and Matthews 1992, Foreyt 1992, USDI BLM Technical Committee 1992, Ward 1993, Foreyt et al. 1994, Foreyt 1994, Pybus et al. 1994, Hunter 1995, Foreyt 1995, University of Idaho 1995).

Of the numerous pathogens affecting bighorn sheep, *Pasteurella haemolytica* is the most important respiratory pathogen of bighorn sheep, and *Pasteurella multocida* may also be important in the pneumonia complex (Foreyt 1993).

Based on experimental data, bighorn sheep are more susceptible to fatal pneumonia than are domestic sheep. Based on all published experimental data, bighorn sheep die after close association with domestic sheep (Foreyt 1993).

Bighorn sheep are highly susceptible to domestic sheep strains of *Pasteurella spp.* while domestic sheep are refractory to bighorn sheep strains (Onderka 1986). Bighorn sheep die after inoculation with specific "strains" of *P. haemolytica* of "healthy" domestic sheep origin (Onderka et al. 1988, Foreyt et al. 1994). Biotype T strains of *P. haemolytica* (*P. treahola*) are found predominately in bighorns and other wild ruminants, biotype A strains of *P. haemolytica* are found predominately in domestic sheep (Foreyt 1993). In a study at the University of Idaho, Biotypes A, T and 3 were isolated from both bighorn and domestic sheep. In culture positive individuals, biotype T organisms were isolated from 76% of the bighorns and 21% of the domestic sheep, while biotype A organisms were isolated from 30% of the bighorns and 75% of the domestic sheep (Ward et al. 1990). There are many serotypes (10-20 or more) of *P. haemolytica* found in both bighorn and domestic sheep. There are many DNA types (50-100 or more) of P. haemolytica in bighorns and domestics. Different DNA types are present within a serotype and different serotypes are within a ribotype. Most *P. haemolytica* serotypes and DNA types look the same on agar, multiple colonies have to be typed from each animal. Multiple biotypes and serotypes can be isolated from the same animal. Tonsillar (pharyngeal) samples yield the highest isolation rate of *P. haemolytica*, nasal swabs have limited value except for the fact that healthy bighorn sheep rarely have *P. haemolytica* detected by nasal swabs. *P. haemolytica* survives for less than 24 hours in the environment, survival on dead animals and on many swabs, placed in medium, is often less than 24 hours, but tends to be longer on swabs. For the highest isolation rates of *P. haemolytica*, special steps must be taken to assure good sampling and preservation of samples.

Studies at Washington State University, one in Edmondton, Canada, and one at the Caine Veterinary Center, Boise, Idaho, have shown that specific types of *Pasteurella haemolytica* and *P. multocida* can be directly transmitted to bighorn sheep from domestic sheep (Onderka and Wishart 1988, Foreyt 1989, Foreyt 1990, Foreyt 1992, Hunter IDFG Letter Dated October 14, 1993) Table 1.

Foreyt et al. 1994 published the results of a study where DNA fingerprinting was used to pinpoint the origin of bacteria that lead to the death of bighorn sheep. Identified was the specific DNA type that caused the death of the bighorn sheep. The DNA type originated in the domestic sheep and had not been present in bighorn sheep before they were inoculated. The bacteria was *Pasteurella haemolytica* (biotype A, serotype 2).

In wild situations, domestic sheep and bighorn sheep association often results in death of the bighorns and does not affect the domestics. Often this is based on circumstantial evidence, because direct disease transmission is difficult to substantiate under field

conditions. The finding of a shared *Pasteurella* spp. (by DNA fingerprinting) between feral domestic sheep and bighorn sheep in a Nevada study suggests the Pasteurella spp. can be transmitted between the bighorn and domestic sheep under range conditions (Hunter 1995, Hunter 1996 personal communication). Deaths occur in bighorns after association with domestic sheep because strains of *P. haemolytica* that are nonpathogentic in domestic sheep are transmitted from domestic sheep to bighorns resulting in pneumonia and death of the bighorns (Foreyt 1993, Foreyt et al. 1994).

When bighorn sheep experience a pneumonia episode, all age mortality often occurs. Lambs that are born into these populations generally experience low survival rates for approximately 3 to 5 years or more after the initial pneumonia (Foreyt 1990, Coggins and Matthews 1992, Ward et al. 1992, Foreyt 1995, Hunter 1995). Observations of bighorn sheep have provided evidence that pneumonia associated *Pasteurella* infections may contribute to the high lamb mortality (Jaworski et al. 1993).

Essentially all ungulates carry some strains of *P. haemolytica* (Foreyt 1995). Experimentally, elk, deer, mountain goat, cattle, llama and domestic goat association with bighorn sheep did not result in pneumonia in bighorns (Foreyt 1992, Foreyt 1993, Foreyt 1994). Evaluation of samples from Idaho and Alaska bighorn sheep has conclusively demonstrated that free roaming bighorn sheep which have not had contact with domestic sheep are not free of *P. haemolytica* (Ward 1990, Heimer et al. 1992). There are isolates of *P. haemolytica* in some domestic sheep that are not lethal in bighorn sheep (Foreyt -1993).

There are bighorn sheep die-offs due to pneumonia that have occurred without any association with domestic sheep (Goodson 1982, Onderka and Wishart 1984, Foreyt 1989, Ward 1993 and Ryder et al. 1994). Researchers agree that there are five primary factors that cause pneumonia in bighorn sheep. These are: 1) the presence of bacteria such as *P. haemolytica* and *P. multocida*, types indigenous to bighorn sheep, which with other factors can predispose bighorns to pneumonia, 2) the presence of stress, examples include: depleted forage or human disturbance, 3) the presence of lungworms, 4) the presence of viruses, and 5) exposure to a virulent strain of *P. haemolytica* from domestic sheep. Research indicates that the first four factors are relatively common at times for bighorn sheep (Foreyt 1995).

Bighorn sheep, in particular young rams, have a propensity to travel outside their home range. Domestic sheep in rugged terrain have a tendency to stray from the main flock. Because of both behaviors, buffers between the two species, unless very large, have often failed.

Although attempts have been made, no effective vaccine currently exists that will prevent bighorn sheep from developing pneumonia after contact with virulent strains of *P. haemolytica* (Foreyt 1995).

CONCLUSIONS

1) In both fenced studies and free ranging herds, most contact between bighorn sheep and domestic sheep has resulted in pneumonia in bighorns and the deaths of all or most bighorns while domestic sheep remained healthy.

2) Thirteen fenced studies, some of which were circumstantial evidence, in six states or provinces resulted in: 9 cases where all bighorns died from pneumonia, while from 50% to 83% were lost in the other 4 studies.

3) Additionally, 18 incidents involving free ranging bighorns in 8 states or provinces linked contact with domestic sheep to bighorn die-offs (Table 1).

4) DNA fingerprinting have proven the transfer of *Pasteurella* spp. between bighorn and domestic sheep under both controlled "experimental" and range conditions.

5) No studies reported any bighorn herds, fenced or free ranging, that have come into contact with domestic sheep and remained healthy.

6) Published research has shown that *Pasteurella haemolytica* (usually biotype A, serotype 2) is the major pathogen responsible for the death of bighorn sheep after contact with domestic sheep.

7) No vaccine currently exists that will prevent bighorn sheep from developing pneumonia after contact with virulent strains of *Pasteurella* spp.

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Table 1. Bighorn declines and die-offs believed to have resulted from contacts with domestic sheep.

Location	Cause of die-off	Results	Year(s)	Source
Sun River, Mont.	Unknown	>70 died	1910-35	Goodson (1982)*
Upper Rock Ck., Mont.	Unknown	All died	1965-70s	Goodson (1982)*
Thompson Falls, Mont.	Unknown	All died	1940-60	Goodson (1982)*
Kootenay Natl. Pk. BC., Can.	Pneumonia		1939	Goodson (1982)*
Bull River, BC., Can.	Pneumonia	96% died	1965	Brandy (1968) in Goodson (1982)*
MacQuire Creek, BC., Can.	Pneumonia		1981-82	Davidson in Goodson (1982)*
Lava Beds Natl. Mon., Cal***	Pneumonia	All died	1980	Blaisdell (1982)* and Hunt (1980)
Mormon Mtns., Nev.	Pneumonia	50% died	1980	Jessup (1981)*
Dinosaur Natl. Mon., Colo.	Unknown	All died	1950	Barmore (1962) in Goodson (1982)*
Rock Ck., Mont.	Unknown	8 left	1900-20	Goodson (1982)*
Rocky Mtn. Natl. Pk., Colo.	Pneumonia	All died	1917-30	Packard (1939a), (1939b) in Goodson (1982)*
Methow Game Range, Wash.***	Pneumonia	13 of 14 died	1979-81	Foreyt and Jessup (1982)*
Warner Mtn., Cal.	Pneumonia	All died	1988	Weaver (1988)*
Latir Parks, N.M.	Pneumonia	All died	1978-82	Sandoval (1988)*
Utah St. Univ., Utah**	Pneumonia	All died	1970s	Spillett in Goodson (1982)*
Univ. BC., Can**	Pneumonia	All died	1970s	Herbert in Goodson (1982)*
Colorado St. Univ., Colo.**	Pneumonia	All died	1970s	Hibler in Goodson (1982)*
Lostine, Or.	Pneumonia	70% died	1986	Coggins (1988)
Utah St. Univ., Utah**	Pneumonia	4 of 5 died	1988	T.D. Bunch (Utah St. Univ. Pers. Comm)*
Sheep River Alberta, Can.**	Pneumonia	2 of 2 died	1988	Onderka (1988)
Wash. St. Univ., Wash.**	Pneumonia	6 of 6 died	1989	Foreyt (1989)
Wash. St. Univ., Wash.**	Pneumonia	2 of 2 died	1990	Foreyt (1990)
Utah St. Univ., Utah**	Pneumonia	5 of 5 died	1991	Callan (1991)
Wash. St. Univ., Wash.**	Pneumonia	2 of 2 died	1991	Foreyt (1991)
Wash. St. Univ., Wash.**	Pneumonia	5 of 6 died	1992	Foreyt (1992)
Caine Vet. Cnt., Boise, ID**	Pneumonia	2 of 4 died	1993	Hunter (1993) (IDFG pers. Comm.)
East Range, Nev.	Unknown	85 died	1992-93	Hunter (1993) (IDFG pers. Comm.)
Desatoya Range, Nev.	Pneumonia		1992-93	Tanner (1993) (NDW pers. Comm.)
Tollgate Ram	Pneumonia	died	1994	Hunter (1996) (pers. Comm.)
Hells Canyon Ram (BR95014)	Pneumonia	died	1995	Hunter (1995)

* From Desert Bighorn Council 1990
** University Controlled Conditions
*** Large Pen or Paddock

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